HARVEST SUSTAINABILITY OF SULAWESI TORTOISE *Indotestudo forstenii* IN INDONESIA

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INTRODUCTION

Indotestudo forstenii (Schlegel & Müller 1844) (a.k.a. Forsten's Tortoise, Sulawesi Tortoise, Sulawesi Forest Turtle; Family Testudinidae, Order Testudines) is an endemic land tortoise of Sulawesi, Indonesia. It is currently recognized as one of three species of the genus *Indotestudo.* The other two species are *I. elongata* and *I. travancorica.* The *I. forsteni* was first described by Schlegel & Müller as *Testudo forstenii* in 1840 based on a specimen from Halmahera Island (World Chelonian Trust 2003, Iverson *et al.* 2001). Since then, there was a hypotheses whether the *I. forstenii* was actually an introduce species of *Indotestudo travancorica* from India, brought to Sulawesi by early seafarers. A recent philogenetic study (Ives *et al.* 2008, Iverson *et al.* 2001) revealed that the two species are quite distinct and, thus, the hypothesis was rejected.

I. forsteni was listed in the CITES Appendix II in 1 July 1975. At the twenty-third meeting of the CITES Animals Committee (AC) held in Geneva on 19-24 April 2008 (Agenda Item 8.5), the AC agreed that *I. forstenii* was included in the Review of Significant Trade. Currently, this species is not protected under Indonesian law although it is listed in Appendix II of CITES and classified as 'Endangered' by IUCN categories. This document explains the current situation of the population and harvest of this species in Indonesia.

GEOGRAPHIC DISTRIBUTION

Sulawesi is a home of three non-marine chelonians, namely the widespread Malayan Box Turtle *Cuora amboinensis* and two endemic species: the Sulawesi Tortoise *Indotestudo forstenii* and Sulawesi Forest Turtle *Leucocephalon yuwonoi* (Platt 2006). The *I. forstenii* have a limited distribution on the islands of Halmahera and Sulawesi (Fig. 1), yet specific locality information exists only for Sulawesi (Platt *et al*. 2001, Iverson 1993).

Sulawesi is the largest island (227,654 km^2) in the Wallacea biogeographic region, lying between the islands of Borneo to the west and New Guinea to the east. Halmahera is a relatively small island (17,780 km^2), located to the east of Sulawesi. Sulawesi's biota is highly distinctive and has extremely high levels of endemism. Sulawesi's reptile endemism in particular is high, with 26% of its 117 reptile species found nowhere else (Whitten *et al*. 1987).

The documented range of *I. forstenii* in Sulawesi is localized and significantly restricted. Scientists suggested that the distributions of this species are parceled within Sulawesi and surrounding islands (Ives 2006, Platt *et al.* 2001), especially in North and Central Sulawesi, in the western region of the Northern Peninsula of Sulawesi. Known localities in North Sulawesi are Mount Boliahutu and around Buol (Platt *et al*. 2001).

In Central Sulawesi, population of *I. forstenii* were discovered in Santigi and Morowali Reserve (Platt *et al*. 2001). Additionally, Ives (2006) reported that this species can be found in some localities in Palu Valley, Kulawi Valley, Bora Village near Gimpu, as well as along the western border of Lore Lindu National Park, suggesting a high possibility of its existence in the park. Another study by Riyanto *et al.* (2008) also found some specimens in Gunta Hill and Bodi Hill, both located in the Palu Valley. Further, Platt (2006) examined a single living *I. forstenii* that was being held by a villager in Wanggarasi Timur pending sale to a wildlife trader. This record represents an eastward range extension of approximately 100 km from previously reported populations on Cape Santigi in Central Sulawesi.

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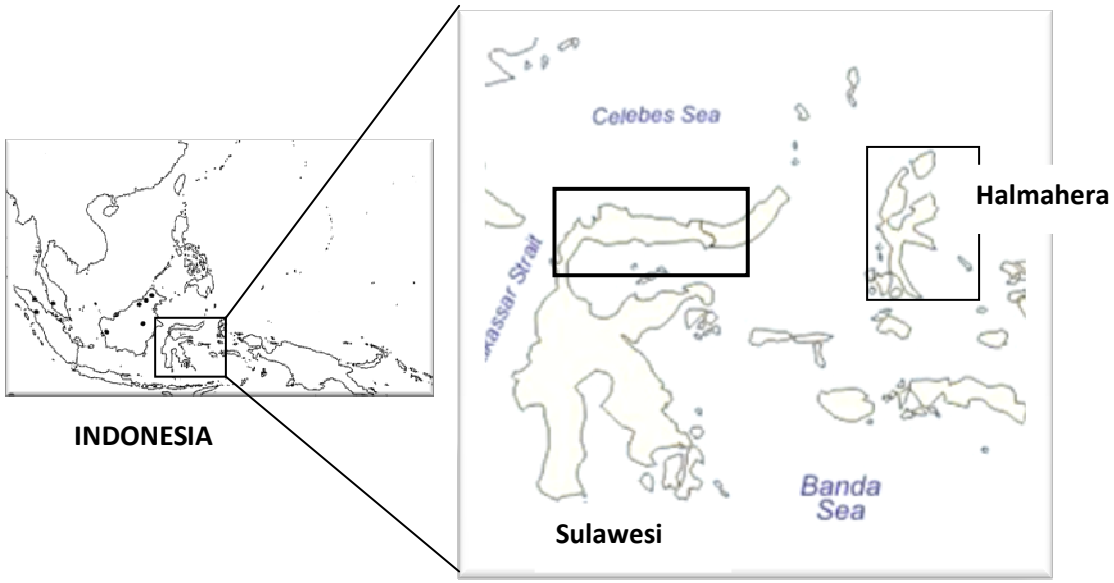

Fig. 1. Distribution of *Indotestudo forstenii* in Sulawesi Island and probably in Halmahera.

As for the population of *I. forstenii* in Halmahera Island and other satellite islands of Sulawesi, traders reported that there has been no record on harvest of *I. forstenii* from those areas in several past decades. Further research is needed to find out the status of current distribution of this species.

Because the full extents of *I. forstenii's* distributions are not clearly known, their status in the wild is uncertain. The lack of information about this species creates a significant challenge to its conservation, and confounds effective establishment of management plans (Platt *et al*. 2001).

POPULATION

I. forstenii is considered as one of the world's rarest tortoises. Very few field data on scattered local population surely is not sufficient to make an estimation of the overall population. Platt *et al.* (2001) reported that local communities considered the tortoise as rare, and a few had ever seen a specimen.

TAXONOMY

As mentioned previously, the genus *Indotestudo* has three members: Sulawesi Tortoise *I. forstenii*, Elongated tortoise *I. elongata* and Travancore tortoise *I. travancorica*. Previously *I. travancorica* had been considered a synonym of *I. forstenii* , leading to much confusion in the literature, as one of the common names attributed to *I. forstenii* is the Travancore tortoise (Iverson *et al.* 2001).

Some researchers speculated that the Indonesian populations of *I. forstenii* might represent an introduction of *I. travancorica* from India. Recently, using a molecular genetic approach to construct phylogenetic relationships among the genus *Indotestudo,* researchers (Ives *et al.* 2008, Iverson *et al.* 2001) concluded that three nominal species in the genus *Indotestudo* are now recognizable: *I. elongata*

from the mainland of southern and south-eastern India, *I. travancorica* from the Western Ghats of south-western India, and *I. forstenii* from the islands of Sulawesi and Halmahera in eastern Indonesia.

Due to the confusion in the past, the nomenclature of the Sulawesi Tortoise has been changed several times: *Testudo forstenii* (Schlegel & Müller 1844), *Geochelone forsteni* (Pritchard 1967), and *Indotestudo elongata forsteni* (Obst. 1985). Turtle Taxonomy Working Group (2007) reconfirmed that the *Indotestudo forstenii* (Schlegel & Müller 1844) is indeed the agreed Latin name for the Sulawesi Tortoise.

BIOLOGICAL INFORMATION

I. forstenii is a medium sized tortoise. Typically, they are about 25 cm long and 2.5 kg as an adult although, there are larger specimens. Females tend to be wider and more rounded than males. In addition, males have a tail that is noticeably larger as well as longer than that of the female. The tip of the tail is tipped with a small keratinous hook. Males also have a slightly concave plastron while the plastron of the females is completely flat (Auliya 2007, World Chelonian Trust 2005) (Fig. 2)

Fig. 2. Plastron of *Indotestudo forstenii:*
concave plastron in female (top) and flat plastron in male (bottom).
Photo: Ani Mardiasuti.

Little is known about the habitat requirements of *I. forstenii* in the wild. This species is primarily a damp forest species though it can be found in dry areas as well (World Chelonian Trust 2005) (Fig. 3). One specimens of Ives (2006) was found near a stream on the border of Lore Lindu National Park in Kulawi (km marker 71 south of Palu). The capture location was 5m upstream from the main road in a plot of land cleared for a mixed cocoa, banana and palm plantation.

I. forstenii shell was found among rock outcrops in second-growth forests growing on the steep hillsides of Cape Santigi. Likewise, local hunters in this area reportedly found tortoises by searching crevices and rock overhangs (Platt *et al*. 2001). Ives (2006) found *I. forstenii* among xerophytic scrub vegetation in the dry Palu Valley, while Platt (2006) reported that villagers found the tortoise in secondary forest on the edge of an agricultural field after being alerted by their dog.

The tortoise is mainly crepuscular, active in the twilight hours before dawn or just after sunset. Its large eyes are well adapted to low light levels. The species has an omnivorous diet in the wild consisting of fruits, leafy greens, worms, slugs and carrion if available (World Chelonian Trust 2005).

Fig. 3. *Indotestudo forstenii* found in its natural habitat near Palu, Central Sulawesi.
Photo by Awal Riyanto.

A lack of shell damage suggested that predators were not responsible for a natural mortality. The tortoises may have succumbed from desiccation or starvation during the severe, prolonged El-Niño-related droughts of 1997 and 1998. Wildfires may be responsible for considerable mortality among *I. forstenii* populations in northern Sulawesi (Platt *et al.* 2001).

Iskandar (2000) reported that clutch size of wild *I. forstenii* is 2-9 eggs. The eggs are oval shape, measuring 45-50 x 36-40 mm. Limited reproductive observations in captivity suggest that females may produce clutches 3 times a year (Ives 2006) and the females have been recorded to lay a clutch of 1-4 eggs in an excavated nest in early spring (World Chelonian Trust 2005).

HARVEST AND TRADE

Due to the taxonomic dispute in the past, in the early 1990s, nearly all specimens of the genus *Indotestudo* imported into the United States were identified as *I. elongata* or *I. travancorica*. Therefore, the data may be not reflecting the actual export (World Chelonian Trust 2005).

Based on the data of CITES Secretariat, Compton (2000) noted that between 1985 and 1998, *I. forstenii* ranked the third in term of the number of turtle specimens exported from Southeast Asia, totaling 5,263 individuals. Samedi & Iskandar (2000) also reported that the population number of this species in the wild have declined considerably.

Considering the restricted distribution of this species, number of individuals that can be harvested is also limited. Interviews with traders in Jakarta revealed that they have been receiving shipment of *I. forstenii* mostly from an area at the boundary of North Sulawesi and Central Sulawesi Provinces. No specific geographic location mentioned, as the traders received shipment from collectors in cities of Sulawesi, not from hunters who directly capture the species. None of the traders receive *I. forstenii* from Halmahera or other small satellite islands of Sulawesi.

Further field observation need to be conducted to find out whether *I. forstenii* still exists in Halmahera Island. According to the traders, the absence of *I. forstenii* shipment from Halmahera and its surrounding islands probably due to the social unrest that has been going on for years in that area. Another reason is because Halmahera Island is relatively far from Menado, the closets city from Halmahera where collectors are located, and thus transportation cost is too high.

From their natural habitat in northern and central Sulawesi, *I. forstenii* are collected by searching crevices and rock overhangs (Platt *et al.* 2001). Usually hunters capture the *I. forstenii* with the help of hunting dogs. Once the dog has discovered a tortoise, the hunter will scour the area for additional individuals, often discovering nests in the immediate vicinity areas (Ives 2006). Observation in holding facilities in Palu by Ives (2006) revealed that harvest have been conducted for both age class (juvenile and adult), and males are likely to be easily caught, maybe due to the fact that females are more sedentary and less likely to be caught roaming out in the open.

Almost all Indonesian turtles and tortoises are characterized by a dull, greenish or brownish carapace, to enable them blend in the natural habitat in order to avoid predation. Unlike other Indonesian tortoise species, *I. forstenii* has a combination of a cream and black color, making this species unique in an international pet market. A recent survey of pet markets in Jakarta by Sinaga (2008) revealed that there was a small number of *I. forstenii* found on display in domestic market or via cybermarket, although this species is not considered as popular pet because the Indonesian hobbyist prefers more colorful exotic turtles or tortoises. Thus, domestic demand for this species is low compare to export demand.

Export destinations of *I. forstenii* are mostly USA (c. 75%) and Japan (c. 25%). The popular size of exported individuals is juveniles of about 10-15 cm in carapace length. Younger individuals might not survive long transportation and acclimatization period in the destination country.

Population number in the wild derived from harvest data is difficult to estimate. This is due to the fact that in the last ten years or so the quota of *I. forstenii* has been set at low figures. Exporters in Jakarta admit that from time to time collectors in Sulawesi are still offered individuals of *I. forsteniii* by hunters. However, due to the limited number of quota for each exporter (i.e., 270 heads for 6 exporters),

the exporters have to refuse the offer. As a result, many individuals of *I. forstenii* can be found in the collectors' holding compound in Sulawesi. A few maybe still can be sold in the domestic market.

SUSTAINABILITY OF TRADE

A. Quota and Its Related Regulation

Indonesia has been a Party to CITES since 1978. As *I. forstenii* is listed in the CITES Appendix II since 1975, the trade of this species is regulated accordingly. A quota number is set by the Scientific Authority (Indonesian Institute of Sciences) as the basis of harvest level.

In 1993, the quota of this species was set at 1,500 heads. Aware of the naturally restricted geographical area, coupled with low reproductive rate and the decreasing population in the wild due to harvest and agriculture expansion, the CITES Authority of Indonesia has been drastically reduced the quota number. Quota for 2000 to 2008 was set only about 450 – 500 heads and in 2008 the quota was further reduced as low as 270 heads (Table 1).

Table 1. Quota and actual export of *Indotestudo forstenii* from Indonesia.
(Source: Directorate General of Forest Protection and Nature Conservation, Ministry of Forestry).

Year	Quota (heads)	Actual Export (heads)
2000	450	435
2001	450	450
2002	400	398
2003	500	491
2004	475	474
2005	475	475
2006	475	475
2007	475	470
2008	270	165*

*up to mid September

By lowering the quota number, it was expected that the population of *I. forstenii* in the wild will be recovered. As for now, the available data is not sufficient to set a more exact sustainable harvest level. Further field survey to reveal the distribution and population estimation of *I. forstenii* in the remaining areas, as well as other life history is planned to be conducted by the Scientific Authority.

B. Traders and Their Exports

Traders of reptiles and amphibian in Indonesia have created an association called IRATA (Indonesian Reptile and Amphibian Traders Association) since 1991. Initially the members consisted on traders in tannery and finished product. Later on in 1995 pet traders joint the association. Currently IRATA's membership can be categorized as live reptiles (pets), tannery, and finished product.

As for now, IRATA has 18 pet exporter members (IRATA 2008), of which 6 are listed as exporter of *I. forstenii* this year. The number of export companies has been reduced during the past three years due to the decreasing quota number. The export quota was divided among these members by IRATA, based on criteria set by the CITES Authority. Export of *I. forstenii* by all exporting companies is presented in Table 2.

Table 2. Export of *Indotestudo forstenii* by all companies in 2006-2008 and export quota for each company in 2008.
(Source: Directorate General of Forest Protection and Nature Conservation, Ministry of Forestry).

No.	Company Name	Year			Export Quota 2008 (heads)
		2006	2007	2008*	
1	CV Terraria Indonesia	106	108	54	93
2	PT Mega Citrindo Indonesia	168	138	54	93
3	PT Alam Nusantara Jayatama	55	58	17	29
4	CV Penta Exomania	36	19	11	19
5	CV Silva Patria Lestari	0	19	11	19
6	FA Hasco	0	22	9	16
7	CV Prestasi	50	53	0	0
8	CV Herpafauna	50	53	0	0
9	CV Leo Jaya	10	0	0	0
Total					269

*up to mid September

Breeding operations of *I. forstenii* in Indonesia have been started since 1996 by CV Pasundan. Currently there are 4 companies listed to breed this species (i.e., PT Alam Nusantara Jayatama, CV Prestasi, CV Pasundan, and CV Terraria Indonesia) (Fig. 4). Data on parental stock and the first generation of each company is presented in Table 3, while data on export from breeding operation is listed in Table 4.

Fig. 4. Breeding operation of *Indotestudo forstenii* by CV Prestasi.
Photos by Suwita Widjaja.

Table 3. Breeding stocks of *Indotestudo forstenii* for captive breeding operations.
(Source: Directorate General of Forest Protection and Nature Conservation, Ministry of Forestry).

Year	Generation	PT Alam Nusantara Jayatama		CV Prestasi		CV Pasundan		CV Terraria Indonesia	
		Male	Female	Male	Female	Male	Female	Male	Female
2006	F0	2	4	3	7	27	81	9	9
	F1	1	2	5	10	114	121	0	0
2007	F0	2	4	3	7	27	81	9	9
	F1	1	2	14	28	27	30	0	0
2008	F0	2	4	3	7	27	81	9	9
	F1	5	9	14	28	27	30	0	0

Table 4. The number exported specimens of *Indotestudo forstenii* from Indonesia, originated from breeding operations.
(Source: Directorate General of Forest Protection and Nature Conservation, Ministry of Forestry).

No	Company	Export (head)	Year of Export
1	PT Alam Nusantara Jayatama	10	2008
2	CV Pasundan	20	2006
		178	2007
3	CV Prestasi	0	-
4	CV Terraria Indonesia	0	-

CONCLUDING REMARKS

I. forstenii is a rare and endemic tortoise, having a very narrow distribution in Sulawesi Island. Some field research have been conducted, triggered by the uniqueness of this species in term of geographical distribution within the Wallacean biogoegraphy region and taxonomy.

The species is very popular as pet in the international market, although a few specimen is also reported has been used for consumption. The export quota for *I. forstenii* has been set at low and safe number of 270 heads, despite the high international demand of this species for pet. Further research toward estimation number and sustainable harvest level will continue to ensure the sustainability of this species in its natural habitat. In addition, captive breeding of this species has been started by some companies, and will be intensified and extended to others in the future.

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