Short Communication

Conservation of turtles in Vietnam: a survey of Cat Tien National Park

Minh Le

Abstract Turtles in South-east Asia, especially in Vietnam, have been overexploited for more than a decade, largely because of international trade with and demand from China. This study examined natural populations in Cat Tien National Park and the local trade in surrounding areas to find ways of protecting remaining turtle populations more effectively. The results show that although trade around this protected area remains high, viable turtle populations still exist. However, these populations need immediate measures to protect them. Increased protection measures in such areas should have priority over trade control, given the complexity of the trade network and the lack of government resources to control it. Nevertheless, for long-term conservation goals additional measures such as trade control, environmental education in buffer zones, and raising people's awareness in urban areas, where wildlife consumption has increased, are also required.

Keywords Cat Tien National Park, population survey, turtle conservation, turtle trade, Vietnam.

This paper contains supplementary material that can be found online at http://journals.cambridge.org

Turtle populations around the world have declined drastically during the past 30 years (van Dijk *et al.*, 2000). In Asia the main threats to turtles are the destruction and modification of natural habitats, and wildlife trade. While the former is considered the greatest threat to many species, current levels of turtle trade have a much greater impact (van Dijk *et al.*, 2000; Ginsberg, 2002). Overexploitation of turtle populations in Asia to supply wildlife trade results primarily from an increasing demand in China where a long tradition of using turtles for food and medicine arises from the belief that turtles have a significant role in improving human health (Compton, 2000). Although the tradition has existed for centuries, the trade in turtles has grown at an unprecedented rate since the early 1990s because of demand from China's growing middle class and because the Chinese currency is now being readily converted to other currencies (Zhao, 1995; Behler, 1997). Turtle trade has also increased because of growth in the Malaysian and Thai economies as well as the opening up of markets in Vietnam, Laos and Cambodia after their long isolation (van Dijk *et al.*, 2000).

Minh Le Department of Herpetology and the Center for Biodiversity and Conservation, American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024, USA, and Department of Ecology, Evolution and Environmental Biology, Columbia University, 2960 Broadway, New York, NY 10027, USA. E-mail minhl@amnh.org

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The turtle fauna in Vietnam is especially threatened because of its geographical proximity to China. Although collecting wildlife species is illegal, Vietnam's traders exported 35.7 t of mostly wild turtles comprising 11 species to China and Taiwan during 1994-1999 (Nguyen, 2003). The quantity of turtles used locally is insignificant, accounting for <10% of the harvest (Le & Broad, 1995; Hendrie, 2000).

Conservation efforts to date in Vietnam have focused on emergency measures such as the confiscation of illegally traded animals. To set appropriate priorities for conservation, data on population status, distribution, and trade patterns are required but the data available (Hendrie, 2000) are insufficient for this purpose. To address this problem a survey was conducted in Cat Tien National Park in southern Vietnam because the Park is relatively well protected and has been chosen as a site for the release of turtles (Turtle Conservation and Ecology Project, 2001). Turtle populations in many protected areas in the north may have already been extirpated (Kiester & Juvik, 1997). The Park comprises a total area of 73,878 ha over three provinces, Dong Nai, Lam Dong, and Binh Phuoc (Fig. 1), and is home to 108 mammal, 339 bird, 123 reptile and amphibian, 130 fish, 439 butterfly species, and eight (Table 1) of the 24 species of terrestrial turtle known from Vietnam. It has permanent and seasonal wetlands that provide important habitat for both aquatic and semi-aquatic species.

I carried out diurnal and nocturnal surveys in Cat Tien National Park during 21 July-26 August and

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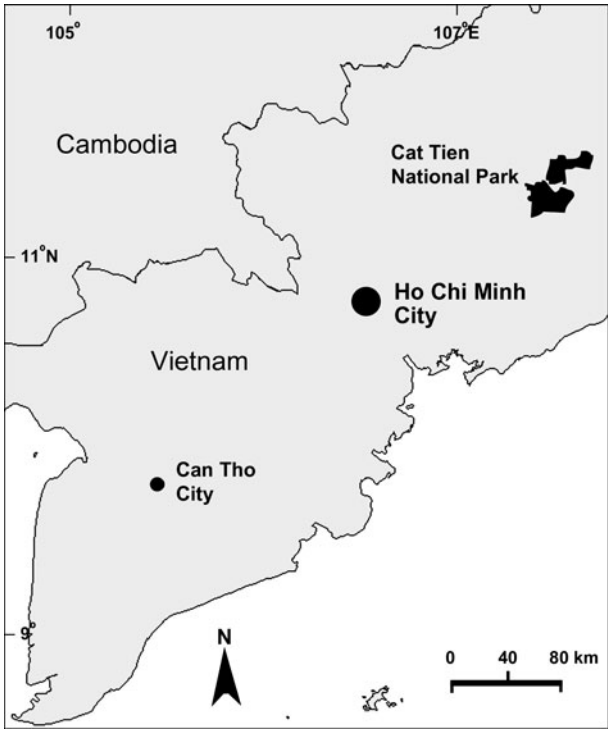

Fig. 1 Map of Southern Vietnam showing the location of Cat Tien National Park.

10 October-1 November 2004, focusing on permanent and temporary wetland areas because most turtle species that occur in the region are aquatic or semi-aquatic (Ernst & Barbour, 1989). In total 68 hours were spent searching for turtles. Surveys were more intensive in the Bau Sau Wetland Complex because this permanent wetland is a potentially important site for turtles. It contains well preserved habitat able to support large populations of both carnivorous and herbivorous species.

In the Bau Sau Wetland Complex I searched for breeding and feeding sites around the shore and in the lake, respectively. The latter were identified based on the unique vegetation pattern that remains after turtles have fed (Plate 1). Three funnel traps (Legler, 1960) were set at two sites during 8-22 August and 10 October-1 November, and checked every 2 days. Captured turtles were photographed, sexed, aged (hatchling, juvenile, adult), measured (carapace length, plastron length and shell height), marked using Sharpie paint pens, to avoid double counting, and released. Information about trade and collecting activities was obtained through informal interviews with local traders, hunters, and forest guards.

Six of the eight species known from the Park were observed (Table 2). No individuals of *Indotestudo elongata* were found in the wild, although a local trader had reportedly bought some *I. elongata* collected from the Park, and one confiscated turtle of this species was released in the Park during the time of my surveys. Softshell turtles *Amyda cartilaginea* were not surveyed because they are not under the same collecting pressure, being farmed throughout Vietnam (M. Le, pers. obs.). A total of 52 individual turtles were located, with 30 individuals of four species (Appendix) trapped in the Bau Sau Wetland Complex, where 12 turtle feeding sites but no breeding sites were found, one individual each of *Heosemys grandis* and *Malayemys subtrijuga* trapped in temporary wetlands and dry forests (Appendix), a total of 13 individuals of the six species for sale, and seven

Table 1 Turtle species in Cat Tien National Park, compiled from the checklist of reptiles and amphibians in Cat Tien National Park (G. Polet, pers. comm.), with their global and national Red List category and inclusion in a CITES Appendix.

Species	IUCN Red List[1]	Vietnam Red List[2]	CITES Appendix[3]
Amyda cartilaginea	Vulnerable		
Cuora amboinensis	Vulnerable	Vulnerable	II
Cyclemys tcheponensis[4]		Vulnerable	
Heosemys grandis	Vulnerable	Vulnerable	II
Hieremys annandalii	Endangered	Vulnerable	II
Indotestudo elongata	Endangered	Vulnerable	II
Malayemys subtrijuga	Vulnerable	Vulnerable	II
Siebenrockiella crassicollis	Vulnerable		II

[1]IUCN (2006)
[2]Ministry of Science, Technology and Environment of Vietnam (2000)
[3]CITES (2007)
[4]*C. tcheponensis* is not listed on the IUCN Red List (2006) or in CITES (2007) because not all taxonomists accept the split of the genus *Cyclemys* into several species.

Plate 1 A feeding site in Bau Sau Wetland Complex. Note the difference between natural vegetation with water primrose *Ludwigia adscendens* on the left and vegetation browsed by turtles on the right.

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Table 2 Number of turtles observed in Cat Tien National Park in this survey, their price, and where they were found. Details of all turtles trapped are in the Appendix.

Species	Sex	Age class	Price (VND; USD)	Sources[1]
C. amboinensis	1M, 2F	3 adult	50,000; 3.3	3s
C. tcheponensis	2F	2 juvenile	70,000; 4.7	2s
H. grandis	7F	2 juvenile, 3 adult, 2 subadult	60,000; 4	2w, 2s, 3k
H. annandalii	7F	3 adult, 4 juvenile	75,000; 5	3w, 1s, 3k
M. subtrijuga	3M, 6F	5 adult, 2 subadult, 2 juvenile	50,000; 3.3	7w, 2s
S. crassicollis[2]	7M, 17F	17 adult, 7 juvenile	60,000; 4	20w, 3s, 1k

[1]k, kept as pets by local people; s, for sale by traders; w, trapped and found in the wild
[2]Although populations were not estimated, the number of captured *S. crassicollis* is particularly high given the short duration of the survey and the small size of the areas where traps were deployed.

individuals of three species being kept as pets (Table 2). According to one local trader *C. tcheponensis* is the most commonly traded species. In addition, surveys in the Park in 2001-2004 recorded a large adult male of *M. subtrijuga*, two adults of *H. grandis*, an adult of *Siebenrockiella crassicollis*, and 12 *Cyclemys tcheponensis* representing all age classes from hatchlings to adults (W. van Devender, pers. comm.).

This study shows that, although turtle populations in Vietnam have been heavily exploited since 1989, viable populations still appear to survive in Cat Tien National Park. These populations require protection because trade is still prevalent. The local trade surveys indicated that turtles are sold in a number of places around Cat Tien National Park. Malayan pangolin *Manis javanica* and Javan wart snake *Acrochordus javanicus* were also observed being traded at Phuong Lam Town and Dac Lua Village near the Park. From these locations wildlife probably enters the international trade with China or is sold domestically to urban areas, where eating wildlife is becoming common (Nguyen, 2003; Polet & Ling, 2004).

For the immediate future, increasing the effectiveness and level of investment in Park protection, including the coordination of law enforcement between policemen and forest guards, would help conserve these turtle species. Measures to control trade may not be effective because of the complexity of the trade network and limited government resources. Even if individuals for sale are confiscated, costs associated with rehabilitation and release are often high, and releases may introduce diseases to natural populations (Jacobson *et al.*, 1995). In addition, the release of turtles to their natural range may not be successful if regulations in the protected areas are not strictly enforced as the released turtles could be re-caught. For the long-term conservation of these species several measures must be taken simultaneously, including implementation of stricter laws, better enforcement, improved cooperation between the governments of Vietnam and China, and raising of awareness among local people in protected area buffer zones and urban areas.

The major difficulties that Cat Tien National Park and other protected areas in Vietnam face are a shortage of forest guards relative to hunting and collecting pressures, and a lack of good coordination between the local government and Park officials in enforcing the law (Morris *et al.*, 2004). With *c.* 100 guards, hunting and other violations are still common in the Park (Morris *et al.*, 2004) and many violations go unnoticed (Murphy, 2004; Polet & Ling, 2004).

Other threats should also be taken into account in the conservation of turtles in Cat Tien National Park: (1) the high prevalence of fishing in the Bau Sau Wetland Complex may reduce food availability for carnivorous turtle species such as *S. crassicollis,* (2) fishing using electric devices, as used in the Park, can harm turtles and other aquatic species, (3) collecting of snails by local people can affect the food supply of *M. subtrijuga* because this species feeds almost exclusively on snails, (4) fire during the dry season, logging, and the invasion of exotic species, such as mimosa *Mimosa pigra* and water hyacinth *Eichhornia crassipes*, have reduced suitable habitat (Polet & Ling, 2004).

As Cat Tien National Park, and particularly Bau Sau Wetland Complex, is an important area for turtle conservation it should be given priority in future turtle conservation programmes in Vietnam. Recommendations to the Park authorities are being prepared, and will include the recommendation to establish three more guard stations in the wetland. At present there is only one guard station there, and it is therefore difficult for the guards to patrol the whole wetland area effectively. In addition, long-term research and conservation programmes for the turtle species in the Park need to be established.

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Appendix

The appendix for this article is available online at http://journals.cambridge.org

Biographical sketch

Minh Le has been working on natural resource management and turtle conservation since the mid 1990s. He is currently working on a project that addresses the systematics, biogeography, and conservation of the turtle family Geoemydidae, the most threatened clade of turtles.