



Observations of threatened Asian box turtles (*Cuora* spp.) on trade in Vietnam

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Asian box turtles (genus *Cuora*; Geoemydidae) are among the most threatened Asian turtles. Here, we present (i) a field investigation from 2014-2018 on the *Cuora* individuals traded by high-level traders in six provinces of Vietnam and (ii) the estimated numbers of traded individuals determined through interviews with traders. In addition, we (iii) provide an analysis of the confiscated individuals that were carried out at the main wildlife rescue centre of the Socialist Republic of Vietnam. Overall, the number of traded individuals observed was relatively small ($n = 481$), with *C. bourreti* being by far the most frequently observed in trade. During the same period, the interviewed traders estimated that about 3,400 individuals were traded through the period 2014-2018, most of them being *C. bourreti*. During 2010-2018, a total of 281 individuals were carried to the wildlife rescue centre, with over 60 % of the total rescued individuals being *C. galbinifrons*. Overall, the numbers of traded *Cuora* individuals recorded in the present study were very small compared to the huge estimates from other Asian countries. However, this lower traded number does not imply that the status of the target species are not affected, as their population sizes are already catastrophically reduced in Vietnam.

Keywords: turtle trade, Vietnam, interviews, field surveys

INTRODUCTION

Asian box turtles (genus *Cuora*; Geoemydidae) number 13 known species worldwide (Turtle Taxonomy Working Group, 2017). Some *Cuora* species are overexploited (Fig. 1) (e.g. Stuart, 2004; Schoppe, 2009; Nijman, 2010) and presumably in heavy decline (Stanford et al., 2018), are therefore considered as Critically Endangered by the IUCN (2018). Six *Cuora* species are native to Vietnam, with another species (*C. zhoui*) still in doubt (Turtle Taxonomy Working Group, 2017). Of these, *Cuora galbinifrons* was originally described by Bourret (1941) from a specimen collected from Vietnam. Based on its distinctive morphological features, this species was then separated into three subspecies (Obst & Reimann, 1994), that were subsequently even considered as distinct species by most of the authors: *Cuora galbinifrons*, *C. bourreti*, and *C. picturata* (Stuart & Parham, 2004).

Of these three species, *C. galbinifrons* is known from southern China, and the northern and central parts (southernmost are Quang Binh province) of Vietnam and Laos (Fritz et al., 2002; McCormack et al., 2016), while *C. bourreti* is found in Quang Binh Province to Kon Tum

province and southern Laos (McCormack & Stuart, 2016; Stuart et al., 2011). *C. picturata* is endemic to Binh Dinh, Khanh Hoa and Phu Yen provinces, in central Vietnam (Ly et al., 2011; Duong et al., 2014). Thus, apparently the three species exhibit a continuously allopatric or contiguously parapatric distribution in Vietnam: *C. galbinifrons* in the northern provinces, *C. bourreti* in the central provinces, and *C. picturata* in the southern provinces of Vietnam (IUCN, 2018). There is still doubt concerning the coexistence between *C. bourreti* and *C. picturata* which, apparently, could coexist in Gia Lai province (McCormack & Stuart, 2016), however species delimitations are often difficult in this turtle genus due to a great propensity for natural and human-induced hybridisation (Spinks et al., 2012). Interestingly, the sympatric occurrence of *C. galbinifrons* and *C. bourreti* was instead confirmed in Phong Nha Ke Bang National Park, Quang Binh province (Fritz et al., 2002). Overall, Vietnam is one of the most important countries in east Asia as for the conservation prospects of these declining species.

The preferred habitat of the three above-mentioned *Cuora* species is montane moist forest (Fig. 1 and see, e.g.

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Figure 1. Individuals of *C. bourreti* being traded at Quang Nam province (photo a), *C. bourreti* and a few *C. galbinifrons* at Da Nang city (photo b), *C. galbinifrons* (with also a few individuals of *C. mouhotii*) for sale in Quang Binh province in north Vietnam (photo c), and *C. galbinifrons* transferred to Hanoi Wildlife Rescue Center, Tien Duoc, Soc Son district in 2018 after confiscation from illegal wildlife trade (photo d). This plate also shows the general view of the habitat of *C. bourreti* in Bach Ma National Park (photo e) and *C. galbinifrons* at Phong Nha-Ke Bang National Park (photo f). Photo credit: (a), (b), (d), (e) Thong Pham Van; (c), (f) Benjamin Leprince.

Ly et al., 2013) at an altitudinal range of 500-1000 m a.s.l. for *C. galbinifrons* (Blanck, 2013), slightly lower (300-700 m a.s.l.) for *C. bourreti* (Stuart et al., 2011; McCormack & Stuart, 2016) and from 346 to 561 m a.s.l. for *C. picturata* (Ly et al., 2011; McCormack et al., 2016). Thus, the protection of the rapidly disappearing mountain forest patches may represent the most important conservation action for securing the future of these threatened species in Vietnam. Other than habitat loss, the decline of Vietnamese *Cuora* species has also been driven by intensive exploitation since the 1990s to supply the Chinese food markets (Hendrie, 2000). In addition, all *Cuora* species were also traded for pet markets (Pham et al., 2019) and the Chinese traditional medicine markets (McCormack & Stuart, 2016).

Overall, there was an indirectly estimated population collapse of over 90 % during the past 60 years due to over exploitation and habitat loss (IUCN, 2018), with *C. galbinifrons* being now listed among the 25 most threatened turtle species of the world and *C. bourreti* and *C. picturata* among the top 50 (Stanford et al., 2018). Nonetheless, no direct field demographic data from any

population studies are available to confirm this presumed population collapse.

Here, we present quantitative data from (i) field investigations on individuals of three of *Cuora* species traded by high-level traders in six provinces of Vietnam, and (ii) on the estimated numbers of individuals on the basis of interviews with the same high-level traders. In addition, we (iii) provide data on the numbers of confiscated individuals that were carried out at the main wildlife rescue centre of the Socialist Republic of Vietnam (Hanoi Wildlife Rescue Center, Tien Duoc, Soc Son district) in 2010-2018.

METHODS

The field study was carried out in six big cities and provinces of Vietnam, including Da Nang, Nha Trang, Hanoi, Ho Chi Minh, Buon Ma Thuat and Quang Nam (Fig. 2). The survey was conducted in August to September 2014, April, July and December 2016, April 2017, January, March and September 2018. Each survey trip lasted for 10 to 20 days.

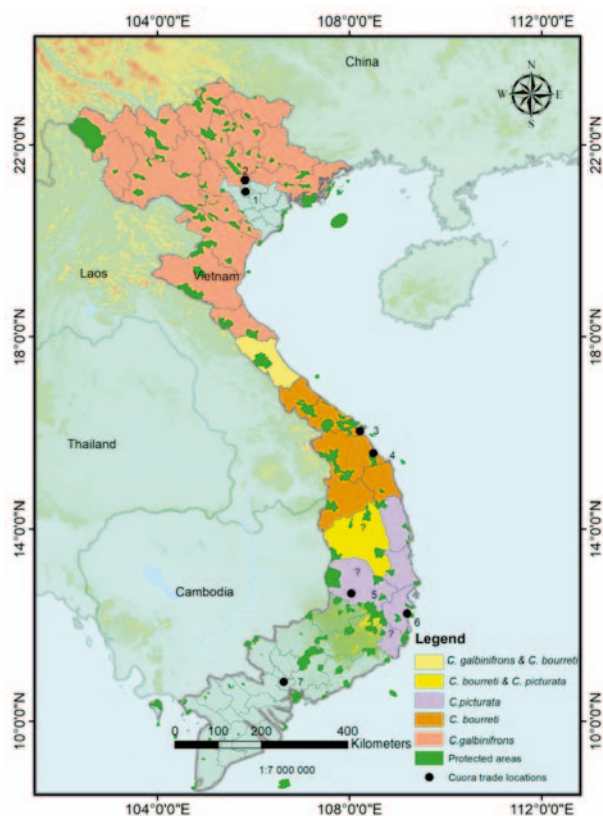


Figure 2. Map of Vietnam showing the study areas used for the field surveys with 1= Hanoi city, 2= Hanoi Wildlife Rescue Center, 3 = Danang city, 4 = Tam Ky city, Quang Nam province, 5 = Buon Ma Thuat city, Dak Lak province, 6 = Nha Trang city, Khanh Hoa province, 7 = Ho Chi Minh city. The map also shows the *Cuora* spp. distribution in Vietnam. Question marks (?) indicate areas where the species' presence is still unconfirmed

The field investigation, explicitly authorised by the CITES Vietnam and Soc Son Wildlife Rescue Center (Hanoi), was based on surveys of turtles in the hands of illegal traders actively involved in the pet market in Vietnam. We met these traders after contacting them through Facebook (Pham et al., 2019). Two of the co-authors (Leprince & Pham) conducted the interviews with each of the illegal traders in Hanoi from 2014. When possible, we examined the animals that they had for sale and also escorted them in the field. Each time we accompanied the trader in the field, we also examined the turtle individuals collected by other traders in their network and temporarily stored for sale in their private houses. Overall, we surveyed the turtle individuals in the hands of six traders of high level (level 4) out of about 20 operating at the country scale. According to Pham (2018), in each commune of Vietnam there are at least 1 to 2 small wildlife traders (level 1), each district has at least also 1-2 bigger traders (level 2), each province has at least 1-2 traders (level 3), and each region has usually one big trader (level 4), who collects all turtle individuals from lower-level traders. Thus, our survey was well representative of the volume of turtles on trade in the explored regions of Vietnam throughout the study period. When inside the traders' houses, we asked which species they keep and how many individuals. We took photos

of the various turtle individuals if the trader allowed us to do so. We also identified each individual to species level, and counted the number of traded individuals, also recording their body size (carapace length). If the trader did not allow us to take photos, we recorded all the other data as mentioned above. We also asked to the interviewees the following information: (i) where did each turtle individual come from? (ii) what was the price for each turtle individual for sale? (iii) where will they sell the turtle? (iv) what type of means do they use to transport turtles to customers? (v) in which months do they obtain the largest quantity of that given turtle species? (vi) how many individuals of that given species do they sell per year in the region? For the number of turtles traded per year, they were also asked to include the numbers traded by other traders of their province working under them.

We also accessed the database of the Soc Son Wildlife Rescue Center (Hanoi) to see how many *Cuora* ssp. individuals were transferred to the rescue centre when confiscated by the police from illegal trading. This rescue centre is the main governmental rescue centre of Vietnam, with all protected wildlife species being potentially housed in the centre when confiscated from the trade. In the period of survey, the centre housed such species as tigers, Malayan bears, king cobras, and turtles. The quantitative data presented here were obtained by the head of the rescue centre during the period 2010 to 2018. Differences between frequencies of observed individuals by species, as well as of estimated individuals by species, were evaluated by χ^2 test. Past software 3.0 version was used for performing any statistical tests.

RESULTS

Overall, we observed 481 individuals of *Cuora* ssp. on trade in Vietnam during the study period (Table 1). The numbers of observed individuals differed significantly among species ($\chi^2 = 270.2$, $df = 2$, $P < 0.0001$), with *C. bourreti* being far more frequently observed in trade than the other two species. *Cuora bourreti* also dominated the estimated numbers of traded specimens according to the performed interviews ($\chi^2 = 2219$, $df = 2$, $P < 0.0001$) (Table 1).

Interview data presented in this paper were obtained from six high-level traders (level 4) who operated in six provinces and cities. We found that turtle individuals came essentially from hunters living nearby the nature reserves (see also Le, 2007), and were then sold to local traders from districts and communes going to collect them directly in the hunters' villages. For example, the level 4 trader in Da Nang claimed that he normally orders *C. bourreti* individuals from the local traders (level 1 and level 2) from different sources such as protected areas: Song Thanh Nature Reserve (Quang Nam province), Sao La Nature Reserve, and Bach Ma National Park (Thua Thien Hue Province). Additionally, he even claimed that he ordered turtle individuals from Laos, and then illegally imported them to Vietnam through border gates in Nam Giang district. The same level 4 trader claimed that he usually orders *C. galbinifrons* individuals from traders of levels 3 and 4 in Quang Tri and Ha Tinh areas. The same

Table 1. Synopsis of the observations concerning the number of *Cuora* ssp. individuals on trade in Vietnam during the present study. In this table, both the number of individuals directly observed by us on trade and those estimated (per year) by the hunters/sellers during semi-structured interviews are presented, as well as their origin (province) according to the interviews with traders.

Date	Observation locations	Species	No. observed	No. adults + subad.	No. hatchlings + juv.	Estimated No. Turtles per yr	Source of turtle from provinces of Vietnam and Laos
11-Aug-14	Hanoi	<i>Cuora bourreti</i>	8	8	0	300	Kon Tum, Gia Lai, Quang Nam, Quang Ngai, Hue, Quang Binh, Quang Tri
2-Sep-14	Da Nang city	<i>C. bourreti</i>	41	41	0	500	Kon Tum, Gia Lai, Quang Nam, Quang Ngai, Hue, Quang Binh, Quang Tri
22-Jul-16	Buon Ma Thuot	<i>C. bourreti</i>	23	19	4	60	Kon Tum, Gia Lai, Quang Nam, Quang Ngai, Hue, Quang Binh, Quang Tri
20-Dec-16	Da Nang city	<i>C. bourreti</i>	37	29	8	0	Kon Tum, Gia Lai, Quang Nam, Quang Ngai, Hue, Quang Binh, Quang Tri
17-Dec-16	Da Nang city	<i>C. bourreti</i>	100	85	15	1000	Kon Tum, Gia Lai, Quang Nam, Quang Ngai, Hue, Quang Binh, Quang Tri
17-Dec-16	Da Nang city	<i>C. bourreti</i>	5	5	0	0	Kon Tum, Gia Lai, Quang Nam, Quang Ngai, Hue, Quang Binh, Quang Tri
19-Dec-16	Buon Ma Thuot	<i>C. bourreti</i>	53	53	0	30	Kon Tum, Gia Lai, Quang Nam, Quang Ngai, Hue, Quang Binh, Quang Tri
15-Apr-16	Da Nang city	<i>C. bourreti</i>	34	34	0	500	Kon Tum, Gia Lai, Quang Nam, Quang Ngai, Hue, Quang Binh, Quang Tri
15-Apr-17	Quang Nam Province	<i>C. bourreti</i>	6	5	1	50	Kon Tum, Gia Lai, Quang Nam, Quang Ngai, Hue, Quang Binh, Quang Tri
20-Apr-17	Da Nang city	<i>C. bourreti</i>	22	22	0	0	Kon Tum, Gia Lai, Quang Nam, Quang Ngai, Hue, Quang Binh, Quang Tri
20-Apr-17	Da Nang city	<i>C. galbinifrons</i>	24	24	0	400	Quang Binh, Ha Tinh, Nghe An, Thanh Hoa
9-Jan-18	buon Ma Thuot	<i>C. galbinifrons</i>	13	13	0	0	Quang Binh, Ha Tinh
9-Jan-18	Da Nang city	<i>C. galbinifrons</i>	16	16	0	0	Quang Binh, Ha Tinh, Nghe An, Thanh Hoa
9-Jan-18	Da Nang city	<i>C. galbinifrons</i>	41	41	0	200	Quang Binh, Ha Tinh, Laos, Nghe An, Thanh Hoa
25-Mar-18	Hanoi	<i>C. picturata</i>	2	2	0	100	Phu yen & Khanh Hoa
25-Mar-18	Ho Chi Minh	<i>C. picturata</i>	2	2	0	200	Phu yen & Khanh Hoa
25-Mar-18	Buon Ma Thuot	<i>C. picturata</i>	26	24	2	26	Kon Tum, Gia Lai, Quang Nam, Quang Ngai, Hue, Quang Binh, Quang Tri
24-Sep-18	Nha Trang	<i>C. picturata</i>	11	8	3	50	Phu yen & Khanh Hoa
24-Sep-18	buon Ma Thuot	<i>C. picturata</i>	17	16	1	17	Phu yen & Khanh Hoa
		TOTAL	481	447	34	3433	

information was also independently provided by the interviewed level 4 trader in Nha Trang city (Khanh Hoa province), thus confirming its reliability. Most individuals were sold in cities such as Da Nang, Quang Tri, and Hanoi (Table 1) before heading to China; and many individuals are also sold via Facebook (Pham et al., 2019).

All six level 4 traders agreed that turtles were collected by hunters from February to August in each year, thus indicating that this is the period of highest above-ground activity of these reptiles. These data were in good agreement with interview data from Espenshade III & Thien Duc (2000), which reported a main hunting

season between April and September. According to the traders, turtles were usually hunted by dogs. The price offered by traders for each turtle individual varied among years, sites and species. However, the average price of *C. galbinifrons*, *C. bourreti*, *C. picturata* were, respectively, US\$159.09, US\$134.09 and US\$209.09. According to the traders, the transportation of turtles from villages to cities is mainly made by bus. Turtles are also routinely exported to China by bus, car, and train, and generally illegally pass the political border with China via the provinces of Lang Son, Quang Ninh, and Lao Cai. In the Soc Son Rescue Center, a total of 281 individuals

were observed during 2010–2018 (Table 2). Well over 60 % of the total rescued individuals were *C. galbinifrons*, in contrast with the fact that *C. bourreti* dominated the traded sample in our field surveys.

Table 2. Numbers of *Cuora* individuals confiscated and transferred to the Soc Son Rescue Center, Hanoi, Vietnam, during the period 2010–2018.

Date	Species	No. of individuals	Source
31-Jul-14	<i>C. bourreti</i>	1	FPD Hanoi
24-Oct-14	<i>C. bourreti</i>	1	FPD Hanoi
25-Jul-15	<i>C. bourreti</i> & <i>C. galbinifrons</i>	8	FPD Hanoi
31-Jul-15	<i>C. bourreti</i> & <i>C. galbinifrons</i>	110	FPD Hanoi
13-Jan-10	<i>C. galbinifrons</i>	24	FPD Quang Ninh province
19-Oct-12	<i>C. galbinifrons</i>	18	FPD Lang Son province
30-Jul-14	<i>C. galbinifrons</i>	55	FPD Quang Ninh province
03-Aug-14	<i>C. galbinifrons</i>	1	FPD Quang Ninh province
07-Jan-16	<i>C. galbinifrons</i>	3	Hanoi police
22-Jun-16	<i>C. galbinifrons</i>	2	Hanoi police
15-Sep-16	<i>C. galbinifrons</i>	2	Hanoi police
16-Sep-16	<i>C. galbinifrons</i>	1	Hanoi police
15-Oct-16	<i>C. galbinifrons</i>	5	Hanoi police
27-Nov-17	<i>C. galbinifrons</i>	2	Hanoi police
09-Aug-18	<i>C. galbinifrons</i>	48	Vinh Phuc police
TOTAL		281	

DISCUSSION

Our surveys revealed a clear difference between field surveys (with *C. bourreti* being by far the most intensely traded species) and the Soc Son Rescue Center surveys (with *C. galbinifrons* dominating the samples). We think that the field surveys do reflect the real pattern, i.e. that *C. bourreti* is by far the most intensely traded *Cuora* species in Vietnam, as it is probably also the commonest in the wild (Pham et al., unpublished observations). The preponderance of *C. galbinifrons* in the rescue centre likely reflects the current law enforcement in Vietnam, with only *C. galbinifrons* being fully protected (by national law Decree 160/2013/NĐ-CP). Thus, most of *Cuora* official rescue data were relative to this species because *C. galbinifrons* is the only *Cuora* species that can routinely be confiscated from traders/owners by police authorities. Similar patterns have also been observed in China, where local families very frequently raise captive *Cuora trifasciata* in Nanning City, but where an increased level of enforcement has led (i) to a decrease in the wild-caught individuals trade and (ii) to many captive-bred turtles also being confiscated (Shi et al., 2004).

Overall, the numbers of traded individuals recorded in this study were very small compared to the huge estimates on *Cuora* species traded in other Asian countries. Schoppe (2009), for instance, estimated that

about 2 million individuals were exported annually with an official quota amounted to only 18,000 individuals, thus showing that the majority of turtles were exported undeclared. However, Schoppe's (2009) data relate to *Cuora amboinensis*, and not to the Vietnamese species of *Cuora* studied herein. Concerning Vietnam, the number of *Cuora* officially traded according to the UNEP-WCMC CITES Trade Database was 2,377 live animals, including 17 *C. galbinifrons* individuals from 1984–2014. In 2000–2003, the number of *C. galbinifrons* recorded in trade in Hong Kong was 15,000 individuals (Cheung & Dudgeon, 2006), while during the same period, CITES only recorded 73 individuals traded around the world. A market survey by the Wildlife Conservation Society recorded 1,826 animals observed in food markets, and another 1,944 animals recorded in the local pet trade (years 2008–2011) in Guangzhou, China (S. Robertson, in litt. to Vietnam CITES Management Authority), with these individuals supplying the pet trade market globally and the Chinese traditional medicine market (McCormack & Stuart, 2016). Data for Vietnam are still uncertain, but in 1999, an estimated 150 *C. galbinifrons* were among specimens seized from a truck travelling from Central Vietnam to Hanoi (Hendrie, 2000). In general, our results would suggest that the current level of illegal trade for *Cuora* species is relatively modest in Vietnam (less than 500 individuals observed in four years, with an estimated 3,400+ individuals at the same sites according to the traders' interviews), at least in comparison with data provided from elsewhere (Schoppe, 2009). However, the relatively low number of traded turtles in this study does not imply that this reduced trade is not affecting the status of the target species, as their population size is already catastrophically reduced in Vietnam (IUCN, 2018; Stanford et al., 2018).

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