

Hunting and trade of big-headed turtles (*Platysternon megacephalum* Gray 1831) in two protected areas in northern Vietnam

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Abstract. The big-headed Turtle (*Platysternon megacephalum*) is an evolutionary distinct and globally Endangered freshwater turtle species. The primary threat to the species is illegal hunting and trade. However, very little is known about hunting, trade and the conservation status of the species in Vietnam. Interviews with 31 professional *P. megacephalum* hunters, traders, and agriculturalists around Pu Hu Nature Reserve and Pu Mat National Park, northern Vietnam, revealed that the illegal hunting and trade of this species began in the area over 20 years ago, overlapping with the peak of the Asian Turtle Crisis. Respondents reported that the main hunting season occurs from March to September, and that the traditional bamboo basket trap is considered the most efficient hunting method. The volume of *P. megacephalum* being hunted and traded has experienced a dramatic decline since the early 2000s, this has been associated with an increased economic value of the species in these illegal markets in which a single kilogram of the species is worth more than the average local monthly income. Despite all respondents acknowledging they were aware of the protected status of freshwater turtles, a lack of sufficient enforcement of protective legislation was evident. The high economic value and ease of hunting this species in its linear stream habitats means urgent improvements to enforcement will be critical to save the remaining populations in both surveyed protected areas.

Keywords. Asian turtle crisis, overexploitation, illegal wildlife trade, Pu Hu Nature Reserve, Pu Mat National Park, Southeast Asia, conservation

Introduction

In the 1990s, many Asian turtles experienced precipitous population declines leading to the Asian Turtle Crisis (van Dijk et al., 2000). These population declines are driven by unsustainable harvesting to supply Chinese food markets. This unsustainable trade was recognised by the IUCN as a significant threat to turtle survival (Turtle Conservation Coalition, 2011).

The big-headed Turtle (*Platysternon megacephalum*) is widely distributed in Cambodia, Laos, Thailand, Myanmar, Vietnam, and southern China (Turtle Taxonomy Working Group, 2017). There are three

recognised subspecies (Zheng et al., 2013), all of which occur in Vietnam. The species is currently listed as Endangered in both the Vietnam Red book (Ministry of Science and Technology - Vietnam Academy of Science and Technology, 2007) and the IUCN Red List (IUCN, 2019) due to illegal hunting and trade. The species is also considered a global priority for conservation due to its global endangerment and evolutionary distinctiveness (Gumbs et al., 2018). *Platysternon megacephalum* is territorial and exhibits site fidelity along linear stream habitats (Shen et al., 2010) and this makes the species inherently vulnerable to overexploitation, as they are collected for consumption, traditional medicine, and to stock turtle farms (de Bruin and Artner, 1999; Lau et al., 2000; Stuart et al., 2000; Gong et al., 2005, 2006; Shi et al., 2007; Zhou and Jiang, 2008).

Platysternon megacephalum has been reported from mountainous areas of northern and central Vietnam (Hendrie, 2000; Nguyen et al., 2009; ATP, unpublished data), including Pu Hu Nature Reserve (NR) in Thanh Hoa Province (Nguyen et al., 2011) and Pu Mat National Park (NP) in Nghe An Province (Le, 2008). Little is known about the historical or current levels of hunting and trade or the status of the species in the wild at the national or local level. The understanding of exploitation

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of *P. megacephalum* at the local level and the associated trade networks is extremely beneficial in allowing informed and targeted enforcement and conservation interventions to be made. *Platysternon megacephalum* is an economically significant and easily identifiable species, making it a suitable target species for interview surveys (Turvey et al., 2018).

Here we present findings from interview surveys on the hunting, trade and conservation status of *P. megacephalum* in Pu Hu NR and Pu Mat NP and we make recommendations to better conserve the species within these protected areas.

Methods

Interview surveys. Interview surveys were conducted around two protected area, Pu Hu Nature Reserve, Thanh Hoa Province (20.3927° – 20.5940°N, 104.7742° – 105.0084°E) and Pu Mat National Park, Nghe An Province (18.7740° – 19.1266°N, 104.4036° – 104.9804°E (BirdLife International in Indochina and MARD, 2004) during June 2019 by two of the authors (HH and HL). At each protected area interviews were conducted in Vietnamese language with professional *P. megacephalum* hunters, traders, and agriculturalists (no evidence of breeding was observed, the captive turtles appear to be attempts to ranch/farm the species). All interviewees were over 18 years of age and gave permission to publish interview data if anonymity was assured. Interview data was stored within a password locked file. Methods were approved internally by the Zoological Society of London (project reference codes: ZIS12 and EDG79). Interviewees were predominantly selected using chain-referral sampling (specifically, snowball sampling) and to a lesser extent opportunistic sampling (Newing et al., 2011). To ensure the local names provided by respondents were *P. megacephalum*, we asked respondents to describe the key morphological features, habitat preference, behaviour and diet of the species before showing them photographs of native tortoises and freshwater turtles. Interviewees were then asked to identify the species described from a selection of 10 photographs of native tortoise and freshwater turtle species occurring within the two protected areas. If respondents were able to successfully match their described species to *P. megacephalum* from the photographs, we continued the interview and obtained information on the local distribution, hunting methods, hunting season, trade, volume and price of hunted *P. megacephalum*. We calculated the economic value of *P. megacephalum*; where historical exchange rates

were available (World Bank, 2020), the price provided by interviewees was converted into US\$ for ease of reporting and comparison. Data on the respondent's demographic characteristics and their knowledge and attitudes related to *P. megacephalum* were also collected. The interviewees were asked to find any living turtles or shells that might be kept around local households or within the nearby community. If turtles were observed, a standardised turtle field record form was filled out and a photographs were taken of each specimen. Geographic coordinates (WGS 84 datum) and elevation (above sea level in metres) were recorded using a Garmin GPS 64st. Interview data was entered and analysed using Microsoft Excel 2013 ®.

Results

A total of 31 interviews at nine communes of Pu Hu NR (n = 15) and Pu Mat NP (n = 16) were completed during our surveys (Table 1; Fig. 1; see Appendix 1 for interview questions). All respondents correctly identified *P. megacephalum*.

Local names. Several local names were used for *P. megacephalum*, which varied according to language and or dialect. Local names included *Rua mo vet* (Kinh and Dan Lai ethnic groups) which means parrot-like beaked turtle; *Tau cu lu* (Thai ethnic group) which means big-headed turtle; *To cap cang* (Thai ethnic group) which means big-jawed turtle; *To tau nam* (Thai ethnic group) which means freshwater turtle and *Vo ki de* (H'mong ethnic group) which also means freshwater turtle. Although villagers used different names for *P. megacephalum*, all names referred to key morphological features and/or the aquatic nature of this species.

Use of *P. megacephalum*. Over the last 15 years, almost all respondents (93.54%) hunted *P. megacephalum* for commercial trading purposes while only two (6.45%) respondents consumed the species themselves. Traditionally, and until recently, the *P. megacephalum* that were collected were only consumed locally when they died during trapping, hunting and transportation. All live individuals of an appropriate size are sold into the trade network. Other than those two uses, respondents did not state any alternative use for *P. megacephalum*.

Hunting. At Pu Hu NR, six respondents (40.00%) visited the forest to specifically look for *P. megacephalum*, another six respondents (40.00%) answered that hunting of *P. megacephalum* was opportunistic, secondary to other activities, and three respondents (20.00%) combined *P. megacephalum* hunting with other activities. Those figures in Pu Mat

Table 1. Demographic characteristic of interviewees at Pu Hu Nature Reserve (NR) and Pu Mat National Park (NP).

Characteristics	Pu Hu NR n (%)	Pu Mat NP n (%)
Ethnicity		
Thai	8 (53%)	13 (81.25 %)
Dan Lai		3 (18.75 %)
Kinh	1 (7%)	
H'mong	5 (33%)	
Muong	1 (7%)	
Gender		
Male	14 (93%)	16 (100%)
Female	1 (7%)	0 (0%)
Age	Average: 42.5 (30–58), SD: 9.61	Average: 49.75 (30–62), SD: 9.52
Main occupation		
Hunter	6 (40%)	9 (56.25%)
Trader	4 (24%)	1 (6.25%)
Famer	5 (33%)	6 (37.5%)

were 5 respondents (31.25%), 4 respondents (25.00%), and 7 respondents (43.75%) respectively.

Hunting methods used by respondents were quite diverse and specific to ethnic group. According

to our surveys, H'Mong people usually caught *P. megacephalum* opportunistically directly by hand during the day. The H'Mong people in Pu Hu NR report fishing for *P. megacephalum* with a single rod without a hook, using bait such as worms or rotten meat whereas the Thai people (in both Pu Hu NR and Pu Mat NP) reported using bamboo basket traps (Fig. 2) baited with rotten buffalo skin, rotten frogs or the guts of pigs and chickens. Bamboo basket traps were considered to be the best hunting method and were the preferred method used by professional *P. megacephalum* hunters. These traps can be made in the forest with fresh bamboo by skilled hunters, it takes less than 15 minutes to construct a cylindrical funnel trap measuring 50 cm x 20 cm. Depending on the number of pools and waterfalls within each stream, hunters reported setting 20–30 traps (set for 3–4 days) during each hunting expedition.

The reported *P. megacephalum* hunting season was similar in both Pu Hu NR and Pu Mat NP with the main period being March to July (lunar). Some respondents reported that they hunted for the species into September (lunar). The hunting season coincides with the transition between the dry and rainy seasons in the region. Local people explained that during this time, it was hot and wet,

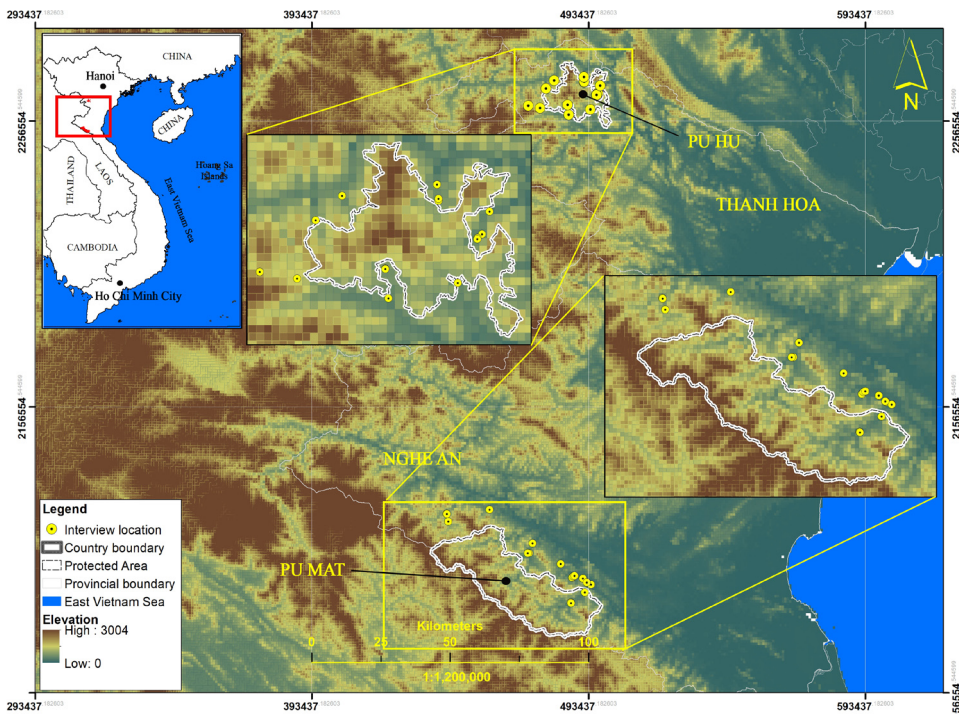


Figure 1. Map showing interview locations and Pu Hu Nature Reserve and Pu Mat National Park within Vietnam.



Figure 2. Bamboo basket traps made and used by professional *P. megacephalum* hunters at both Pu Mat and Pu Hu areas. Photo by Ha Hoang.

resulting in increased turtle activity after the cold winter in northern Vietnam. Some hunters also stated that during the period from May – June (lunar) *P. megacephalum*

were sometimes observed moving to land to lay their eggs (two eggs per clutch per year; anonymous hunter, pers. comm.) and could easily be caught at this time. Respondents stated that *P. megacephalum* retreated to caves in the stream and were inactive between October and February making them difficult to catch.

Respondents from the Pu Mat area stated that in June, local traders refused to buy gravid female *P. megacephalum* as they often die whilst being held prior to sale or during transportation. Across much of the survey area, local hunters reported that animals weighing less than 300 g or those with injuries (e.g., broken shells, missing tails, and missing limbs) would be released back into the wild as local traders would not buy them or they would offer a very low price. However, there were some attempts by villagers to raise wild caught yearling and juvenile *P. megacephalum* in captivity. We observed one local household with seven live *P. megacephalum* (weighing from 150 – 910 g) and by another team of the Asian Turtle Program (ATP with 15 live *P. megacephalum* in 2011 (Asian Turtle Program, 2011) (Fig.3).



Figure 3. Two of the seven *Platysternon megacephalum* being kept at a single household at Pu Hu NR during this survey. Photo by Ha Hoang.

At both sites, the information from respondents on historical and current hunting of *P. megacephalum* indicated a general reduction in the volume (Fig. 4). The peak period of *P. megacephalum* hunting was reportedly between 1995 and 2000. During this time, a high volume of wild *P. megacephalum* were caught by local hunters. On average, one professional hunter in the Pu Hu area caught 5–6 kg of *P. megacephalum*/year, (10–12 turtles if an average turtle is assumed to weigh 0.5 kg (Duc and Broad, 1995). One professional hunter in the Pu Mat area reported collecting 8–9 kg/year (16–18 turtles) during the 2000s. Respondents reported a dramatic population decline of *P. megacephalum* at both sites from 2005 onwards due to over-collection. From 2009 (at Pu Hu NR) and 2010 (at Pu Mat NP), respondents reported that only a few young *P. megacephalum* were opportunistically collected. It is notable that since 2008, perhaps due to the scarcity of wild *P. megacephalum* in Pu Mat NP, some hunters reported that they travelled to adjoining forests in Lao People's Democratic Republic where they claimed that catch per unit effort was 7–8 times higher than in Pu Mat NP.

Illegal trade. The local trade of *P. megacephalum* experienced a clear downward trend when we talked with five local traders, accounting for 16% of total respondents (Fig. 5).

In 1999, the interviewed traders stated that they could buy from 15–80 kg of *P. megacephalum* (approx. 8–40 individual turtles assuming an average turtle weight of 0.5 kg) from local hunters. The volume of *P. megacephalum* purchased by traders decreased sharply in 2002 and since then, has remained at a very low volume (Fig. 5).

From data provided by respondents, we were able to calculate the average price of *P. megacephalum* on the local illegal market from 1993–2018 (Fig. 6). Although the price differed between the two survey areas, trends were similar over the past 25 years. In the Pu Hu area, the economic value of *P. megacephalum* rose dramatically by 130 times from 25,000 VND/kg (US\$2.35) in 1993 to 3,260,000 VND/kg in 2018 (US\$144.23). In the Pu Mat area, the price increased by 181 times, from 25,000 VND/kg (approx. US\$2.35) in 1993 to 4,533,333 VND/kg in 2018 (US\$200.57). It should be noted that these prices do not take into account the inflation rate of VND over the reported period.

Using data from General Statistics Office Of Vietnam (2019), we were able to compare the most recent price (2018) and historical price (1999) of *P. megacephalum* with the local average monthly income per capita. In 2018, the price of *P. megacephalum* was 1.08 and 1.50

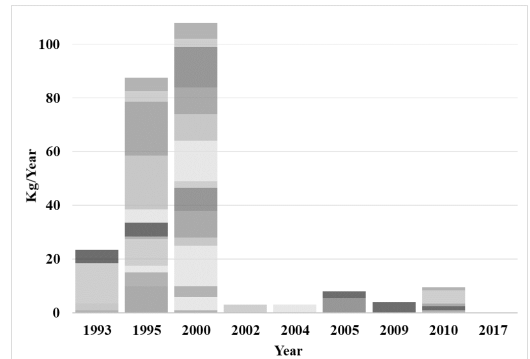


Figure 4. Volume of *Platysternon megacephalum* hunted in Pu Mat NP and Pu Hu NP over time. Different shades represent data from different hunters.

times the local average monthly income per capita in Pu Hu and Pu Mat areas respectively. In 1999, the price of *P. megacephalum* was 1.03 times local average monthly income per capita in both areas.

Currently, in the Pu Mat area, *P. megacephalum* is the second most economically valuable native turtle species (the first being *Cuora cyclornata*). In Pu Hu NR, *P. megacephalum* is the most economically valuable turtle species.

In Pu Hu NR, 73% (n = 11) of respondents reported that the wild *P. megacephalum* population decreased by more than 80% over the last 20 years. The figure was 87.5% (n = 14) in Pu Mat NP.

The majority of respondents reported that illegal hunting and trade were the two primary reasons for the significant decline of wild *P. megacephalum* at both survey sites (86.67%, n = 13, Pu Hu NR) and (87.50%, n = 14, Pu Mat NP). Other respondents (13.33% n = 2) stated that a combination of illegal hunting/trade and habitat loss were the main reasons why *P. megacephalum*

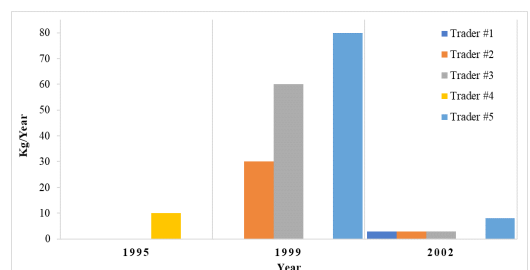


Figure 5. Volume of trade of *Platysternon megacephalum* through different periods in Pu Mat NP and Pu Hu NR.

had declined in Pu Hu, while 12.5% (n = 2) of Pu Mat respondents reported that habitat loss was the primary reason for population declines. This significant depletion of *P. megacephalum* has had a direct impact on 60% of respondent’s household income in Pu Hu NR and 25% of respondent’s household income in Pu Mat NP. The income generated from *P. megacephalum* hunting and trade was the main source of income in the past; in Pu Hu NR a local trader stated that in 1999 he built a house costing 70–80 million VND (US\$5,020 – US\$5,737) and that 35% of the cost was covered by the money he made trading *P. megacephalum*.

Knowledge and attitudes toward *P. megacephalum*.

Based on the situational question: “If on your next trip into the forest you encounter a big-headed turtle trapped in a cage and alive, what would you do?”. Remove it from the trap and bring it home to sell, use, or gift to others was the most common option among the two sites with 80% of respondents selecting this option in Pu Hu NR. The figure was similar (75%) in Pu Mat NP.

All respondents in both protected areas thought that turtles in general, and *P. megacephalum* in particular, were protected by law. Therefore, the acts of hunting and trading are illegal. The hunting of all tortoise and freshwater turtle species from within protected areas is prohibited under the Vietnam Forest Law 2017, which prohibits any hunting of wildlife within forests of Vietnam, both protected areas and non-protected.

However, when we asked about details of relevant regulations, 100% of respondents in Pu Hu NR were unable to name any legal documents and were not aware of fines, while 13% of respondents in Pu Mat NP could list the names of legal documents and 43.75% of them could actually describe the fines applied for breaking the wildlife protection law. Both of Vietnams principle wildlife protection laws, Decree 06/2019/ND-CP and Decree 160/2013/ND-CP (amended and supplemented by Decree 64/2019/ND-CP) both list *P. megacephalum* as a nationally protected species. In Pu Mat NP, one respondent had been fined and had animals and equipment seized three times for illegal hunting of *P. megacephalum* inside the National Park.

The majority of respondents (100% in Pu Hu NR and 75% in Pu Mat NP) reported that forest rangers or authorities never, or rarely, confiscated *P. megacephalum* from local people. This could be explained by the small size of this turtle which makes them easy to be hide when hunters and traders pass the ranger’s check point. In addition, logging was stated to be the primary concern of rangers, not the illegal exploitation of *P. megacephalum* (anonymous hunter, pers. comm.).

Discussion

The peak reported periods of exploitation of *P. megacephalum* at our study sites overlap with the height of the Asian Turtle Crisis in which turtles were collected

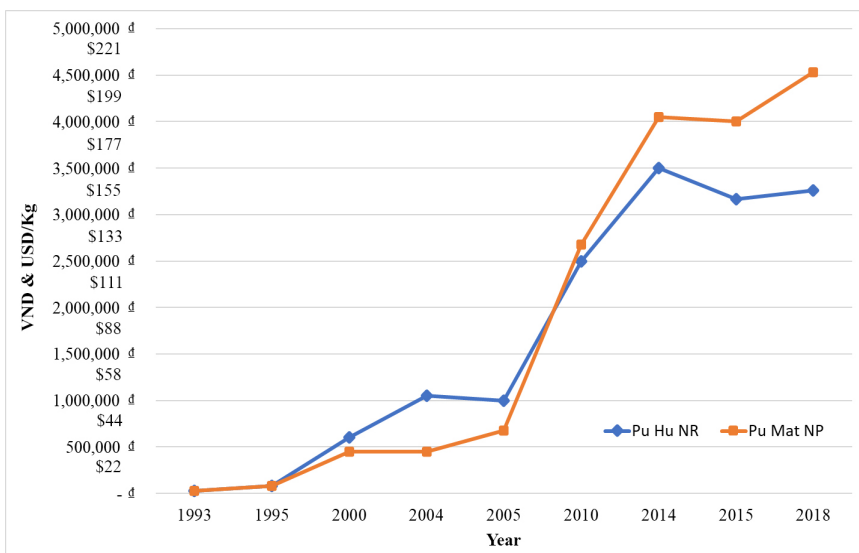


Figure 6. Graph shows the increasing economic value of *Platysternon megacephalum* in illegal market in Pu Mat NP and Pu Hu NR.

throughout Southeast Asia to meet the high demand for tortoises and freshwater turtles in Chinese markets. The fact that hunters and traders at both sites provided the same information on the specific criteria that turtles must meet in order for them to be purchased (i.e. healthy, non-gravid, and weighing in excess of 300 g) indicates that the data collected in this study is reliable.

The severe reported decline in the volume of hunted and traded *P. megacephalum* in both protected areas could have a number of explanations; depletion of wild populations due to intensive hunting, and illegal trade in the preceding decades. An alternative explanation for the decline in volume of hunted turtles could be related to the improved protection through the establishment of Pu Hu NR in 1999 and Pu Mat NP in 2001 (BirdLife International in Indochina and MARD, 2004) coupled with enforcement of protective legislation, education and the protection of Endangered turtle species could have reduced the number of people entering the forest to hunt. However, professional hunters stated greater effort was required to find *P. megacephalum* during hunting trips in the forest, this indicates that animals had become increasingly rare rather than better protected. Moreover, most of respondents considered the illegal hunting and trade to be the main causes of *P. megacephalum* population decline. This population decline due to hunting pressure, is also well recognised and reported throughout the species' range, including Cambodia (Stuart et al., 2000), China (Gong et al., 2006, 2017), Hong Kong (Lau et al., 2000), Laos (Stuart and Timmins, 2000; Stuart et al., 2000), Myanmar (Shepherd and Nijman, 2007), and Thailand (Pipatsawasdikul et al., 2010).

During the interview surveys at Pu Mat NP, it was challenging to obtain recent information on the volume of hunted and traded *P. megacephalum*. Some respondents were reluctant to be interviewed or potentially gave false or underestimated numbers, cautious that information might be disclosed to the authorities. These concerns have likely been exacerbated by recent confiscations and strict fines applied for illegal hunting activity around Pu Mat NP (Cam Thi, 2019). Therefore, the recent data on volume of hunted *P. megacephalum* was potentially an underestimate. Other lines of evidence suggest this may be the case. For example, at the Turtle Conservation Centre (TCC) of Cuc Phuong NP – the specialised rescuing, breeding and holding facility for more than 1500 turtles representing 23 of 25 Vietnam's native species, a total of 364 *P. megacephalum* which might have been collected from Vietnam's protected

areas, including Pu Hu NR and Pu Mat NP, were received from wildlife confiscations from 2015–2019 (Asian Turtle Program (ATP), unpublished data).

All respondents were aware of legal protection of tortoise and freshwater turtle species in general, and *P. megacephalum* in particular, at both surveyed sites. However, the results from the interview surveys suggest that illegal hunting and trade of *P. megacephalum* is likely to continue at both survey sites and we hypothesise that this could be due to the following (1) the high economic value on the illegal market; (2) insufficient law enforcement at the site level; and (3) lack of other livelihood alternatives that offer a comparable significant income. *P. megacephalum* is currently offered the highest level of protection under the two primary wildlife protection laws of Vietnam (i.e. Decree 160/2013/ND-CP, and Decree 06/2019/ND-CP). However, inadequate law enforcement should be considered as the main barrier for the protection of the remaining *P. megacephalum* populations in Pu Hu NR and Pu Mat NP; most of the respondents claimed that forest rangers and authorities have never or rarely confiscated *P. megacephalum* from local people. As a result, the hunting and trade of this Endangered turtle species continues, despite the areas being designated as protected. This is a common issue in most protected areas throughout Vietnam, where weak enforcement of legislation is common and economic incentives for local communities to engaging in hunting and other forest resource collection activities remains high (Dang, 2004; Ruppell, 2008; Brook et al., 2014).

The average reported value of *P. megacephalum* was similar to the values reported in earlier studies (Duc and Broad, 1995; Espenshade III and Le, 2000). The dramatic increase in economic value of *P. megacephalum* during the last 25 years was also reported by Thong et al. (2019) in a study of longitudinal monitoring of turtle trade through Facebook in Vietnam.

Improved enforcement of existing wildlife protection laws will be critical in safeguarding the remaining populations of *P. megacephalum* in the wild in Pu Hu NR and Pu Mat NP and other protected areas in Vietnam. This could be achieved by regular patrols and anti-poaching activities being undertaken to coincide with the peak hunting activity between March and September annually. Efforts should also be made to disrupt the broader illegal wildlife trade networks into which this, and other species, are most likely to be traded. Further survey work might be needed in order to fully understand the community awareness of and

attitude towards *P. megacephalum* at the local level before implementing any communication intervention for *P. megacephalum* at either site. In the meantime, the local communities should continue to be informed of the laws protecting this species.

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References

- Asian Turtle Program (2011): *Interview survey for the Indochinese Box turtle around Pu Hu Nature Reserve in Northern Vietnam*. The Asian Turtle Program. Available at: <http://www.asianturtleprogram.org>. Accessed on 20 January 2020.
- BirdLife International in Indochina and MARD (2004): *Sourcebook of Existing and Proposed Protected Areas in Vietnam: Second Edition*. Hanoi, Vietnam.
- Brook, S.M., Brook, Sarah M., Dudley, N., Mahood, S.P., Polet, G., et al. (2014): Lessons learned from the loss of a flagship: The extinction of the Javan rhinoceros *Rhinoceros sondaicus annamiticus* from Vietnam. *Biological Conservation* **174**: 21–29.
- Cam Thi (2019): *Nghe An: Hunting 02 langurs, 05 subjects sentenced to imprisonment*, Kiem sat online. Available at: <https://kiemsat.vn>. Accessed on 20 January 2020.
- Dang, C.O. (2004): Study and conservation activities on Sao la (*Pseudoryx nghetinhensis*) in Pu Mat national park from 1993 to 2003. In: Proceedings of the 'rediscovering the Saola - a status review and conservation planning workshop, p. 45–51. Hardcastle, J., Cox, S., Nguyen, T. D., Johns, A. G., Ed., Con Cuong, Nghe An, Vietnam, WWF Indochina Programme.
- de Bruin, R.W., Artner, H.G. (1999): On the turtles of Hainan Island, southern China. *Chelonian Conservation and Biology* **3**(3): 479–486.
- Duc, L.D., Broad, S. (1995): *Investigations Into Tortoise And Freshwater Turtle Trade In Vietnam*, First Edition. Oxford, UK, Information Press.
- Espenshade III, W., Le, D. (2000): Pu Mat turtle hunter interview, *Turtle and Tortoise Newsletter* **5**: 16–17.
- General Statistics Office Of Vietnam (2019): *Monthly average income per capita at current prices by residence and by region, 1999–2018*. Statistical Documentation and Service Centre - General Statistics Office Of Vietnam. Available at: <https://www.gso.gov.vn>. Accessed on 20 January 2020.
- Gong, S., Youli, F., Jichao, W., Haitao, S., Rumei, X. (2005): Freshwater turtle trade in Hainan and suggestions for effective management. *Chinese Biodiversity* **13**(3): 239–247.
- Gong, S., Chow, A.T., Fong, J.J., Shi, H.T. (2006): Illegal trade and conservation requirements of freshwater turtles in Nanmao, Hainan Province, China. *Oryx* **40**(3): 331–336.
- Gong, S., Shi, H.T., Jiang, A.W., Fong, J.J., Gaillard, D., Wang, J.C. (2017): Disappearance of endangered turtles within China's nature reserves. *Current Biology* **27**(5): R170–R171.
- Gumbs, R., Gray, C.L., Wearn, O.R., Owen, N.R. (2018): Tetrapods on the EDGE: Overcoming data limitations to identify phylogenetic conservation priorities. *PLoS ONE* **13**(4): 19.
- 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*. p. 63–73. van Dijk, P.P., Stuart, B.L., Rhodin, A.G.J., Ed., Lunenburg, Massachusetts, USA, Chelonian Research Foundation.
- IUCN (2019): *The IUCN Red List of Threatened Species*. Version 2019-3. The IUCN Red List of Threatened Species. Available at: <http://www.iucnredlist.org>. Accessed on 10 December 2019.
- Lau, M., Chan, B., Crow, P., Ades, G. (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*. p. 39–44. van Dijk, P.P., Stuart, B.L., Rhodin, A.G.J., Ed., Lunenburg, Massachusetts, USA, Chelonian Research Foundation.
- Le, H.D. (2008): *Herpetology diversity of Pu Mat National Park*. Unpublished Master thesis, University of Vinh, Nghe An, Vietnam.
- Ministry of Science and Technology - Vietnam Academy of Science and Technology (2007): *Viet Nam Red Book - Fauna*, First edition. Ha Noi, Vietnam, Science and Technology Publishing House.
- Newing, H., Eagle, C.M., Puri, R.K., Watson, C.W. (2011): *Conducting Research in Conservation: Social Science Methods and Practice*, First edition. London, United Kingdom, Taylor & Francis Ltd.
- Nguyen, K.T., Nguyen, T.D., Hoang, T.N., Truong, N.T. (2011): Herpetofauna of Pu Hu Nature Reserve in Thanh Hoa province. In: *The 4th National Scientific Conference On Ecology and Biological Resources*, p. 407–413. Tran, M. H., et al., Eds., Hanoi, Vietnam: Agriculture Publishing House.
- Nguyen, V.S., Ho, T.C., Nguyen, Q.T. (2009): *Herpetofauna of Vietnam*, First Edition. Frankfurt am Main, Germany, Edition Chimaira.
- Pipatsawasdikul, K., Voris, H.K., Thirakhupt, K. (2010): Distribution of the Big-Headed Turtle (*Platysternon megacephalum*, Gray 1831) in Thailand. *Zoological Studies* **49**(5): 640–650.
- Ruppell, J. (2008): The gibbons of Pu Mat National Park in Vietnam. *Gibbon Journal* **4**: 39–46.
- Shen, J.W., Pike, D.A., Du, W.G. (2010): Movements and Microhabitat Use of Translocated Big-Headed Turtles (*Platysternon megacephalum*) in Southern China. *Chelonian Conservation and Biology* **9**(2): 154–161.
- Shepherd, C.R., Nijman, V. (2007): An assessment of wildlife trade at Mong La market on the Myanmar-China border. *Traffic Bulletin* **21**(2): 85–88.
- Shi, H., Parham, J.F., Lau, M., Tien-Hsi, C. (2007): Farming endangered turtles to extinction in China. *Conservation Biology* **21**(1): 5–6.

- Stuart, B.L., Timmins, R.J., Hendrie, D.B., Sopha, L., Sophat, C., Piseth, H., et al. (2000): Turtle trade in Indochina: regional summary (Cambodia, Laos, and Vietnam). In: Asian turtle trade: proceedings of a workshop on conservation and trade of freshwater turtles and tortoises in Asia. p. 74–76. van Dijk, P.P., Stuart, B.L., Rhodin, A.G.J., Ed., Lunenburg, Massachusetts, USA, Chelonian Research Foundation.
- Stuart, B.L., Timmins, R.J. (2000): Conservation status and trade of turtles in Laos. In: Asian turtle trade: proceedings of a workshop on conservation and trade of freshwater turtles and tortoises in Asia. p. 58–62. van Dijk, P.P., Stuart, B.L., Rhodin, A.G.J., Ed., Lunenburg, Massachusetts, USA, Chelonian Research Foundation.
- Pham, V.T., Luu, Q.V., Vu, T.T., Leprince, B., Tran, K.L., Luca, L. (2019): Longitudinal monitoring of turtle trade through Facebook in Vietnam. *Herpetological Journal* **29**: 48–56.
- Turtle Conservation Coalition (2011): *Turtles in Trouble: The World's 25+ Most Endangered Tortoises and Freshwater Turtles*, First Edition. Lunenburg, Massachusetts, USA, MTC Printing, Inc.
- Turtle Taxonomy Working Group (2017): *Turtles of the world, 8th edition: annotated checklist of taxonomy, synonymy, distribution with maps, and conservation status*. In: *Conservation Biology of Freshwater Turtles and Tortoises: A Compilation Project of the IUCN/SSC Tortoise and Freshwater Turtle Specialist Group*. Chelonian Research Monographs, p. 296. Anders, G.J., et al., Eds., Lunenburg, Massachusetts, USA, Chelonian Research Foundation.
- Turvey, S.T., Chen, S., Tapley, B., Wei, G., Xie, F., Yan, F., et al. (2018): Imminent extinction in the wild of the world's largest amphibian. *Current Biology* **28**(10): R592–R594.
- van Dijk, P.P., Stuart, B.L., Rhodin, A.G.J. (2000): *Asian Turtle Trade: Proceedings of a Workshop on Conservation and Trade of Freshwater Turtles and Tortoises in Asia*. Lunenburg, Massachusetts, Lunenburg, USA, Chelonian Research Foundation.
- World Bank (2020): *Official exchange rate (LCU per US\$, period average) - Vietnam | Data*. The World Bank Open Data. Available at: <https://data.worldbank.org>. Accessed on 17 January 2020.
- Zheng, C., Nie, L., Wang, J., Zhou, H., Hou, H., Wang, H., Liu, J. (2013): Recombination and evolution of duplicate control regions in the mitochondrial genome of the Asian big-headed Turtle, *Platysternon megacephalum*. *PLoS ONE* **8**(12): e82854.
- Zhou, Z., Jiang, Z. (2008): Characteristics and Risk Assessment of International Trade in Tortoises and Freshwater Turtles in China. *Chelonian Conservation and Biology* **7**(1): 28–36.