



**ZSL**  
LET'S WORK  
FOR WILDLIFE

EVOLUTIONARILLY DISTINCT  
& GLOBALLY ENDANGERED

# Survival Blueprint

**Big-headed turtle, *Platysternon megacephalum***



Authors: Ha Hoang, Timothy E.M. McCormack, Benjamin Tapley

Suggested citation: Ha Hoang, Timothy E.M. McCormack, Benjamin Tapley (2021). A survival blueprint for the Big-headed turtle, *Platysternon megacephalum*, in Vietnam, an output from the EDGE of Existence fellowship, Zoological Society of London, London, UK



## 1. STATUS REVIEW

### 1.1 Taxonomy:

Class: Reptilia

Order: Testudines

Family: Platysternidae

Genus: *Platysternon*

Species: *Platysternon megacephalum*

Species name author: *Platysternon megacephalum* Gray, 1831

Synonyms: *Platysternon megacephalum* ssp. *peguense* Gray, 1870

*Platysternon megacephalum* ssp. *shiui* Ernst & McCord, 1987

Common name: Big-headed Turtle (BHT) (English); Rùa đầu to (Vietnamese), Táu cù lu (Thai)

Taxonomic source:

Asian Turtle Trade Working Group. 2000. *Platysternon megacephalum* (errata version published in 2016). *The IUCN Red List of Threatened Species* 2000: e.T17585A97386926. <https://dx.doi.org/10.2305/IUCN.UK.2000.RLTS.T17585A7142204.en>. Downloaded on 08 January 2021.

### 1.2 Distribution and population status:

#### 1.2.1 Global distribution:

Country	Population estimate (plus references)	Distribution	Population trend (plus references)	Notes
Cambodia	Unknown	Virachey National Park (NP) in Ratanakiri Province, northeast Cambodia	No information is available on population trends for this species in Cambodia. However, anecdotal information from the local Ministry of Environment rangers suggests that the species is fairly abundant in suitable riparian habitats (Emmett <i>et al.</i> , 2007)	This species has just been confirmed in northeast Cambodia for the first time in 2007 (Emmett <i>et al.</i> , 2007). Since then, there have not been any additional records of this species in Cambodia.



Country	Population estimate (plus references)	Distribution	Population trend (plus references)	Notes
China	<p>The species is considered Endangered and is now rarely seen in the wild (Lau and Shi, 2000; Gong <i>et al.</i>, 2017). However, they are commonly seen in local market in the Guangdong, Guangxi, and Hainan Provinces, being collected by local hunters and residents almost entirely from nature reserves (Gong <i>et al.</i>, 2009, 2017).</p> <p>Field surveys have revealed low abundances; for example, in southern China, Shi, Hai and Ru (2006) captured only eight individuals in over 2,000 capture-days of effort, or Gong <i>et al.</i>, (2017) found that population under high hunting pressure in nearby Guangdong and Hainan province have 0 – 0.36 individuals/stream km.</p> <p>These findings suggesting that remaining BHT populations in China are very small or severely depleted.</p>	Widespread in central and southern China, including Yunnan, Guizhou, Anhui, Jiangsu, Zhejiang, Jiangxi, Hunan, Fujian, Guangdong, Hainan, and Guangxi Provinces	<p>Previously common in the food markets but now only in low numbers of individuals turn up in the market, indicating that wild populations have declined drastically (Lau and Shi, 2000)</p> <p>Over 1,000 wild-caught individuals found in markets of Guangdong, Guangxi, and Hainan provinces during 12-year long study (2002 – 2013) indicating that the species population has reduced dramatically in China (Gong <i>et al.</i>, 2017)</p>	
Hong Kong Special Administrative Region of China (Hong Kong SAR)	Sung, Karraker and Hau (2013) captured a total of 138 turtles after 51 visual encounter surveys (263 hours) and 5,124	Tai Po Kau Nature Reserve (NR), Kadoorie Farm and Botanic Garden (KFBG)	Lau <i>et al.</i> , (2000) reported that the species was regularly recorded in some of the stream systems in central New Territories	



Country	Population estimate (plus references)	Distribution	Population trend (plus references)	Notes
	trapping hours from 5 sites in Hong Kong. Estimated population density ranged from 38.75 – 127.5 individuals/stream km for juveniles, 2.5 – 36.25 individuals/stream km for female, and 2.5 – 48.75 individuals/stream km for male.		indicating that fairly stable populations existed. Sung, Karraker and Hau (2013) also believed that the KFBG populations are unharvested since the gardens were established in 1956.	
Laos	Unknown	Houaphan province, Bolikhamxay province, Nakai-Nam Theun National Biodiversity Conservation Area in Khammouan province, and Xe Kong province.	Populations of the species are probably quite reduced (Stuart and Timmins, 2000)	The species is still poorly studied in Laos
Myanmar	Unknown	The big-headed turtle is reported to occur in the hill streams of the Sittang and Salween drainages (Platt, Platt and Win, 1999), Kyaikhtiyo Wildlife Sanctuary in Mon State (Zaw, 2010),	Two large confiscations with more than 1,000 individuals were seized in 2016 and 2017. Illegal harvest of Big-headed turtle has resulted in dramatic declines of the species through its range in Myanmar (Platt, 2018).  Interview surveys throughout Myanmar from 2009 to 2017 did not record any specimen of the Big-headed turtle kept at local household (Platt <i>et al.</i> , 2018)	The species is still poorly studied in Myanmar



Country	Population estimate (plus references)	Distribution	Population trend (plus references)	Notes
Thailand	Unknown	Mountains of northern, north-eastern, central, north-western, and south western areas (van Dijk and Palasuwan, 2000; Pipatsawasdikul, Voris and Thirakhupt, 2010).	In 2000, the species was reported as uncommon to locally fairly common by van Dijk and Palasuwan (2000). The most recent published surveys are from December 2006 to April 2009, in which the distribution of <i>P. megacephalum</i> was assessed; no information on population size or trends were provided (Pipatsawasdikul, Voris and Thirakhupt, 2010)	

## 1.2.2 Local distribution in Vietnam:

Region / province	Site	Level of Protection	Population size	Reference(s)	Notes
Dien Bien	Cha Cang commune, Muong Nhe district	None	Unknown	Nguyen, Ho and Nguyen (2009)	
	Muong Nhe Nature Reserve	Nature Reserve	Unknown	Cox, Van Dung and Giao (1992) Asian Turtle Program (ATP), unpublished data	In 2013, three Big-headed turtles were confiscated from local hunters and released (ATP, unpublished data).
Lao Cai	Hoang Lien (Sa Pa town, and Van Ban district)	National Park, the highest level of site protection in Vietnam  This site is an Alliance for Zero Extinction (AZE) site (AZE, 2018)	Unknown.  In 2014 and 2015, intensive interview surveys were undertaken in Hoang Lien NP. Results indicate that	Bourret, 1941; Nguyen, Ho and Nguyen, 2009	Currently, the Center for Rescue and Conservative Organism (CRCO) of Hoang Lien NP is trying to breed the species in





Region / province	Site	Level of Protection	Population size	Reference(s)	Notes
			the species population has reduced dramatically in the NP, up to 70% of the population has been lost in last 10 years (Luong Van Hao 2016, pers.comm., 16 December).		captivity from 5 animals (3F:2M), that were voluntarily transferred to the centre (Hoang Truong Giang 2021, pers.comm., 22 January)
Ha Giang	Tay Con Linh	Nature Reserve	Unknown	Nguyen, Ho and Nguyen, 2009	
Cao Bang	Nguyen Binh	Partially protected.  The Phia Oac – Phia Den NP is located within this site. However, it's not clear if the BHT occurs inside this NP.	Unknown	Nguyen, Ho and Nguyen, 2005, ATP, unpublished data	
Bac Kan	Ba Be	National Park	Unknown	Nguyen, Ho and Nguyen, 2005	
	Linh Thong	None	Unknown	Nguyen, Ho and Nguyen, 2009	
Yen Bai	Mu Cang Chai	Species Habitat Conservation Area (SHCA)	Unknown	Tordoff, Lê and Hardcastle, 2001	
Lang Son	Mau Son	None	Unknown	Bourret, 1941; Nguyen, Ho and Nguyen, 2005	
Bac Giang	Son Dong	Partially protected.  The Tay Yen Tu NR is located within this site.	Unknown	Nguyen, Ho and Nguyen, 2005	



Region / province	Site	Level of Protection	Population size	Reference(s)	Notes
		However, it's not known if the BHT occurs inside this NR.			
Thai Nguyen	Vo Nhai	Partially protected.  The Than Sa – Phuong Hoang NR is located within this site. However, it's not known if the BHT occurs inside this NR.	Unknown	Nguyen, Ho and Nguyen, 2005	
Phu Tho	Thanh Son	None	Unknown	Nguyen, Ho and Nguyen, 2009	
Son La	Muong Do	None	Unknown	Nguyen, Ho and Nguyen, 2005	
	Xuan Nha	Nature Reserve	Unknown.  In 2011, a survey team from the ATP found two wild BHTs after 60 days of trapping	ATP, unpublished data	
Thanh Hoa	Ben En	National Park	Unknown	Nguyen, Ho and Nguyen, 2009	
	Pu Hu	Nature Reserve	Unknown.  In 2019, a survey team from the ATP found three wild BHTs in 146 trapping days	Nguyen <i>et al.</i> , 2011; Giang, 2014; Hoang <i>et al.</i> , 2019	28 BHTs were released into this site in May 2020 by a joint effort of the ATP and Cuc Phuong NP
	Xuan Lien	Nature Reserve	Unknown	Le <i>et al.</i> , 1999; Center for Nature Conservation and	One single mature animal was captured during the recent survey in



Region / province	Site	Level of Protection	Population size	Reference(s)	Notes
				Development (CCD), 2020	November 2020 by CCD and Xuan Lien NR.
Nghe An	Pu Mat	National Park.  Currently, there were two other organisations (i.e. Save Vietnam's Wildlife, and Fauna and Flora International) working at this site to stop the illegal poaching. This site is now considered as one of the most secured protected area in the country.	Unknown.  In 2019, a survey team from the ATP found four wild BHTs in 186 trapping days	Hayes and Howard, 1998; Ngat, Quang and Truong, 2000; Le and Nguyen, 2002; Le and Hoang, 2008; Le and Quang, 2008; Hoang and McCormack, 2019	153 BHTs were released at this site in last three years from various sources, including Cuc Phuong NP, Hanoi Wildlife Rescue Centre, and Pu Mat NP.  Radio-tracking of a sub-set of 10 BHTs are currently undertaking at this site.
Nghe An	Pu Huong	Nature Reserve	Unknown.  In 2008, a field survey supported by the ATP found one wild BHT in 45 trapping days	Nguyen, Ho and Nguyen, 2005; Le, 2009	
	Ky Son	None	Unknown	Nguyen, Ho and Nguyen, 2005	
	Pu Hoat	Nature Reserve	Unknown	ATP, unpublished data, Corenacca, 2015	
Ha Tinh	Huong Son	None	Unknown	Nguyen, Ho and Nguyen, 2005	
	Vu Quang	National Park	Unknown	Nguyen, Ho and Nguyen, 2005	
	Cam Xuyen	Partially protected.	Unknown	Nguyen, Ho and Nguyen, 2005	





Region / province	Site	Level of Protection	Population size	Reference(s)	Notes
		The Ke Go NR is located within this site. However, it's not known if the BHT occurs inside this NR.			
Quang Binh	Phong Nha – Ke Bang	National Park	Unknown	Ziegler <i>et al.</i> , 2004; Ziegler and Vu, 2009	
Quang Tri	Dak Rong	Nature Reserve	Unknown	Nguyen, Ho and Nguyen, 2009	
	Dong Tam Ve	None	Unknown	Nguyen, Ho and Nguyen, 2005	
	Huong Hoa	Partially protected.  The Bac Huong Hoa NR is located within this site. However, it's not known if the BHT occurs inside this NR.	Unknown	Nguyen, Ho and Nguyen, 2009	
Thua Thien Hue	Bach Ma	National Park	Unknown	Nguyen, Ho and Nguyen, 2009; Hoang, Hoang and Ngo, 2012	
	Sao La	Nature Reserve	Unknown	ATP, unpublished data	
	Huong Thuy	None	Unknown	Nguyen, Ho and Nguyen, 2009	
Quang Nam	Nam Giang	Partially protected.  The Song Thanh NP is located within this site. However, it's not known if the BHT occurs inside this NP.	Unknown	Wikramanaya ke and Vū, 1997; Nguyen, Ho and Nguyen, 2009	



Region / province	Site	Level of Protection	Population size	Reference(s)	Notes
	Tay Giang	Partially protected.  The Sao La NR is located within this site. However, it's not known if the BHT occurs inside this NP.	Unknown	Wikramanayake and Vũ, 1997; Nguyen, Ho and Nguyen, 2009	
	Ba To	None	Unknown	ATP, unpublished data	
Kon Tum	Kon Plong	None	Unknown	Nguyen, Ho and Nguyen, 2005	It seems that the BHT may be distributed more widely in this province based on the interview information of the ATP (ATP, unpublished data). Additional wild record is needed to confirm the species distribution in Kon Tum.
Gia Lai	An Khe	None	Unknown	FMNH252164 (The Field Museum of Natural History, USA)	
	Kbang	Partially protected.  The Kon Ka Kinh NP and Kon Chu Rang NR are located within this site. However not known if the BHT occurs inside these protected areas.	Unknown	Nguyen, Ho and Nguyen, 2005	



### 1.3 Protection status:

The Big-headed turtle is assessed as Endangered by the IUCN (Asian Turtle Trade Working Group, 2000), proposed to be upgraded to Critically Endangered by Horne, Poole and Walde, (2012) and provisionally ranked as Critically Endangered by (Rhodin *et al.*, 2018).

The species is currently listed in CITES Appendix I since it was up listed from Appendix II in 2013 (CITES, 2020). The Big-headed turtle receives the highest protection level under Vietnam's national wildlife protection laws (Decree 160/2013/ND-CP, amended by Decree 64/2019/ND-CP and Decree 06/2019/ND-CP). Thus, acts of illegally hunting, killing, transporting, trading, and keeping Big-headed turtles, even one individual, or products and parts which are obtained by killing an individual will be subject to up to 5 years in prison or a 2 billion VND (86,688 USD) fine.

Despite its wide distribution range in Vietnam, it is still not clear if it occurs in many of the protected areas. A few national parks (highest protected level area in Vietnam) and nature reserves (second to highest protected level area in Vietnam) are confirmed to be home of the BHT. Notably, there is one site (i.e. Hoang Lien NP) is recognised as site for Zero Extinction (AZE, 2018).

### 1.4 Ecology, behaviour and habitat requirements:

#### 1.4.1. Morphological characteristics

The Big-headed turtle (*Platysternon megacephalum*) is the only extant species within its genus, Platysternidae (Kirkpatrick, 1997). They are a medium sized turtle species with the carapace length reaching up to 25.5cm (Chan-ard *et al.*, 2012). They are well known for the large head that cannot be retracted into its shell, strong parrot-like beak, and the long tails, which are often as long as the whole shell. Cao *et al.*, (2019) highlighted that carapace colour of the BHT hatchlings is polymorphic and often consists of two phenotypes: yellowish brown and olive green. Over the first year, as the turtle grows, its carapace gradually turns from yellowish brown to chestnut brown, or from olive green to dark brown, depending on the phenotype. However, the plastron colour does not change and remains orange with black patterns.

#### 1.4.2. Habitat

The Big-headed turtle inhabits unpolluted clear cool (water temperatures ranging between 12–28°C) rocky mountain streams within forested areas and is also found within the bordering riparian habitats. Water depth and stream width ranges from 7–32cm, and 53–154cm respectively between dry and wet season, from two study sites of a BHT radio tracking study in Hong Kong (Sung, Hau and Karraker, 2015). These streams are characterised by exposed bedrock, areas of accumulated large boulders, small waterfalls and stream pools (Ernst and Laemmerzahl, 2002; Shen, Pike and Du, 2010). Sung, Hau and Karraker (2015) found that there was non-random selection of microhabitat of 27 BHTs in his radio tracking study, all individuals in this study preferred pools rather than other in-stream or terrestrial habitats. Streams in Thailand inhabited by *Platysternon* may dry out for several weeks at the height of the



dry season (monsoon climate area) and local park rangers asserted that *Platysternon* migrate overland in search of streams still containing water (van Dijk, 2002). However, Shen, Pike and Du (2010) recorded occasional terrestrial behaviour, with turtles moving a maximum of 5.8 meters away from the stream, and suggested that the connectivity of the streams where the species occurs may provide critical movement and dispersal corridors. Findings from Sung, Hau and Karraker (2015) in Hong Kong also support this statement.

#### 1.4.3. Movement and home range

In southern China, Shen, Pike and Du (2010) completed a radio tracking study on 16 BHTs and found that translocated animals moved a short daily distance, ranging from 0 – 89.6m. This study also revealed that males move further than females and both sexes move further at night than during the day. In Hong Kong, Sung, Hau and Karraker (2015) studied 27 wild-caught animals and found the same pattern of movements. The animals in this study also moved a short weekly distance, ranged from 0 – 140m in dry season, and 0 – 125m in wet season. However, in Hong Kong, the average weekly distance did not differ between sexes.

BHTs do not require a large home range in the wild. The mean 100% home range length of 27 tracked animals in Hong Kong was  $97\text{m} \pm 66$  (15 – 242m) with a significant longer stream for males. However, there was no difference between males and females in the size of 100% minimum convex polygon home range ( $996\text{m}^2$ ) (Sung, Hau and Karraker, 2015).

#### 1.4.4. Diet

In Hong Kong, wild BHTs primarily eat fruits of *Machilus* spp., followed by insects, plant matter, crabs and mollusks (Sung, Hau and Karraker, 2016).

In captivity at Wildlife Conservation Society's Prospect Park Zoo, BHTs are fed with red worms (*Eisenia foetida*), neonatal mice, super mealworms (*Zophobas morio*), greater wax worm moth larva (*Galleria mellonella*), live freshwater crayfish, live or cut up fish, shrimp and a formulated chopped gel diet that consists of diced leafy greens, grated carrot (Shelmidine, Murphy and Biology, 2016). Wallace (2017) also gave the same diet to captive animals but supplemented them with calcium.

At the turtle conservation center in Huizhou, Guangdong, South China, BHTs are fed with live stream shrimps, and small fish. Fresh loaches, fish, river snails, and earthworms were also offered 2 -3 times a week as supplementary food (Gong *et al.*, 2019).

#### 1.4.5. Reproduction

According to the von Bertalanffy model, generated from measurement of 218 individuals during a mark recapture study in Hong Kong, the mean age at maturation for female and male *P. megacephalum* was 8 and 13 years respectively. At maturity for female and male *P. megacephalum*, mean carapace length was 100 mm and 130 mm, respectively (Sung *et al.*, 2015).



In the wild, in Hong Kong, pairing and copulation is more likely to take place in May and gravid females (n=7) were only found in late June. Unfortunately, the Hong Kong team was unable to find nests laid by two of these seven females, all of which had been fitted with radio transmitters in July, but discovered another clutch of two eggs in leaf litter at 5cm soil depth, at a distance of 1.6m from stream edge. Average clutch size was 3.6 (range 2 – 8, n=7), mean length of oviductal eggs was 35.8 mm and the average width of eggs found in nests was 20.5 mm (Sung, Hau and Karraker, 2014). The findings of this study also suggested that the embryonic developmental period of BHT may be between 103 and 110 days. BHT only lays one clutch per year and clutch size was positively correlated with the carapace length of females.

In captivity at Wildlife Conservation Society's Prospect Park Zoo, females and males are housed separately most of the time. Individuals are paired for breeding in May with daily introduction between individual males and females for 15 – 30 minutes until copulations have occurred. After the last copulation, the female will lay eggs in nests in 59 – 93 days later. The average diameter and depth of the nests were 11.7cm x 7.1cm (n=3). Clutch size was 5 – 6 (n=3). Eggs were slightly bigger than those laid in the wild in Hong Kong (39.64mm length x 21.40mm width). Incubation period was 98 – 105 days at 23.3°C and 90 – 95% humidity with hatching rate higher than 80% (Shelmidine, Murphy and Biology, 2016). Wallace (2017) incubated eggs at 23.8 to 27.7°C with incubation period ranges from 66 to 90 or more days to hatch.

At the turtle conservation center in Huizhou, Guangdong, South China, males and females were housed together in a breeding ponds with plenty of shelters for each individual in an artificial habitat that mimics the natural conditions of the species. Individuals nested from June to August with a mean clutch size of five. Eggs were left to incubate outside under natural conditions with nest temperatures ranging from 11.5 to 32.5°C (mean 22.4°C) and relative humidity in the nest during the incubation period ranging from 63.2% to 100% (mean 97%). The incubation period ranged from 78 – 97 days with a hatching rate of 74.3% (Gong *et al.*, 2019). In addition, multiple paternity is known to occur in *P. megacephalum*. While there was no significant correlation between female body size and the number of offspring, there was a significant correlation between male body size and the number of offspring with the larger males contributing to more clutches and thus producing more offspring. Platt *et al.*, (2020) confirmed that female *P. megacephalum* has an ability to store sperm inside its oviductal glands. Zhang *et al.*, (2009) reported that a temperature range of 22–25°C promotes the best growth and food conversion in captive juvenile *P. megacephalum*.

#### 1.4.6. Social behaviours

Male social rank was found in *P. megacephalum* when significant different sized males were housed together in captivity at the turtle conservation center in Huizhou, Guangdong, South China. Thus, the biggest male would occupy a larger proportion of the enclosure and be able to move around the enclosure while smaller individuals (medium-sized and small ones) had smaller territories and less freedom to move around the enclosure. The same pattern was also recorded with eating order, the biggest individuals ate first, then the medium body sized turtle, followed by the smallest turtles. In contrast, social rank was not found between males and females although their sizes are different (Gong *et al.*, 2019).





## 1.5 Threat analysis:

Threat	Description of how this threat impacts the species	Intensity of threat (low, medium, high, critical or unknown)
Habitat loss	The BHT inhabits the fast flowing clean and cool streams in forested mountainous areas. It is likely that they do not require primary forest as two sites in Hong Kong where several reported self-sustainable populations of BHT are known to occur were in secondary forest vegetation (Sung <i>et al.</i> , 2015).	Medium
Illegal hunting	Most populations of BHT across the species range have undergone sharp declines. They are highly vulnerable to illegal hunting because they are highly aquatic species with small home ranges. Baited fish hooks and aquatic basket traps are the biggest threat to the survivals of BHTs in the wild (Hendrie, 2000; van Dijk, Stuart and Rhodin, 2000; Sung, Karraker and Hau, 2013; Sung, Hau and Karraker, 2015). In addition, there is no evidence that the harvesting has been slowing down (H. Hoang Pers. Obs.).	Critical
Trade	Trade includes both legal and illegal international and domestic trade of BHTs for food and as pets. However, illegal trade coupled with illegal hunting has made this species rare throughout its range and less commonly encountered in food markets (Lau <i>et al.</i> , 2000; Hendrie, 2000). It's also noteworthy that the price on the illegal market for the BHT has increased significantly in last decade indicating high demand and the rarity of the wild BHTs H. Hoang Pers. Obs.).	Critical
Farming	Due to its ecology and specific habitat requirements, the species is difficult to keep and does not breed well in captivity. There were few instances of the species successfully breeding in captivity (Shelmidine, Murphy and Biology, 2016; Wallace, 2017; Gong <i>et al.</i> , 2019). Wild caught BHTs were reported to be legalised through farms in Myanmar and Vietnam (Luc Tung, 2018; Platt, 2018). Turtle farming also needs wild-collected specimens as parental stock (Shi <i>et al.</i> , 2007).	High



Threat	Description of how this threat impacts the species	Intensity of threat (low, medium, high, critical or unknown)
Local consumption & use	Due to high demand and increasing market value in last 20 years, it's more likely that most of wild caught BHTs will be sold to restaurants or food or pet markets in big cities in China (Lau and Shi, 2000). In Thailand, this species was often observed at local market, mainly sold for food or as pets (Pipatsawasdikul, Voris and Thirakhupt, 2010). In Vietnam, nearly all turtles that are collected are sold to traders rather than consumed locally (Hendrie, 2000). This situation is also similar in Myanmar, Lao, and Cambodia (Stuart <i>et al.</i> , 2000; Emmett <i>et al.</i> , 2007; Platt, 2018).	Low
Pathogen disease	A recent analysis to assess the prevalence of the two most significant pathogen disease factors (i.e. Mycoplasma and Herpesvirus) in reptiles shows that Mycoplasma and Herpesvirus were not found in wild caught BHTs (n = 18). Four and 124 samples of 232 swab samples collected from traded and confiscated animals at the Turtle Conservation Centre were positive for Mycoplasma and Herpes virus respectively. However, the Herpesvirus strain found in BHTs seems unlikely to be pathogenic or turtle specific. Further analysis is ongoing to identify the Herpes virus strains. Mycoplasma is likely to be commensal.	Low



## 1.6 Stakeholder analysis:

Country	Stakeholder	Stakeholder's interest in the species' conservation	Current activities	Impact (positive, negative or both)	Intensity of impact (low, medium, high or critical)
Vietnam	Mr Tran Trong Anh Tuan, and Ms Nguyen Thi Van Anh of Species and Genetic Conservation Department of Biodiversity Conservation Agency (BCA), Ministry of Natural Resources and Environment (MoNRE)	Highly interested. MoNRE has proposed and successfully added BHT to the list of fauna and flora species prioritised for conservation in Vietnam under Decree 160/2013/ND-CP, amended by Decree 64/2019/ND-CP.	Regular updates are given to Mr Tuan and Ms Van Anh so BCA/MoNRE is well informed of the species conservation in Vietnam. Necessary law change/modification would be achieved through MoNRE.	Positive	Critical
Vietnam	Vietnam Administration of Forestry (VNFOREST) of Ministry of Agriculture and Rural Development (MARD)	Highly interested. MARD also proposed and get approval for Decree 06/2019/ND-CP on management of endangered, precious and rare forest plant and animals, in which the BHT was listed in Group IB.	VNFOREST is currently overseeing the CITES implementation, commercial farm, and conservation work inside existing protected areas in Vietnam. Forest rangers are also under direct management of VNFOREST.	Both	Critical
Vietnam	Mr Tran Xuan Cuong and Mr Luu Trung Kien, Director and Vice-director of Pu Mat NP, Nghe An	Highly interested.	These leaders support the institutional aspect of the project and dissemination of findings and outcomes to the	Positive	Critical



Country	Stakeholder	Stakeholder's interest in the species' conservation	Current activities	Impact (positive, negative or both)	Intensity of impact (low, medium, high or critical)
			conservation community in the project area		
Vietnam	Mr Nguyen Van Manh and Ms Nguyen Thi Nga	Highly interested.	Manh and Nga are staff of the Scientific Department, have been involved with the project in the last two years	Positive	High
Vietnam	Mr Timothy McCormack, Director, Indo-Myanmar Conservation (IMC).	Highly interested.	IMC is my host organization, IMC provides institutional support, technical and financial support to the project.	Positive	Critical
Vietnam	Sam Hai Son, Ho Van Po, IMC field assistants	Highly interested.	Son and Cong are two field assistant who have carried out most of the project activities in the last two years	Positive	High
Vietnam	Assoc. Prof., Ph.D, Minh Le, Central Institute for Natural Resources and Environmental Studies (CRES)	Highly interested.	Mr Minh Le provides support to molecular work of the project, including genetic and pathogen screening work	Positive	High
Vietnam	Commune people committee(s) (CPC(s))	Medium interest.	CPC(s) issued related paper work and help to coordinate communication activities	Positive	Medium
Vietnam	Local schools around priority sites	Low interest	Local schools help to coordinate outreach activity at schools	Positive	Medium



Country	Stakeholder	Stakeholder's interest in the species' conservation	Current activities	Impact (positive, negative or both)	Intensity of impact (low, medium, high or critical)
Vietnam	Local hunters	Highly interested. BHT value in illegal market is currently high compare to the average monthly income of local community	Local hunters take part in and benefit from community communication activities.	Both	High
Vietnam	Local communities (other community members)	Low interest.	Local communities take part in and benefit from community communication activities	Both	Medium
Vietnam	Border guard station	Low interest	Border guards carry out regular patrols at study sites	Positive	Medium
Vietnam	Hanoi Wildlife Rescue Centre	Highly interested.	Hanoi Wildlife Rescue Centre acts as a national hub for receiving confiscated BHTs from illegal trade.	Positive	High
Vietnam	Cuc Phuong Turtle Conservation Centre (TCC)	Highly interested.	Cuc Phuong Turtle Conservation Centre is the most important rescue centre for BHT rescue and release in Vietnam	Positive	Critical
Vietnam	Hoang Lien Centre for Rescue and Conservative Organism (CRCO)	Highly interested.	This rescue centre is currently housing 5 BHTs and have attempted to breed them in captivity	Positive	High





Country	Stakeholder	Stakeholder's interest in the species' conservation	Current activities	Impact (positive, negative or both)	Intensity of impact (low, medium, high or critical)
Vietnam	Pu Hu Nature Reserve	Highly interested	There is one on-going specific project focused on BHT proposed and implemented by the Pu Hu NR staff.	Positive	High
Vietnam	Other protected areas (Muong Nhe NR, Tay Con Linh NR, Ba Be NP, Mu Cang Chai SHCA, Xuan Nha NR, Ben En NP, Xuan Lien NR, Pu Huong NR, Pu Hoat NR, Vu Quang NP, Phong Nha – Ke Bang NP, Dak Rong NR, Bach Ma NP, Sao La NR)	Medium interest as BHT is a highly protected turtle species but no specific BHT project developed and implemented at those sites	The BHT is currently protected in those protected areas.	Both	High
Vietnam	Other experts (Prof., Ph.D., Nguyen Quang Truong of the Institute Of Ecology And Biological Resources, Dr. Cao Tien Trung of Vinh University)	Highly interested	Those experts are keen to get regular updates on the BHT research and conservation in Vietnam	Positive	High



## 1.7 Context and background information that will affect the success of any conservation action for this species:

	Description	Barriers to conservation	Opportunities for conservation
<b>Socio-cultural effects and cultural attitudes</b>	Across the species distribution range, a large number of ethnic minority groups are present, this includes the H'mong people who are quite a closed group in terms of engaging with strange people. Other groups are Kinh, Thai, Muong, Cotu, Ta Oi, Bru-Van Kieu, Pa Co, Tay, Dao, etc.	Although these groups are diverse in the way they live and interact with nature, their long traditional behaviours of exploitation of natural resources, including logging, hunting of wildlife in general and BHTs in particular are the main barriers to working with them in order to conserve BHTs.	Generally, ethnic minority groups live in harmony with nature with sustainable and sound traditional usage of natural resources developed over thousands of years. However, they are often not aware of the legal protection of BHTs. Therefore, raising local people's awareness for the BHTs conservation should be prioritised.
<b>Economic implications</b>	There is a significant and ongoing increase in the economic value of BHTs in illegal markets which has resulted in ongoing hunting pressure on the wild BHT population throughout its natural range in Vietnam for the illegal trade. There are cases of animal laundering ( Vietnam and Myanmar) where of wild caught BHTs become legalized through commercial farming practices with more than 1,000 animals involved in 2016 – 2018 ( ATP, unpublished data., Platt, 2018)	The major threat/problem of BHT conservation in Vietnam is the severe illegal collection of the species in the wild for the illegal trade. Protecting the species in the wild and poor enforcement are the two main barriers to BHT conservation.	The BHT is now considered rare and was provisionally reassessed as Critically Endangered by (Rhodin <i>et al.</i> , 2018) due to long-term non sustainable hunting. Thus, the species is now receiving more conservation attention and improvements in legal protection and enforcement have been made recently.
<b>Existing conservation measures</b>	BHT is an endangered, precious, rare turtle species, prioritised for conservation under Decree 160/2013/ND-CP, amended by Decree	The cost associated with genetic, pathogen screening and post-release monitoring	These laws are a strong legal framework to protect the BHTs in the wild.



	Description	Barriers to conservation	Opportunities for conservation
	<p>64/2019/ND-CP, and Decree 06/2019/ND-CP. Thus, illegal hunting, killing, trading, transporting, and keeping BHTs are totally prohibited.</p> <p>A three-year long specific project focused on the development of release strategies for confiscated BHT, including genetic and pathogen screening as well as post-release monitoring has been undertaken in Vietnam since 2018. Preliminary findings indicate the need for on-going of genetic, pathogen screening, and post-release monitoring work.</p>	<p>work is the main barrier to the species conservation</p> <p>A lack of baseline data on the pathogens that wild turtles have means that assessing translocation risk is not as robust as it could be.</p> <p>Capacity to only screen for a limited number of reptile pathogens in Vietnam.</p>	<p>BHT is the first ever turtle species in Vietnam that was released following the IUCN reintroduction guideline. This pilot model can be applied to other turtle species in Vietnam (but will need to be heavily funded).</p>
<b>Local expertise and interest</b>	Local researchers have been working on other project throughout the species distribution range and there is potential conflict as well as opportunities to collaborate	Sometimes local research teams have conflicts of interest and compete for funding to work on the conservation of a particular species in Vietnam	Collaborate to have a better understanding of the species situation and work together on BHT conservation in Vietnam
<b>Resources</b>	Small amounts of funding from government are awarded annually for the rescue, breeding, release, research and conservation of turtles in general, including this species at some rescue centres, protected areas of Vietnam. Especially, there is one 3-year-long (2020 – 2022) BHT project funded by the Government at Pu Hu NR.	Inadequate funds are allocated for general turtle conservation and BHT conservation in Vietnam.	Fund raising for turtle conservation in general and BHT in particular needs more efforts.



## 2. ACTION PROGRAMME

<b>Vision (30-50 years)</b>	
<b>Big-headed turtle population viable and effectively conserved throughout its entire distribution range in Vietnam</b>	
<b>Goal(s) (5-10 years)</b>	
<b>Establish and increase viable population(s) of endangered Big-headed turtle in the wild</b>	
<b>Objectives</b>	<b>Prioritisation</b> <i>(low, medium, high or critical)</i>
<b>Improving scientific understanding of the BHTs in the wild in Vietnam</b>	Critical
<b>Updating conservation status of the BHTs</b>	Medium
<b>Raising awareness on the BHTs at key sites</b>	High
<b>Release of BHTs in the wild in Vietnam</b>	Critical
<b>Strengthening enforcement on BHTs in Vietnam</b>	High



Activities	Country / region	Priority (low, medium, high or critical)	Associated costs (currency)	Time scale	Responsible stakeholders	Indicators	Risks	Activity type
<b>Objective 1: Improving scientific understanding of the BHTs in the wild in Vietnam</b>								
Activity 1.1. Interview surveys to collect local ecological knowledge and threats to BHT (13 sites)	Vietnam	Critical	\$ 10,000	18 months	Asian Turtle Program of Indo-Myanmar Conservation, protected areas' management board	At least 15 key informants interviewed at each site	Key informant(s) might refuse to talk or give true information	Improving knowledge
Activity 1.2. Field survey to confirm current species existence using non-lethal aquatic trapping and eDNA (if possible) (13 sites)	Vietnam	Critical	\$ 15,000	24 months	Asian Turtle Program of Indo-Myanmar Conservation, protected areas' management board	At least one 7-day long trapping survey takes place at each site	Accident/illness Extreme natural event Global pandemic	Improving knowledge
Activity 1.3. Assess the prevalence of common pathogens and disease on wild, locally caught BHT	Vietnam	High	\$ 3,500	30 months	Asian Turtle Program of Indo-Myanmar Conservation, Assoc. Prof., Ph.D, Minh Le, Central Institute for Natural	Approx. 50 swab samples collected and analysed from wild and locally caught animals	There might be no turtle/very few turtle to collect sample during interview and field survey	Improving knowledge





population, including Mycoplasma, Herpesvirus, and Ranavirus					Resources and Environmental Studies (CRES)			
Activity 1.4. Publishing scientific papers about those survey findings	Vietnam	Critical	\$100	36 months	Asian Turtle Program of Indo-Myanmar Conservation, Assoc. Prof., Ph.D, Minh Le, Central Institute for Natural Resources and Environmental Studies (CRES), ZSL Ben Tapley		There might be no significant findings or not enough data for the paper	Improving knowledge
<b>Objective 2: Updating conservation status of the BHTs</b>								
Activity 2.1. Providing species data (distribution range; ecology and biology, threats) to IUCN Red List authority in order to update conservation status of the species	Vietnam	Medium	NA, data will be collected based on above activities	Annual, in the next 5 years	Asian Turtle Program of Indo-Myanmar Conservation	Species data will be provided to IUCN Red List authority.	No more update data provide	Law & Policy



Activity 2.2. Providing regular updated information and suggestion to Vietnamese authority in order to remain current level of legal protection	Vietnam	Medium	N/A	Annual, in the next 5 years	Asian Turtle Program of Indo-Myanmar Conservation, Ministry of Natural Resources and Environment, Ministry of Agriculture and Rural Development	Species data will be provided to Vietnamese National Authority team.	No more update data provide	Law & Policy
<b>Objective 3: Raising awareness on the BHTs at key sites</b>								
Activity 3.1. Questionnaire survey to access local people knowledge, awareness and attitudes towards BHTs at six key sites	Vietnam	High	\$ 4,000	6 months	Asian Turtle Program of Indo-Myanmar Conservation, protected areas' management board	At least 500 local people will be interviewed at six key sites	Local people do not want to answer the questionnaire  Travel restriction due to global pandemic or extreme natural event	Education & Awareness
Activity 3.2. Design and implement community activities such as T-shirt, community meetings, signboard, school program, etc.	Vietnam	High	\$ 3,000/year	5 years	Asian Turtle Program of Indo-Myanmar Conservation, protected areas' management board	At least 30 large signboards, 30 community meetings, 30 school programs will be installed/completed	Awareness materials are poorly design	Education & Awareness



Activity 3.3. Questionnaire survey to access local people knowledge, awareness and attitudes towards BHTs at six key sites after the intervention	Vietnam	High	\$ 4,000	6 months	Asian Turtle Program of Indo-Myanmar Conservation, protected areas' management board	At least 90% of interviewees of activity 3.1. will be interviewed	Interviewees do not want to answer the questionnaire Travel restriction due to global pandemic or extreme natural event  Interviewees left the village temporarily or permanently	Education & Awareness
Activity 3.4. Awareness activity evaluation report produced and published	Vietnam	High	N/A	1 months	Asian Turtle Program of Indo-Myanmar Conservation	Evaluation report produced and published	Poor quality report produced	Education & Awareness
<b>Objective 4: Release of BHTs in the wild in Vietnam</b>								
Activity 4.1. Support the rescue and rehabilitation of confiscated BHTs	Vietnam	Critical	\$ 6,000/year	Annual, in next 5 years	Asian Turtle Program of Indo-Myanmar Conservation, Cuc Phuong TCC, Hoang Lien CRCO, other rescue centres	Number of BHTs rescued and rehabilitated at each centre	No or very few confiscated take place in Vietnam  High mortality rate in rescue and rehabilitation of confiscated BHTs	Animal rescue
Activity 4.2. Pathogen health screening (pooling sample) and genetic analysis	Vietnam	Critical	\$ 4,000	Annual, in next 5 years	Asian Turtle Program of Indo-Myanmar Conservation, Cuc Phuong TCC,	Number of samples collected and analysed	No or very few confiscated take place in Vietnam  Pathogenic organism found in most of seized animals	Animal rescue



(individual) of captive animals (approx. 100 animals per year)					Hoang Lien CRCO, other rescue centres, Assoc. Prof., Ph.D, Minh Le, Central Institute for Natural Resources and Environmental Studies (CRES), ZSL Ben Tapley			
Activity 4.3. Breeding BHTs in captivity, including establishment of an assurance colony of BHTs in Vietnam (approx. 30 (20F:10M) founders remain in captivity in next 5 years)	Vietnam	Critical	Total \$18,000 for 5 years (\$10,000/ 1 <sup>st</sup> year, \$2,000/year from 2 <sup>nd</sup> year)	5 years	Asian Turtle Program of Indo-Myanmar Conservation, Cuc Phuong TCC, Hoang Lien CRCO, other rescue centres	Number of offspring produced in captivity, expect to have more than 70 hatchlings each year	Deaths occur during animal pairing  Turtles do not breed in captivity due to various reasons such as stress, lack of nutrition, etc.  Very few hatchlings produced each year	Animal breeding
Activity 4.4. Release both confiscated and captive bred animals with clear identification (PIT tag, notching)	Vietnam	Critical	\$ 3,000/year	Annual, in next five years	Asian Turtle Program of Indo-Myanmar Conservation, Cuc Phuong TCC, Hoang Lien CRCO, other rescue centres	Number of BHTs release back to the wild at protected areas in Vietnam, expect to release approx. 300 turtles in next five years	No or very few confiscated take place in Vietnam  Pathogenic organism found in most of seized animals Species does not breed readily in captivity	Animal release



**Objective 5: Strengthening enforcement on BHTs in Vietnam**

Activity 5.1. 2-day long enforcement training on BHT, general turtle and reptile protection for local authorities at key sites (6 key sites)	Vietnam	High	\$ 2,000 per training	36 months	Asian Turtle Program of Indo-Myanmar Conservation, provincial forest protection department	Number of rangers involved with training  Number of BHT related confiscation at key sites after training	Training content and material are poorly design  Rangers don't actively involve with the trainings	Training
Activity 5.2. Print and distribute BHT legal protection poster (1,000 A3 copies)	Vietnam	High	\$ 1,500	6 months	Asian Turtle Program of Indo-Myanmar Conservation	Number of poster distributed	Poster is poorly designed	Education & Awareness





### 3. LITERATURE CITED

- Asian Turtle Trade Working Group (2000) 'Platysternon megacephalum (errata version published in 2016)', *the IUCN Red List of Threatened Species 2000*: e.T17585A97386926. doi: <https://dx.doi.org/10.2305/IUCN.UK.2000.RLTS.T17585A7142204.en>.
- AZE (2018) *2018 Global AZE map | Alliance for Zero Extinction*. Available at: <https://zeroextinction.org/site-identification/2018-global-aze-map/> (Accessed: 22 January 2021).
- Bourret, R. (1941) *Les Tortues de l'Indochine*. l'Institut Océanographique de l'Indochine.
- Cao, D. *et al.* (2019) 'Observations on carapace color change in the juvenile big-headed turtle (*Platysternon megacephalum*)', *PeerJ*. PeerJ Inc., 7, p. e7331.
- Center for Nature Conservation and Development (CCD) (2020) *Turtles and tortoises conservation in Xuan Lien Nature Reserve*. Available at: <https://ccd.org.vn/en/news/nghien-cuu-va-bao-ton-cac-loai-rua-tai-khu-bao-ton-thien-nhien-xuan-lien/> (Accessed: 23 January 2021).
- Chan-ard, T. *et al.* (2012) 'Measurements of the Big-Headed Turtle (*Platysternon megacephalum* Gray, 1831)(*Platysternidae*, *Testudines*) from Phu Luang, Loei Province, Northeastern Thailand'.
- CITES (2020) *Appendices | CITES*. Available at: <https://cites.org/eng/app/appendices.php> (Accessed: 25 January 2021).
- Corenacca (2015) *Khu bảo tồn thiên nhiên Pù Hoạt, huyện Quế Phong, Việt Nam*. Available at: <https://www.corenacca.org/vi/du-an/pu-hoat-nature-reserve-en/> (Accessed: 23 January 2021).
- Cox, C. R., Van Dung, V. and Giao, P. M. (1992) 'Report of a management feasibility study of the Muong Nhe Nature Reserve (November/December 1991)', *World Wildlife Fund/Ministry of Forestry. Hanoi*.
- van Dijk, P. P. (2002) 'The legal status of tortoises and freshwater turtles in Asia', in *Technical Workshop on Conservation of and Trade in Freshwater Turtles and Tortoises in Asia, Kunming, Yunnan Province (People's Republic of China)*, pp. 25–28.
- van Dijk, P. P. and Palasuwan, T. (2000) 'Conservation status, trade, and management of tortoises and freshwater turtles in Thailand', *Chelonian Research Monographs*, 2, pp. 137–144.
- van Dijk, P. P., Stuart, B. L. and Rhodin, A. G. J. (2000) *Asian Turtle Trade: Proceedings of a Workshop on Conservation and Trade of Freshwater Turtles and Tortoises in Asia--Phnom Penh, Cambodia, 1-4 December 1999*. Lunenburg, Mass.: Chelonian Research Foundation.
- Emmett, D. *et al.* (2007) 'First Record of the Big-Headed Turtle *Platysternon megacephalum* from Cambodia', *Turtle and Tortoise Newsletter*, (10), pp. 27–30.
- Ernst, C. H. and Laemmerzahl, A. F. (2002) 'Geographic variation in the Asian big-headed turtle, *Platysternon megacephalum* (Reptilia: Testudines: Platysternidae)', *PROCEEDINGS-BIOLOGICAL SOCIETY OF WASHINGTON*, 115(1), pp. 18–24.
- Giang, T. T. (2014) *Báo cáo kết quả điều tra, đánh giá hiện trạng loài Rùa hộp trán vàng bắc bộ Cuora galbinifrons (Bourret, 1939) tại Khu Bảo tồn thiên nhiên Pù Hu tỉnh Thanh Hóa*. Hà Nội, Việt Nam : Trường Đại học Lâm nghiệp.
- Gong, S. *et al.* (2009) 'Recent records of freshwater turtles from Guangdong, China', *Turtle and Tortoise Newsletter*, pp. 24–27.



- Gong, S. *et al.* (2019) 'Unique multiple paternity in the endangered big-headed turtle (*Platysternon megacephalum*) in an ex situ population in South China', *Ecology and evolution*. Wiley Online Library, 9(17), pp. 9869–9877.
- Gong, S. ping *et al.* (2017) 'Disappearance of endangered turtles within China's nature reserves', *Current Biology*. Cell Press, pp. R170–R171. doi: 10.1016/j.cub.2017.01.039.
- Hayes, B. and Howard, T. (1998) 'Technical report on the biodiversity survey of Pu Mat Nature Reserve', *Unpublished Report*.
- Hendrie, D. B. (2000) 'Status and conservation of tortoises and freshwater turtles in Vietnam', in *Asian turtle trade: proceedings of a workshop on conservation and trade of freshwater turtles and tortoises in Asia*. Chelonian Research Monographs, pp. 63–73.
- Hoang, H. Van *et al.* (2019) *Survey report on the status of Big-headed turtle population at Pu Hu Nature Reserve, Thanh Hoa province*. Hanoi, Vietnam.
- Hoang, H. Van and McCormack, T. E. M. (2019) *Survey report on the status of Big-headed turtle population at Pu Mat National Park, Nghe An, Vietnam*. Hanoi, Vietnam.
- Hoang, Q., Hoang, N. T. and Ngo, C. (2012) *Amphibians and reptiles in Bach Ma national park*.
- Horne, B., Poole, C. and Walde, A. (2012) *Conservation of Asian Tortoises and Freshwater Turtles: Setting Priorities for the Next Ten Years*.
- Kirkpatrick, D. T. (1997) 'The family Platysternidae and its sole member: *Platysternon megacephalum*, the big-headed turtle', *The Biology, husbandry and health care of Reptiles*, 2, pp. 438–446.
- Lau, M. *et al.* (2000) 'Trade and conservation of turtles and tortoises in the Hong Kong Special Administrative Region, People's Republic of China', in *Asian Turtle Trade: Proceedings of a Workshop on Conservation and Trade of Freshwater Turtles and Tortoises in Asia*. Chelonian Research monographs, pp. 39–44.
- Lau, M. *et al.* (no date) 'Trade and conservation of turtles and tortoises in the Hong Kong Special Administrative Region, People's Republic of China', *Chelonian Research monographs*.
- Lau, M. and Shi, H. (2000) 'Conservation and trade of terrestrial and freshwater turtles and tortoises in the People's Republic of China', *Chelonian Research Monographs*, 2, pp. 30–38.
- Le, D. T. (2009) *Chelonian diversity of Pu Huong Nature Reserve, Vietnam*. Vinh University.
- Le, H. D. and Hoang, Q. X. (2008) 'Participation in supplementing documents about the distribution characteristic of turtles in Pu Mat National Park', *collection of agricultural science research projects (2002-2008)*, pp. 410–416.
- Le, H. D. and Quang, H. X. (2008) *Đa dạng sinh học lưỡng cư, bò sát Vườn quốc gia Pù Mát*, *Biology*. Vinh University.
- Le, N. N. and Nguyen, T. Q. (2002) 'Study of turtles from the Pu Mat National Park, Nghe An province', *journal of Biology*, 24(2A), pp. 58–64.
- Le, T. T. *et al.* (1999) 'A feasibility study for the establishment of Xuan Lien Nature Reserve, Thanh Hoa province', *Birdlife International Vietnam Programme, Hanoi*.
- Luc Tung (2018) *Tranh cãi nẩy lửa quanh nghi án Kiểm lâm Đồng Tháp 'phù phép' biến hàng chục rùa hoang dã quý hiếm thành thú nuôi thương*. Available at: <https://laodong.vn/phap-luat/tranh-cai-nay-lua-quanh-nghi-an-kiem-lam-dong-thap-phu-phep-bien-hang-chuc-rua-hoang-da-quy-hiem-thanh-thu-nuoi-thuong->



640577.Ido (Accessed: 28 January 2021).

Ngat, L. N., Quang, H. X. and Truong, N. Q. (2000) 'Báo cáo tổng kết về việc điều tra nghiên cứu khu hệ rùa tại khu bảo tồn thiên nhiên Pù Mát tỉnh Nghệ An'.

Nguyen, K. T. *et al.* (2011) 'Herpetofauna of Pu Hu Nature Reserve in Thanh Hoa province', in Hoi, T. M. *et al.* (eds) *The 4th National Scientific Conference On Ecology and Biological Resources*. Hanoi, Vietnam: Agriculture Publishing House, pp. 407–413. Available at: [http://www.iebr.ac.vn/PAGES/proceedings4\\_Display.asp](http://www.iebr.ac.vn/PAGES/proceedings4_Display.asp).

Nguyen, V. S., Ho, T. C. and Nguyen, Q. T. (2005) 'A checklist of amphibians and reptiles of Vietnam', *Nha xuất bản nông nghiệp, Hanoi*, 180.

Nguyen, V. S., Ho, T. C. and Nguyen, Q. T. (2009) 'Herpetofauna of Vietnam, Edition Chimaira', *Frankfurt am Main, Germany*.

Pipatsawasdikul, K., Voris, H. K. and Thirakhupt, K. (2010) 'Distribution of the Big-Headed Turtle (*Platysternon megacephalum*, Gray 1831) in Thailand', *Zoological Studies*, 49(5), pp. 640–650.

Platt, K. (2018) *Turning adversity into a bright future: hundreds of Big-Headed Turtles confiscated in Burma (Myanmar) used to establish a new conservation breeding programme*. Available at:

<https://myanmar.wcs.org/News/articleType/ArticleView/articleId/11292.aspx> (Accessed: 21 January 2021).

Platt, S. G. *et al.* (2018) 'Field records of turtles, snakes and lizards in Myanmar (2009–2017) with natural history observations and notes on folk herpetological knowledge', *Natural History Bulletin of the Siam Society*, 63, pp. 67–114.

Platt, S. G. *et al.* (2020) 'Platysternon megacephalum (Big-headed Turtle) sperm storage', *Herpetological Review*. Society for the Study of Amphibians and Reptiles, 51(2), pp. 266–267.

Platt, S. G., Platt, K. and Win, K. K. (1999) 'Exploitation and conservation status of tortoises and freshwater turtles in Myanmar', *Chelonian Research Monographs*, 2, pp. 95–100.

Rhodin, A. G. J. *et al.* (2018) 'Global Conservation Status of Turtles and Tortoises (Order Testudines)', *Chelonian Conservation and Biology*, 17(2), pp. 135–161.

Shelmidine, N., Murphy, B. and Biology, K. M. (2016) 'Husbandry and propagation of the Chinese big-headed turtle (*Platysternon megacephalum*) at the Wildlife Conservation Society's Prospect Park Zoo', *Wiley Online Library*, 35, pp. 174–179. doi: <https://doi.org/10.1002/zoo.21271>.

Shen, J.-W., Pike, D. A. and Du, W.-G. (2010) 'Movements and Microhabitat Use of Translocated Big-Headed Turtles (*Platysternon megacephalum*) in Southern China', *Chelonian Conservation and Biology*. Chelonian Research Foundation, 9(2), pp. 154–161. doi: 10.2744/CCB-0833.1.

Shi, G., Hai, S. and Ru, X. (2006) 'A Survey of Freshwater Turtles in Jianfengling Nature Reserve, Hainan Province, China', *Chinese Journal of Zoology*.

Shi, H. *et al.* (2007) 'Farming endangered turtles to extinction in China', *Conservation Biology*. Wiley Online Library, 21(1), pp. 5–6.

Stuart, B. L. *et al.* (2000) 'Turtle trade in Indochina: regional summary (Cambodia, Laos, and Vietnam)', *Chelonian Research Monographs*, 2, pp. 74–76.

Stuart, B. L. and Timmins, R. J. (2000) 'Conservation status and trade of turtles in Laos', *Chelonian Research Monographs*, (2), pp. 58–62.

Sung, Y.-H. *et al.* (2015) 'Growth rate and an evaluation of age estimation for the endangered big-headed turtle (*Platysternon megacephalum*) in China', *Journal of Herpetology*, 49(1), pp. 99–103.





- Sung, Y.-H., Hau, B. and Karraker, N. (2014) *Reproduction of endangered Big-headed Turtle, *Platysternon megacephalum* (Reptilia: Testudines: Platysternidae)*. doi: 10.13128/Acta\_Herpetol-14184.
- Sung, Y.-H., Hau, B. and Karraker, N. (2016) *Diet of the endangered big-headed turtle *Platysternon megacephalum**. doi: 10.7717/peerj.2784.
- Sung, Y.-H., Karraker, N. E. and Hau, B. C. H. (2013) 'Demographic Evidence of Illegal Harvesting of an Endangered Asian Turtle', *Conservation Biology*. John Wiley & Sons, Ltd, 27(6), pp. 1421–1428. doi: <https://doi.org/10.1111/cobi.12102>.
- Sung, Y., Hau, B. C. H. and Karraker, N. E. (2015) 'Spatial ecology of endangered big-headed turtles (*Platysternon megacephalum*): Implications of its vulnerability to illegal trapping', *The Journal of Wildlife Management*, 79(4), pp. 537–543.
- Tordoff, A. W., Lê, T. Đ. and Hardcastle, J. (2001) *A rapid biodiversity survey of Che Tao commune, Mu Cang Chai district, Yen Bai province, Vietnam*. BirdLife International Vietnam Programme and Fauna & Flora International Indochina Programme.
- Wallace, M. (2017) 'Platysternon Megacephalum Captive Breeding and Hatchling Care', p. 10.
- Wikramanayake, E. D. and Vũ, V. D. (1997) *A Biological and Socio-Economic Survey of West Quang Nam Province, with Recommendations for a Nature Reserve*. UNDP.
- Zaw, W. (2010) *Study on Reptilian Fauna of Kyaikhtiyo Wildlife Sanctuary, Myanmar*.
- Zhang, Y.-P. et al. (2009) 'Low optimal temperatures for food conversion and growth in the big-headed turtle, *Platysternon megacephalum*', *Aquaculture*, 295(1–2), pp. 106–109.
- Ziegler, T. et al. (2004) 'The amphibians and reptiles of the Phong Nha-Ke Bang National Park, Quang Binh Province, Vietnam', *HAMADRYAD-MADRAS*, 28, pp. 19–42.
- Ziegler, T. and Vu, T. N. (2009) 'Ten years of herpetodiversity research in Phong Nha-Ke Bang National Park, central Vietnam', *Phong Nha-Ke Bang National Park and Cologne Zoo*, 10, pp. 1999–2009.

