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Siebenrockiella leytensis (Taylor 1920) – Palawan Forest Turtle, Philippine Forest Turtle

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Summary. – The Palawan Forest Turtle (or Philippine Forest Turtle), *Siebenrockiella leytensis* (Family Geoemydidae), is one of the most enigmatic species of freshwater turtles in Southeast Asia, and has been surrounded with more confusion and misconception than almost any other turtle in the region. For over 80 years, its true geographic distribution in the Philippines remained a mystery; its apparent rarity and the rudimentary knowledge of its ecology and natural history had bestowed upon it an almost mythical reputation. Long thought to come from the eastern Philippine island of Leyte, it was very recently discovered to actually occur in the Palawan region of the western Philippines. The species is the largest and heaviest geoemydid turtle known from the Philippines, attaining a carapace length of more than 300 mm and weighing as much as 3.5 kg. Known clutch size is 1–2, and eggs average 49.6 x 26.5 mm in size and weigh 18–30 g. As predicted by previous workers, the recent discovery of a natural population of *S. leytensis* on Palawan has already spurred a collecting frenzy among wildlife trappers and traders to supply domestic and international markets for the illegal wildlife trade. In spite of its official protected status in local and international listings, the illegal trade in *S. leytensis* is rampant and is perceived currently as the greatest threat to the species. This threat is exacerbated by the continuing destruction of the lowland forests of Palawan, the primary habitat of the species. If the current trend of overexploitation continues, it is certain that several subpopulations of *S. leytensis* will soon collapse. In the face of these threats, wildlife authorities on Palawan must immediately enforce relevant laws and encourage greater coordination among appropriate government agencies that typically work in isolation. Conservation programs need to prioritize efforts that will curb illegal collection of *S. leytensis* and other threatened species and monitor known populations. Top priority research studies for *S. leytensis* include population biology, ecology, and in-depth investigation of the dynamics of illegal trade in the species.

Distribution. – Philippines. The species appears to be restricted to the northern half of the island group of Palawan in western Philippines. It does not occur at the erroneous original type locality of Leyte Island in eastern Philippines.

Synonymy. – *Heosemys leytensis* Taylor 1920, *Geoemyda leytensis*, *Siebenrockiella leytensis*, *Siebenrockiella (Panyaenemys) leytensis*, *Panyaenemys leytensis*.

Subspecies. – None.

Status. – IUCN 2012 Red List: Critically Endangered (CR A2d, B1+2c) (assessed 2000); TFTSG Draft Red List: Critically Endangered; CITES: Appendix II; Philippines: Republic Act 9147 (*Wildlife Resources Conservation and Protection Act*).

Taxonomy. — *Heosemys leytensis* was described by Edward H. Taylor in 1920 based on two unnumbered specimens that were retrieved from a zoological laboratory in the University of the Philippines, Manila (Taylor 1920). He placed the species in the genus *Heosemys* based primarily on the absence of a temporal arch (Taylor 1920). Among the additional characters that established its affinity with the genus *Heosemys* were the broad bridge between

Figure 1. Adult male *Siebenrockiella leytensis* in its primary habitat on Palawan, the lowland riparian forests from the northern region of the island. These lowland habitats are imperiled because of slash-and-burn farming, timber poaching, charcoal making, and the impacts of mining and quarrying. Photo by Rafe Brown.

the plastron and carapace, the entoplastron intersected by the humeropectoral suture, the lack of quadratojugal bones, and the rudimentary scalation of the head (Buskirk 1989; Ernst and Barbour 1989; Ernst et al. 2000). Wermuth and Mertens (1961) suppressed *Heosemys* and allocated most of its member species to *Geoemyda*, a placement that was rejected by McDowell (1964), citing the distinctive skull anatomy of turtles within the group (see also Ernst and Barbour 1989). Nonetheless, some authors subsequently considered *leytensis* as a species of *Geoemyda* (review in Iverson 1992). McCord et al. (2000) proposed that *leytensis*, along with the Indian species *silvatica*, remain in *Heosemys* until more robust information on the systematics of these taxa indicated otherwise.

Spinks et al. (2004), in a phylogenetic study of turtles of the family Geoemydidae, demonstrated the potential non-monophyly of *Heosemys*, but declined to make taxonomic conclusions pending further phylogenetic investigations. *Heosemys leytensis* was not included in their phylogenetic analyses due to lack of genetic samples. Following the recent rediscovery of the species (Diesmos et al. 2004), morphological study and molecular phylogenetic analysis demonstrated that *leytensis* is the sister lineage to the previously monotypic Sundaic turtle genus *Siebenrockiella* (Diesmos et al. 2005). Thus, *S. leytensis* is the sister species to *S. crassicollis*, a species that occurs from Peninsular Malaysia to Borneo (Ernst et al. 2000). Nonetheless, there is high genetic divergence (ca.13% cyt*b*) between *S. leytensis* and *S. crassicol-*

Figure 2. Subadult *Siebenrockiella leytensis*. Photo by Emerson Sy.

Figure 3. Adult *Siebenrockiella leytensis*. Photo by Sabine Schoppe.

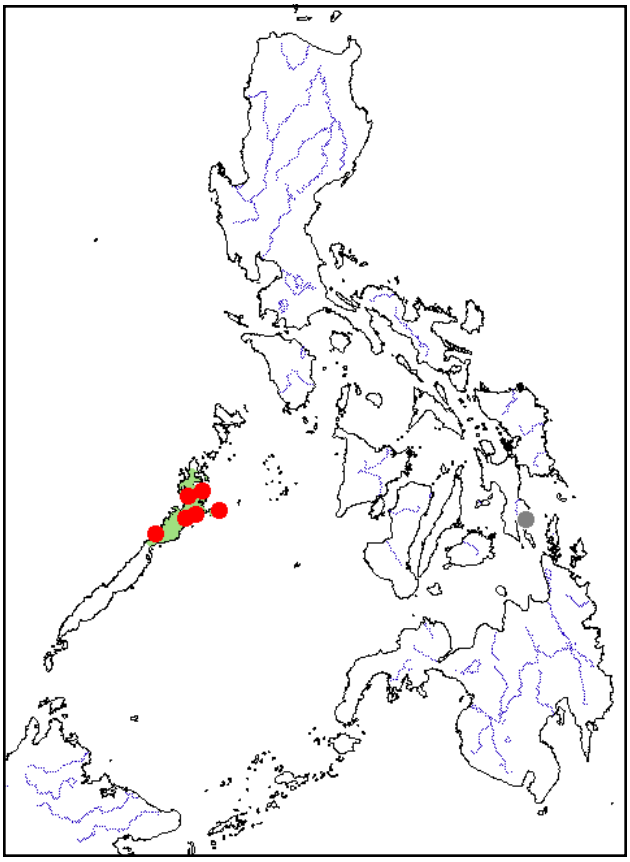

Figure 4. Distribution of *Siebenrockiella leytensis* in the Palawan Island group in the Philippines. Red dots = museum and literature occurrence records of native populations based on Iverson (1992), plus more recent and authors' data; gray dot = erroneous original type locality on Leyte Island; green shading = projected native distribution based on GIS-defined hydrologic unit compartments (HUCs) constructed around verified localities and then adding HUCs that connect known point localities in the same watershed or physiographic region, and similar habitats and elevations as verified HUCs (Buhlmann et al. 2009), and adjusted based on authors' data.

lis, prompting Diesmos et al. (2005) to erect the subgenus *Panyaenemys* (etymology: *panya-en*, "enchanted" and *emys*, "turtle") to accommodate the distinct Philippine lineage (see also Philippen 2006; Vetter and van Dijk 2006).

Restriction of Type Locality. — The historical record of *S. leytensis* from the island of Leyte in east central Philippines ("Cabalian, southern Leyte"; fide Taylor 1920)—long designated as the type locality—is erroneous and resulted from a mislabeling of the type specimens (Diesmos et al. 2008). In accordance with the provisions of Article 76 of the International Code of Zoological Nomenclature (ICZN 1999), we consider it advisable to correct the error at this time.

The types of *S. leytensis* (holotype, one paratype, and neotype; Taylor 1920; Buskirk 1989) were collected by G.F. Lopez, a seasoned field collector from the Philippine Bureau of Science (now the National Museum of the Philippines). Lopez was known to have collected specimens for Taylor and served as his field assistant. During the course of Taylor's decades of pioneering work in Philippine herpetology (Diesmos and Brown 2011), Taylor amassed a sizeable herpetological collection, most of which is now housed at the California Academy of Sciences (CAS), Field Museum of Natural History (FMNH), Museum of Comparative Zoology (Harvard University), and Carnegie Museum. The herpetological collection databases of CAS (http://research.calacademy.org/herp/collections) and FMNH (http://fm1.fieldmuseum.org/collections) reveal that Lopez collected amphibians and reptiles from the northern regions of Palawan Island and from the islands of Coron and Busuanga in the Calamian group, north of Palawan (see also Taylor 1922a, 1922b, 1923, 1925; Buskirk 1989). It is therefore a logical assumption that the types of *S. leytensis* most likely originated from northern Palawan or the Calamian group of islands. But since up to now *S. leytensis* has only been confirmed to occur in northern Palawan, we hereby restrict the type locality of *S. leytensis* to "northern Palawan in the Province of Palawan, Philippines."

Description. — The Palawan Forest Turtle is the largest and the heaviest geoemydid turtle known from the Philip-

Figure 5. Hatchling *Siebenrockiella leytensis*. Photo by Emerson Sy.

Figure 6. Juvenile *Siebenrockiella leytensis*. Photo by Sabine Schoppe.

Figure 7. Illegal wildlife trade of *S. leytensis* is the greatest threat to the species. Over a thousand juvenile and adult turtles have already been smuggled out of Palawan to supply the illegal trade. Photo by Emerson Sy.

pines. Old adults attain a median carapace length (MCL) of more than 300 mm, a median plastron length (MPL) of over 220 mm, and weigh as much as 3.5 kg. Hatchlings are typically ≤ 46 mm MCL. Range of measurements of 325 specimens is as follows (Schoppe, unpubl. data).

Immature turtles of undetermined sex (n = 190): maximum carapace length, MCL, 41.0–170.0 mm (mean = 124.2 ± 37.2); maximum carapace width, MCW, 36.5–130.0 mm (mean = 95.0 ± 24.4); maximum plastron length, MPL, 33.5–152.0 mm (mean = 105.7 ± 32.8); plastron width, PW, 25.3–109.0 mm (mean = 73.7 ± 20.9); body height, BH, 20.5–78.0 mm (mean = 50.9 ± 13.2); tail length, TL, 3.2–21.0 mm (mean = 12.3 ± 3.7); body mass, 10–950 g (mean = 341.7 ± 223.3).

Adult males (n = 76): MCL, 175.0–299.0 mm (mean = 223.5 ± 33.7); MCW, 127.0–226.0 mm (mean = 172.9 ± 26.0); MPL, 137.0–222.0 mm (mean = 188.4 ± 23.5); PW, 94.0–178.0 mm (mean = 132.9 ± 19.5); BH, 63.0–109.0 mm (mean = 85.7 ± 11.7); TL, 9.7–41.3 mm (mean = 26.4 ± 6.6); body mass, 810–3580 g (mean = 1799.5 ± 714.2).

Adult females (n = 49): MCL, 172.0–212.0 mm (mean = 190.6 ± 9.6); MCW, 124.0–159.0 mm (mean = 141.3 ± 7.7); MPL, 140.0–178.0 mm (mean = 161.1 ± 8.5); PW, 96.0–138.0 mm (mean = 110.7 ± 8.0); BH, 64.0–92.0 mm (mean = 77.2 ± 7.0); TL, 10.4–24.0 mm (mean = 18.0 ± 3.9); body mass, 770–1400 g (mean = 1081.1 ± 161.0).

Sexual dimorphism is less prominent in subadult and sexually immature turtles. Adult male turtles are distinguished from adult females by their slightly concave plastron at the posterior end and by their longer and thicker tail. The plastron of large females is flat or slightly convex. Sexual maturity is probably reached at 200 mm MCL (Schoppe, unpubl. data). Males are generally larger than females.

The carapace of *S. leytensis* is wide, somewhat flattened, and heavily buttressed. A vertebral keel is present in juveniles, gradually becomes less prominent in subadults, and is usually absent in adults. The anterior marginal scutes are blunt and rounded in juveniles; with age the first two marginals project forward into a serrated rim. The posterior marginals are serrated during various life history stages in both males and females, but the serrations usually wear away in old females. There are four costals and usually 12 (range, 11–13) marginals on each side of the carapace, although some specimens may exhibit an uneven number of marginals. In old adults, a collar is formed by two extremely projecting marginals on either side of the nuchal scute, which extends well beyond the rim of the carapace; the gulars are also strongly projecting. Vertebral 1 is mushroom-shaped, vertebrals 2–4 are ginkgo leaf-shaped, and vertebral 5 is more or less hexagonal (Diesmos et al. 2005). The plastron is unhinged, ovoid, and is notched anteriorly and posteriorly. The anal plate has a deep gap and is either round or V-shaped. Plastral formula varies greatly.

The head is large, the snout projecting and rounded, and the nostrils are placed anteriorly. There are 6–7 large tubercles above the upper eyelids. The upper jaw is slightly hooked and bicuspid with corresponding indentations on the lower jaw. The anterior surface of the forelimbs and hind limbs has 3–5 enlarged transverse scales; the forelimb has a large transverse scale on the heel, which is not found on the hind limb. The toes are fully webbed. All five digits of the forefoot bear a sharp, curved claw while only four digits of the hind foot have claws; the fifth has no claw.

Carapace color varies from chestnut brown, dark brown, pale yellow to pale brown. Plastron and bridge coloration varies from chestnut brown to pale yellow with a pattern of black blotches in some individuals, without a radiating color pattern. The head is dark brown with a typical black patch on the crown and rostrum. There are pink-orange spots on the sides of head, temporal region, and lower jaw. A distinctive narrow white or yellowish band crosses the head transversely just behind the tympanic region, which may or may not be medially divided. The transverse band and pink-orange spots on the head fade with age and may be completely absent in old individuals, especially in males. Coloration of limbs and tail varies from pale yellow to dark gray.

Distribution. — In the past, the apparent rarity of *S. leytensis* and misconceptions about its origin have triggered discussion about its distribution pattern (e.g., Gaulke and Fritz 1998; Gaulke and Altenbach 2006). It is only recently that it has been established with certainty that *S. leytensis* is endemic to the Philippines, that it does not occur on Leyte Island, and that it is instead actually restricted to the Palawan group of islands in the western region of the archipelago (Diesmos et al. 2004; Fidenci 2004; Diesmos et al. 2008; Schoppe et al.

2010). This chain of islands, referred to biogeographically as Palawan Pleistocene Aggregate Island Complex or Palawan PAIC (Brown and Diesmos 2002, 2009), is renowned for its biotic affinity with islands to the southwest in the Sunda Shelf and is biologically distinct from the rest of the Philippines (Heaney 1986). Regardless, the Palawan PAIC retains a significant number of endemic fauna and flora not found in the Sundaic region (Widmann 1998; McGuire and Alcala 2000; Brown and Guttman 2002; Evans et al. 2003). *Siebenrockiella leytensis* is known from northern Palawan (in the municipalities of Roxas, San Vicente, and Taytay), on the island of Dumaran northeast of Palawan, and from Puerto Princesa in the west central region of the island. There are unconfirmed records of the species from the islands of Coron, Culion, and Busuanga in the Calamian island group north of Palawan (Schoppe et al. 2010; D. Acosta, unpubl. data).

Habitat and Ecology. — The Palawan Forest Turtle lives in forest habitats near sea level up to an altitude of about 300 m. Primary habitat is pristine lowland forest but the species has been found in disturbed and fragmented forests, second growth vegetation, and in cultivated areas (such as flooded rice fields) that are adjacent to remnant original forests (Schoppe et al. 2010). The species inhabits streams, creeks, moderate-sized rivers, inland freshwater lakes, and freshwater swamps (Fidenci 2004; Diesmos et al. 2008). Adult turtles are semi-aquatic, whereas hatchlings and juveniles appear to be fully aquatic (Schoppe 2006). It is a nocturnal species. *Siebenrockiella leytensis* shares its habitat with *Cyclemys dentata* and *Cuora amboinensis*.

During the day, *S. leytensis* has been found ensconced under rocks and boulders or in burrows located on the banks of streams and rivers. At night, turtles actively forage along sandy shores and in stationary pools of streams and rivers. The species may be found deep in the forest interior, especially during the warmest months of the year when most streams and small rivers have dried up. *Siebenrockiella leytensis* preys on fish, crabs, shrimp (genus *Macrobrachium*), and freshwater gastropods of the family Thiaridae (Schoppe 2006); it also feeds on algae and wild fruits, especially ripe figs (Diesmos et al. 2008). The assumption of Schoppe (2010) that *S. leytensis* feeds on the golden apple snail (*Pomacea canaliculata*), an invasive alien pest species that is widely found in rice fields on Palawan, has been confirmed by an ongoing study (Schoppe, unpubl. data).

The reproductive biology and natural history of the species remain poorly understood. Females have been observed to lay 1–2 eggs. The eggs are brittle-shelled, oblong, and pale pink in color. In captivity, turtles laid eggs from June through December (Yuyek 2004; Diesmos et al. 2008; Schoppe, unpubl. data). Measurements of eggs laid by captive turtles (n = 19) ranged from 41.0–57.8 mm in length (mean = 49.6 ± 3.9), 19.7–29.4 mm in width (mean = 26.5 ± 2.7), and weighed 18–30 g (mean = 24.0 ± 4.3). Juvenile turtles and hatchlings have been found in the wild during the dry season (January–April) (Widmann et al. 2004; Schoppe 2006, 2008a). Wildlife poachers claim that *S. leytensis* oviposits in deep burrows located on near-vertical banks of streams and rivers.

Growth rate in *S. leytensis* decreases with increasing body size (Schoppe 2006, 2008a). Captive juvenile turtles measuring 46, 55, and 75 mm MCL grew at a rate of 0.10, 0.10, and 0.09 mm/day, respectively, whereas larger juveniles (82 and 120 mm MCL) grew 0.02 mm/day. Growth rate of an adult male (225 mm MCL) was 0.03 mm/day. In wild populations, mean juvenile growth rate was 0.07 mm/day (Schoppe 2006, 2008a).

Population Status. — For over 80 years since the species was described, the failure of herpetologists to find *S. leytensis* at its alleged type locality on the island of Leyte, combined with a general absence of information on its ecology and natural history, led many to conclude that it was an extremely rare species (Taylor 1920; Alcala 1986; Buskirk 1989; Ernst and Barbour 1989; Das 1995; Gonzalez et al. 1997; Gaulke and Fritz 1998; van Dijk et al. 2000; Gaulke and Altenbach 2006). Data collected since the time of its rediscovery on Palawan (Diesmos et al. 2004; Fidenci 2004) indicate that *S. leytensis* is not locally rare at all (Diesmos et al. 2008; Schoppe et al. 2010). Estimates of population density of *S. leytensis* from several locations in northern Palawan range from 4 to 121 turtles/ha (Acosta 2006; Schoppe et al. 2010).

Results of field surveys, however, reveal a decreasing trend in abundance, especially in areas where turtles are heavily collected (Schoppe and Cervancia 2009; Schoppe et al. 2010). On the other hand, wildlife poachers suggest that *S. leytensis* is "as common" as the other geoemydid turtles found on Palawan (i.e., *Cuora amboinensis* and *Cyclemys dentata*), but since it is such an elusive species, it is apparently not encountered as often as the other two (Diesmos et al. 2008).

Threats to Survival. — Exploitation for the illegal wildlife trade is the single and most important threat to the Palawan Forest Turtle. Since its rediscovery (Diesmos et al. 2004; Fidenci 2004; Widmann et al. 2004), we estimate that well over 1000 *S. leytensis* have already been collected from and smuggled out of Palawan to supply the illegal pet trade within and outside of the Philippines (Yuyek 2004; Diesmos et al. 2008; Fidenci and Maran 2009; Diesmos et al., pers. obs.). Collection of turtles for the illegal trade is unrelenting and indiscriminate. In 2004 over 70 *S. leytensis* of various age and size were found stockpiled in a single holding facility in Puerto Princesa City, and over 200 were found in one such facility in Manila (Gavino and Schoppe 2005; Sy, unpubl. data). In May 2010, over 1100 turtles of various species (including 74 *S. leytensis*) intended for animal

markets in China were confiscated by wildlife authorities on Palawan (Anda 2010; Schoppe, pers. obs.).

The northern Palawan subpopulations of *S. leytensis*—particularly those from Taytay—are likely to be the source of most, if not all, illegally caught turtles that are available in the pet trade. From the period 2004 to 2010, wildlife authorities on Palawan have seized over 600 *S. leytensis* that were being shipped out from a single seaport in Taytay (Lopez and Schoppe 2004; KFI 2007; Diesmos et al. 2008; Anda 2010; Schoppe et al. 2010). Data are lacking from other strategic seaports in the region where wildlife trafficking undoubtedly occurs; such routes typically lack facilities and trained personnel to monitor illegal wildlife trade (Lepiten-Tabao and Tabaranza 2004; Diesmos et al. 2008; Schoppe et al. 2010). Despite the absence of quantitative population analysis, we predict that the northern Palawan population of *S. leytensis* may soon collapse.

Wildlife traders purchase turtles from poachers—typically for a low price—and ship the animals to Manila, Cebu, and Davao through illegal channels. These major cities serve as trans-shipment points. Wildlife traffickers then transport the animals to destinations across Southeast Asia, Indochina, China, Japan, Europe, and the USA (Gavino and Schoppe 2004; Yuyek 2004; Diesmos et al. 2008; Fidenci and Maran 2009; Schoppe et al. 2010). In Manila, *S. leytensis* is routinely sold in Cartimar, a hugely popular pet market that also serves as a major trading center for *S. leytensis* and other threatened species of vertebrates (Fidenci and Maran 2009; Sy and Schoppe, unpubl. data; Diesmos et al., pers. obs.).

We have gathered compelling evidence that certain zoos and wildlife rescue and nature centers that are involved in trade of *S. leytensis* (and other threatened and/or charismatic species) falsely claim their animals as "captive-bred" when in fact, they were sourced from wild populations (Sy, unpubl. data; Diesmos et al., pers. obs.). This practice is becoming increasingly common elsewhere in Southeast Asia (Schoppe 2008b, 2009b) and warrants in-depth investigation by wildlife authorities in the Philippines.

Habitat loss and degradation remain major threats to the species. Although Palawan is widely promoted as the "last ecological frontier" of the Philippines (see Anda and Tabangay 2004), the region continues to lose critical habitats—especially the lowland forest—through timber poaching, mining, quarrying, charcoal-making, and slash-and-burn farming (Mallari et al. 2001; Anda and Tabangay 2004; Diesmos and Palomar 2004; Diesmos et al. 2008; Diesmos and Brown 2011).

Like most other species of turtles in the Philippines, *S. leytensis* is considered an important source of protein by some groups of people. Collection for food was found to be the most significant threat to *S. leytensis* in some areas on Palawan (Schoppe et al. 2010). This and other species of turtles are also used in traditional medicine. In addition, turtle body parts, especially the carapace, are fashioned into curio items either for non-commercial use or are sold to tourists. These forms of utilization are being carried out by members of indigenous peoples groups and by the economically marginalized populace (Acosta 2006; Diesmos et al. 2008; Matillano 2008; Schoppe et al. 2010).

Conservation Measures Taken. — *Siebenrockiella leytensis* has been listed as Critically Endangered on the IUCN Red List (IUCN 2012) since 2000 and is included in Appendix II of CITES (CITES 2011). Its IUCN Red List status was provisionally reaffirmed as Critically Endangered by the IUCN Tortoise and Freshwater Turtle Specialist Group in 2011 (Turtle Taxonomy Working Group 2011), and the species was included among the world's top 25 most endangered tortoises and freshwater turtles in 2011 (Turtle Conservation Coalition 2011). It is a nationally protected species by virtue of Republic Act 9147 (*Wildlife Resources Conservation and Protection Act*), the violation of which carries a penalty of heavy fines including imprisonment (Anonymous 2001; DENR 2004; PCSD 2006).

The species occurs in several protected areas in the Palawan region, which provides some protection for a number of its subpopulations. Since 2006, Katala Foundation Inc. (KFI, a Palawan-based conservation NGO) and the Philippine government (through the Protected Areas and Wildlife Bureau of the Philippine Department of Environment and Natural Resources and the Palawan Council for Sustainable Development) have implemented various conservation projects under the Philippine Freshwater Turtle Conservation Program (PFTCP) in Palawan. Apart from efforts that emphasize research and conservation management of *S. leytensis* and other species, the program aims to strengthen law enforcement capacities of wildlife authorities on Palawan to reduce illegal collection and trade through community-based anti-wildlife trafficking monitoring groups (Schoppe and Acosta 2010b; Schoppe and Ibañez 2011).

KFI has also established an assurance colony on Palawan for captive conservation breeding of *S. leytensis* and other species (Schoppe and Fernando 2009; Schoppe 2010; Schoppe and Diaz 2011).

Conservation Measures Proposed. — The uncontrolled exploitation of *S. leytensis* for the illegal trade is primarily due to a lack of enforcement by government authorities of the relevant national and international policies on wildlife conservation and trade. Environmental agencies in the Philippines are generally unaware of the extent of illegal wildlife trade in the country. Worse, most agencies are ill-equipped and under-trained to monitor and control this problem (Lepiten-Tabao and Tabaranza 2004; Diesmos et al. 2008).

In light of the relentless and indiscriminate collection of the species, we recommend the uplisting of *S. leytensis* to

CITES Appendix I. We believe that this proposed category is more reflective of the present conservation status of the species. Placing *S. leytensis* in the highest possible category of CITES will offer another level of protection to wild populations and may considerably reduce illegal trade of the species. We also consider *in-situ* conservation of *S. leytensis* and of its habitat, together with effective law enforcement to reduce illegal trade, as high priority conservation strategies for the species.

Because the lack of effective enforcement of wildlife laws is the biggest setback to current conservation efforts for *S. leytensis*, we propose that large samples of known populations of the species be genotyped using multiple, variable, unlinked genetic loci (mitochondrial and nuclear gene sequences and/or microsatellites) and that a freely accessible, web-based genetic database be established. Such an enforcement tool would allow trade forensics and determination of geographic origin of confiscated animals (Welton et al., in press). A resource such as this would serve as a deterrent for poachers and smugglers who might otherwise be able to claim that animals in their possession were "captive-bred." At present, no genetic enforcement resources are available to wildlife managers in the Philippines and there is little hope for informed management or reintroduction of confiscated trade animals.

Current Research. — Several local and international groups are currently conducting field surveys to gather additional important information on the distribution, population ecology, habitat requirements, captive husbandry, and illegal trade and exploitation of the species. In partnership with academic institutions and wildlife agencies on Palawan, KFI is leading public awareness campaigns that are designed to improve law enforcement against illegal wildlife trade. Long-term studies on population trends, ecology, and life history of *S. leytensis* are also being undertaken by KFI since 2008 (Schoppe 2009b; Schoppe and Acosta 2010a, 2011, 2012).

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