

Taxonomic and Morphometric Analysis of a Trade Confiscation of Turtle Shells from Java, Indonesia

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A single large illegal shipment of turtle shells weighing 897 kg and containing approximately 10,000 whole and broken turtle plastra originating from Java, Indonesia, was confiscated in Hong Kong in January 2006 (Figs. 1–2; Anonymous 2006).

The shipment contained three CITES Appendix II listed species: *Cuora amboinensis* (Southeast Asian Box Turtle), *Siebenrockiella crassicolis* (Black Marsh Turtle), and *Orlitia borneensis* (Malaysian Giant Turtle) (Figs. 3–4). Four subspecies of *Cuora amboinensis* are currently recognized (Schoppe 2009), and based on the point of origin of the shipment, it was assumed that the subspecies involved was *C. a. couro* from Java and Sumatra.

All shells were turned over by HKSAR Government's Agriculture, Fisheries and Conservation Department (AFCD) to Kadoorie Farm and Botanic Garden (KFBG) for taxonomic and morphometric analysis.

Methods

For complete plastra, three measurements were obtained to the nearest mm: (1) curved plastral length (tape measure, greatest), (2) curved plastral width (tape measure, midpoint), and (3) straight plastral width (ruler, greatest).

Also recorded were the sex (male, female, or unknown), determined by the degree of concavity or convexity of the



Figure 1. Cartons of turtle plastra, as delivered by AFCD to KFBG; each carton weighed between 35 and 40 kg for a total weight of 897 kg, January 2006. Photo by R.C. Kendrick.



Figure 2. Half of all the turtle plastra in the shipment, sorted and boxed for analysis, January 2006. Photo by R.C. Kendrick.



Figure 3. Boxes of turtle plastra of two of the species identified in the shipment: (top) *Cuora amboinensis*, (bottom) *Siebenrockiella crassicollis*. Photos by R.C. Kendrick.

plastron, with males being concave, and the relative age of the animal, i.e. juvenile (small, very “fresh” plastrons), subadult, or adult; based upon the degree of wear and length of the plastron, with smaller worn plastrons classified as adult, but smaller than median and much less worn plastrons classified as subadult). Determination of sex in a few cases was not clear; a small number of plastrons were classified as “undetermined” since they did not show sufficiently strong concavity or convexity to be clearly male or female.

Results

The size of the confiscated shipment was approximately 10,000 turtle plastra, weighing ca. 897 kg in total. Many plastra were broken and were not measured; 6951 whole plastra were measured, of which there were 4588 *Cuora amboinensis* (66.0%), 2253 *Siebenrockiella crassicollis* (32.4%), 33 *Orlitia borneensis* (0.5%), and 77 not identified to species (1.1%).

The breakdown of each species according to age and sex is given in Tables 1 and 2. Most plastra (ca. 89% for *C. amboinensis*, ca. 75% for *S. crassicollis*, and ca. 94% for *O. borneensis*) appear to have come from adult turtles, though the *O. borneensis* specimens were substantially smaller than the maximum size of 800 mm length given by Ernst et al. (1997), thus it may be possible that some of the *O.*



Figure 4. Turtle plastra of the three species identified in the shipment: (top) *Cuora amboinensis*, (middle) *Siebenrockiella crassicollis*, (bottom) *Orlitia borneensis*. Photos by R.C. Kendrick.

borneensis plastrons classified as adult were from subadult turtles. There were slightly more females than males for *C. amboinensis* and *S. crassicollis*. Three-quarters of the *O. borneensis* were females.

For the two species with many plastra (*C. amboinensis* and *S. crassicollis*), overall distribution of plastron lengths by sex were plotted in 10 mm class ranges (Figs. 5–6).

For *C. amboinensis* (Fig. 5) the median class range was 161–170 mm, both overall and for males and females; the largest specimens were females, up to 220 mm in length. Maximum adult length is in the region of 220–250 mm (Ernst et al. 1997, Bonin et al. 2006), thus the range of *C.*

Table 1. Age composition of plastra.

Age Class	<i>Cuora amboinensis</i>	<i>Siebenrockiella crassicollis</i>	<i>Orlitia borneensis</i>
Adult	4094	1672	31
Subadult	4	106	0
Juvenile	483	454	2
Undetermined	7	21	0
Total	4588	2253	33

Table 2. Sex composition of plastra.

Sex	<i>Cuora amboinensis</i>	<i>Siebenrockiella crassicollis</i>	<i>Orlitia borneensis</i>
Male	2113	1053	6
Female	2460	1179	26
Undetermined	15	21	1
Total	4588	2253	33

amboinensis plastron lengths observed here probably covers class sizes from juvenile to fully mature adult individuals.

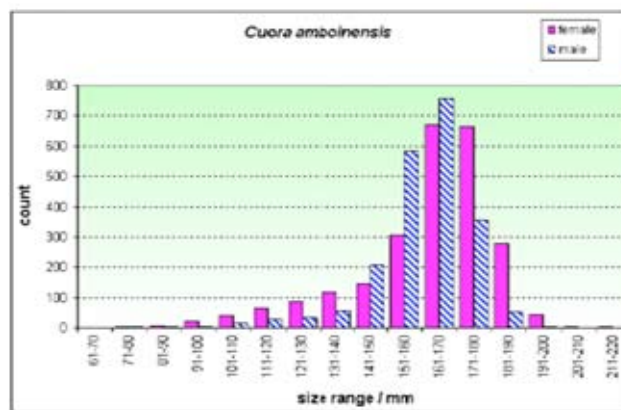
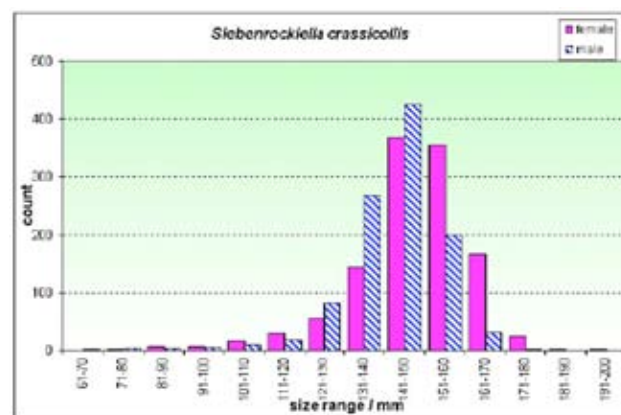
For *S. crassicollis* (Fig. 6), the median class range was 141–150 mm, both overall and for males and females; the largest specimens were females, up to 200 mm in length. The overall adult length is in the region of 200 mm (Bonin et al. 2006), rarely up to 340 mm (Jenkins 1995), thus the range of *S. crassicollis* plastron lengths observed here probably covers class sizes from juvenile to fully mature adult individuals.

For *O. borneensis*, the median class range was 361–370 mm overall and for females, but for males the median class range was 421–430 mm and the largest plastron was a male, just under 500 mm in length. It is noted that for *O. borneensis*, adults grow up to approximately 800 mm in total length (Ernst et al. 1997). From this small sample, it is clear that all the specimens were not fully grown individuals and probably represented young adults.

The morphometric observations indicate that the largest proportion of turtles for all three species being collected at this time (late 2005) were relatively young adults, with mature and old adults forming only a small part of the populations.

Removal of plastra appears to have been undertaken roughly and without automated tools, as cutting was jagged, inconsistent in terms of the actual cutting location, and in some cases dried body tissue was still attached.

The presence amongst the plastra upon arrival at KFBG of hundreds of pupae of a meal moth species (*Pyralis manihotalis*), which specializes in animal detritus, indicated that there had been significant amounts of body tissue remaining during shipment. It is not known if the moth pupae were derived from eggs laid in Hong Kong while the shipment was being held by AFCDD, or from the original location (Java), though the latter is more likely, as this tropical moth species is not

**Figure 5.** Size distribution of *Cuora amboinensis* turtle plastra classed by sex.**Figure 6.** Size distribution of *Siebenrockiella crassicollis* turtle plastra classed by sex.

normally found in sufficient abundance in Hong Kong to have been able to produce such a large infestation, especially during the winter in Hong Kong, when *P. manihotalis* is normally in a prolonged hibernation phase.

Discussion

The distribution patterns for both *C. amboinensis* and *S. crassicollis* plastron lengths (Figs. 5 and 6) were skewed normal distributions, with few large adults. This suggests that at the time of capture (probably late 2005), the wild populations still contained representatives of all age classes. The distribution of *O. borneensis* specimens (from a much smaller sample) indicated there were no large adults in the captured sample.

Based on the knowledge that most species of Southeast Asian freshwater turtles are under intense collecting pressure for the food market in China (van Dijk et al. 2000, Shi et al. 2009), it is unlikely that the three species included in this shipment were being harvested from the wild in a sustainable manner. Removal of large numbers of subadults and young adults from wild populations have a detrimental impact upon the future breeding stock of the species. Under the current practice, we agree with observations reported by Cheung and Dudgeon (2006) and Chen et al. (2009), that the

collection and trade of wild populations of these species is unsustainable.

This confiscation represents just a small part of the overall illegal trade in live animals, meat, and shells of these and other turtle species in Asia, and is clearly another indication of the unsustainable trade that is affecting turtles across the region (van Dijk et al. 2000, Cheung and Dudgeon 2006, Hudson 2009, Philippen 2009, Chen et al. 2009).

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