

Indotestudo travancorica...

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Photos by the author

The tortoises of the genus *Indotestudo* are medium-sized, mesic-adapted species from southern and southeastern Asia and Indonesia, characterized *inter alia* by the presence of a ridge extending from the inferior processes of the parietals anterolaterally over the dorsal surfaces of the pterygoids and palatines to the external pyterygoid processes, and by the shortened trachea with the bifurcation into the bronchii occurring just the skull (Crumly, 1982).

An unusually well-marked juvenile *I. elongata* showing finely radiating markings on dorsal scutes.



a Valid Species





However, the most remarkable aspect of the genus today is its highly disjunct distribution, with a population in southwestern India (in the Western Ghats, in Kerala, north to the Coorg District of Karnataka, and extreme western Tamil Nadu), another ranging from southeastern China and northeastern India (Uttar Pradesh, Meghalaya, Bihar, West Bengal) through lowland Nepal, Burma, Thailand, Laos, Cambodia, and Vietnam into northern peninsular Malaysia, and a third isolated in limited (northern) areas of the Indonesian island of Sulawesi (Celebes) and possibly neighboring Halmahera (Gilolo) (Iverson, 1992).

Current Taxonomy

These three populations have all been described as distinct species, namely *Indotestudo travancorica* (Boulenger, 1907), *Indotestudo elongata* (Blyth, 1853), and *Indotestudo forstenii* (Schlegel and Moller, 1844). They have been discussed or reviewed by many authors, including Smith (1931), Groombridge (1982), Tikader and Sharma (1985), Moll (in Swingland and Klemens, 1989), and Das (1991). Most identification keys repeat the characters cited by Smith (1931), namely the presence of a nuchal scute and an interpectoral seam equal to or longer than the interhumeral seam in *I. elongata*, and the reverse condition (i.e., no nuchal and interhumeral longer than the interpectoral) in *I. travancorica*. For want of adequate museum specimens, however, the status of *I. forstenii* has never been satisfactorily evaluated, even though it was named earlier than its two congeners. Smith (1931) considered *travancorica* to have "become just sufficiently distinct to be separated off from *elongata*," and Auffenberg (1974), quoting Smith, observed that "the extant populations [of *Indotestudo*] are possibly all conspecific on the basis of broad overlap of characters."

top: Adult shells of *Indotestudo elongata* of various sizes, showing the typical long, narrow, parallel-sided nuchal scute. In the largest and oldest specimen (lower left), the left side of the nuchal is in process of fusing with the first left marginal scute.

middle: Plastra of subadult *Indotestudo forstenii* (left) and *I. elongata* (right). Note the different shape of the abdominal blotches and the short interpectoral and long interhumeral seams of *I. forstenii* as compared with *I. elongata*.

bottom: Bony plastron of adult female *I. travancorica* showing the short gulars and somewhat lengthened interpectoral seam.

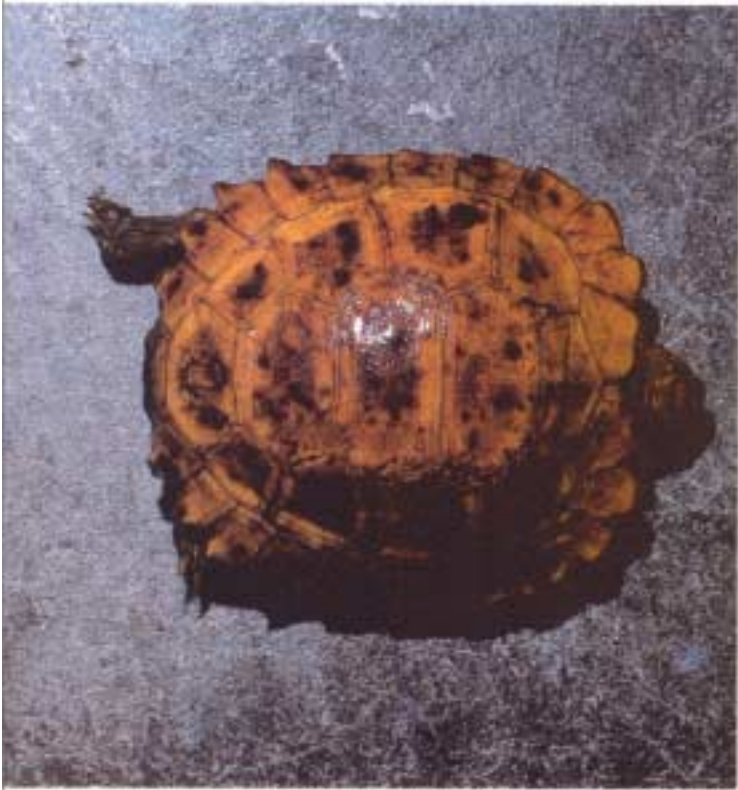
facing 

A group of *I. elongata* of various ages near Khon Kaen in eastern Thailand.

Bottom: A group of adult *I. forstenii* showing characteristic large, intensely black carapacial markings.







Auffenberg's suggestion has found little acceptance to the extent that subsequent authors have all considered the southwestern Indian and northeastern Indian populations (which actually show remarkably little overlap in the traditional characters of nuchal presence and plastral seute ratios) to be distinct species.

However, Hoogmoed and Crumly (1984) investigated the relationship of the island population ("forstenii") to the mainland ones and concluded that the Indonesian (Sulawesi and Halmahera) and the southwestern Indian populations

were indistinguishable. This required that the older of the two names (i.e., *I. forstenii*) be applied to both, *I. travancorica* being relegated to synonymy. Hoogmoed and Crumly were unable to explain this extraordinarily distribution, but did cite various rumors and speculations that the island populations may have been introduced in early times by travellers from southern India.

Tortoises on Sulawesi, Indonesia

Hoogmoed and Crumly found only five Sulawesi tortoises in all the collections they examined (RMNH 3811, RHMB

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137, BM(NH) 1872.4.6.116 and 1896.12.9.1 and USNM 52973), and the characters they selected for examination, apart from presence/absence of the nuchal seute, were limited to the two cited by Mertens and Wermuth (1961), i.e., relative proportions of the gular scutes and presence of dark blotches on the abdominal scutes. These characters were cited by the latter authors simply as the last couplet in a lengthy identification key to the genus *Testudo*, and there was no discussion or indication that specimens were actually examined.

Hoogmoed and Crumly's comparisons with the specimens of *I. travancorica* in the Florida Museum of Natural History collection revealed no convincing differences between the insular and the southwestern Indian tortoises, although they did report that the nuchal seute, absent in their island tortoises but consistently present in *I. elongata*, served to separate these populations. But clearly their comparisons were limited by the small number of insular tortoises available and by the fact that most of the *travancorica* specimens examined had many of their scutes missing.

Just as Hoogmoed and Crumly's paper was going to

60. Plastral view of juvenile *I. elongata* showing modest separation and elongate form of abdominal blotches. Compare with ventral pattern of juvenile *I. forstenii*.

g page. Dorsal and ventral views of juvenile *I.*

[BM(NH) 1896.12.9.1] in collection of British Museum (Natural History).



press, these authors received word from E Meylan at the Florida Museum of Natural History that 60 tortoises, supposedly from Sulawesi, had recently been imported into the United States. Furthermore, Meylan reported that many of these tortoises had cervical [nuchal] scutes as well as having darker carapaces and lighter plastra than are characteristic of *I. elongata*. But Hoogmoed and Crumly concluded in a footnote added in proof that "the color pattern of *I. elongata* is notoriously variable and we suspect that some of the *I. forstenii*' are, in fact, specimens of *I. elongata* that became confused with Sulawesi specimens by the pet traders." Status of the Sulawesi Tortoises

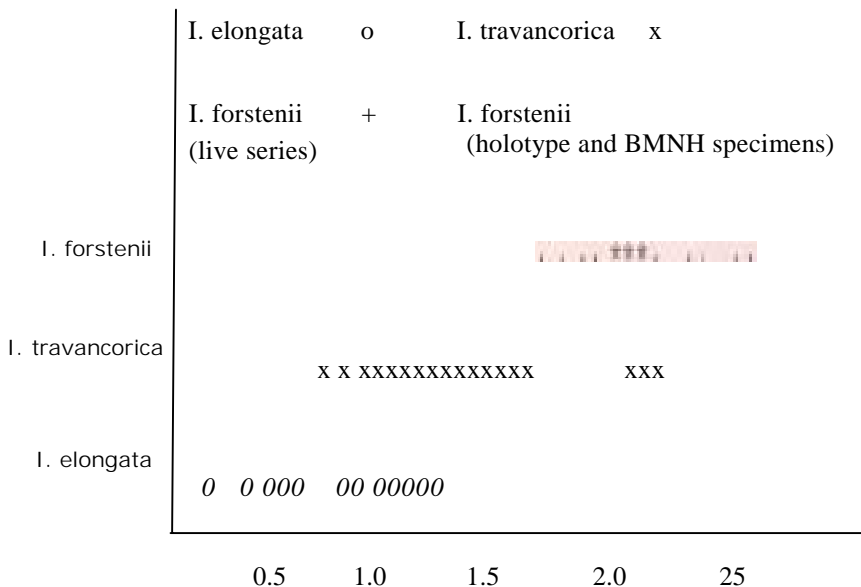
Hoogmoed and Crumly's synonymization of *I. travancorica* and *I. forstenii* has been accepted by virtually all subsequent authors. But the commercial export of tortoises from Sulawesi has continued, and I have taken advantage of the opportunity to examine substantial numbers of such animals over the last fifteen years. In that re-exportation and other fac

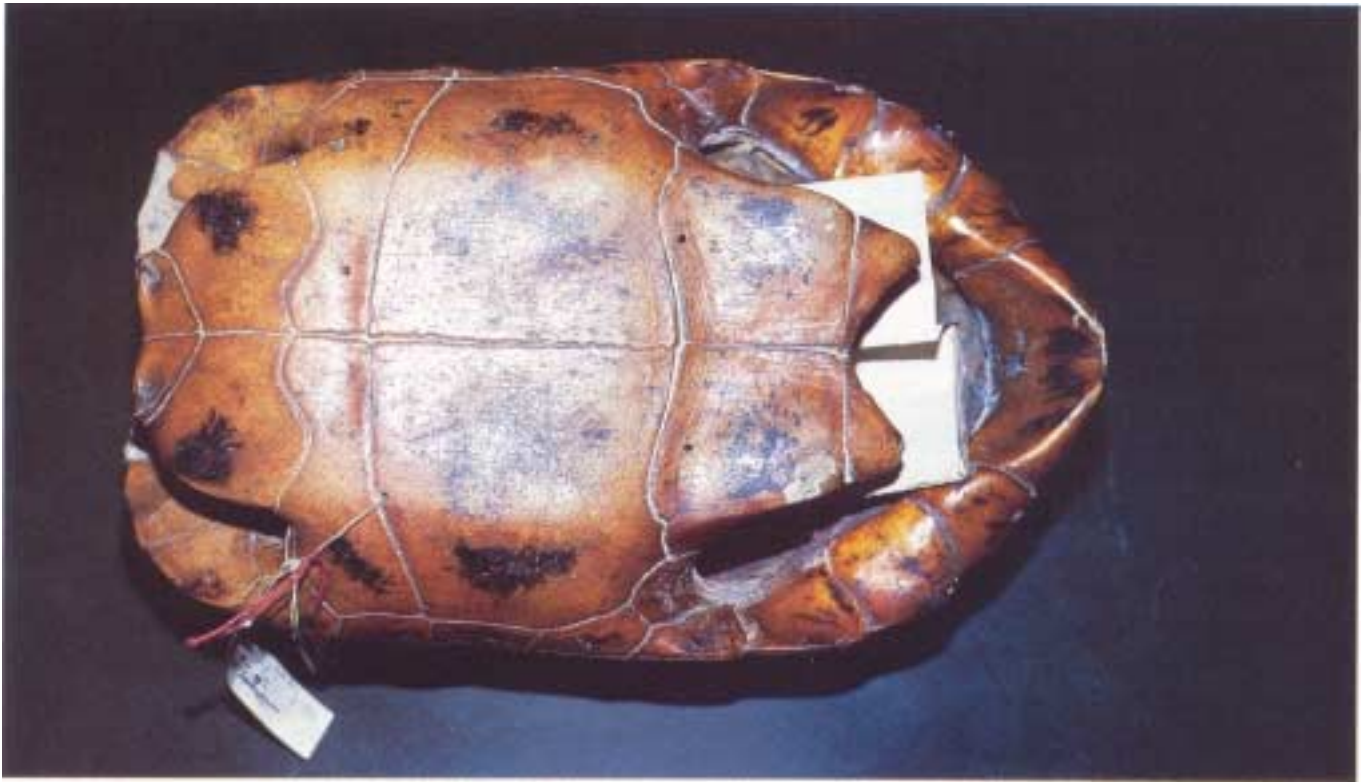
tors can confuse the real origins of live animals exported in trade, I sought simply to determine whether the tortoises in groups of animals that were allegedly from Sulawesi showed external characters that would distinguish them from either *elongata* or *travancorica*. Many live animals were examined casually, including hundreds of *elongata* in a "tortoise village" near Khon Kaen, Thailand, as well as specimens commercially imported into the United States, and detailed comparisons were made between formal museum

series, including the excellent series of *I. travancorica* in the Florida Museum of Natural History and the miscellaneous (mostly Thai) specimens of *I. elongata* in the collection of the Institute for Chelonian Research. A series of nine live adult tortoises imported from Sulawesi by Mr. Al Weinberg of Port St. Lucie, Florida, was used to characterize the Sulawesi population.

General comparisons resulted in the selection of the following characters: 1) presence/absence of the nuchal scute. 2) Relative proportions of the scutes of the anterior plastral lobe, codified as the ra-

Interhumeral/Interpectoral Seam Ratios for the Three Species of *Indotestudo*





above Plastral view of holotype of *I. travancorica* in British Museum (Natural History).

facing page: Plastral views of live adult *I. travancorica* (left) and *I. elongata* (right), showing differences in coloration and relative proportions.

ratio of the length of the interhumeral to the interpectoral seam.
3) Coloration and pattern of carapace and plastron. Population 1.

"Indotestudo elongata"

Nuchal scute: Present in all fourteen specimens examined in the PCHP collection. Smith (1931) found it absent in one of 60 specimens (the exception being abnormal in other ways). Anderson (cited by Smith, 1931) found that the nuchal was absent in four out of 86 specimens examined. The nuchal is almost always long and narrow, with parallel sides, in both dorsal and ventral aspects.

Plastral seute ratios: Das (1995) reported a plastral formula of abd-fem-pect-hum-gul-an (in decreasing order of length along the midline). In 12 specimens I examined, the ratio of interhumeral:interpectoral seam length ranged from 0.589 to 1.173 (mean: 0.787). This series included immatures from 10.5 cm upwards, and the ratio was always less than 1.0 in adults. In the two largest specimens (PCHP 2838; 33.2 cm and PCHP 2369; 28.8 cm) the humerals were especially narrowed (hum/pect ratios .589 and .452 respectively). The former, from Kanchanaburi Province, Thailand, is the largest reported speci-

men [(cf. Smith, 1931 ("275 mm"); Ernst and Barbour, 1989 ("275 mm"); Gunther, 1864 ("13 inches"); Das, 1995 ("33 cm"))]. The shortening of the interhumeral seam in this form is a result of both the lengthening of the interpectoral and also the strong posterior angulation of the gular-humeral seams. Smith (1931) reported "suture between the pectoral shields as long as or longer than that between the humerals in the adult."

Coloration: Background of carapace and plastron pale cream or greenish yellow. A variable degree of dark (gray to black) markings usually present, most commonly expressed as a prominent blotch on each abdominal seute and a single blotch or vague ocellus on each of the costals and vertebrals. Smaller dark markings may be present on other plastral scutes. Generally, the abdominal blotches, when present, are closer to the midline and more elongate than the more widely separated, blocky (irregularly quadrangular) abdominal blotches of *I. forstenii*. However, variation is extreme and may also change with ontogeny; some juveniles have traces of radiating patterns on the scutes, and some very large, old individuals may almost lack dark shell pigmentation. Adult dorsal coloration may literally range from uniformly pale to uniformly black. Head very pale, almost white.

Population 2. *"Indotestudo travancorica"*

Nuchal seute: Always absent, according to Smith (1931). In a series of 20 specimens examined at the Florida Museum of Natural History, none had any dorsal expression of a nuchal seute. However, a nuchal was evident on the underside of the

carapace overhang in a 15.6 cm subadult male (FSM 40378), although not visible from above.

Plastral seute ratios: Plastral formula abd-fem=hum-gul=pect-an according to Das (1995)-i.e., pectoral fifth rather than third longest as in *I. elongata*. In 20 FSM specimens examined, hum/pect ratio ranged from 0.69 to 1.73 (only two less than 1.0;



three more than 1.4). Mean was 1.22.

Coloration: Background color of carapace a rich mid-brown or chocolate brown, often with a darker blotch or ring, lacking sharp margins, on each of the vertebrals and costals. Sometimes as in the type specimen (Boulenger, 1907) and in one illustrated by Tikader and Sharma (1985)-the plastron may be almost immaculate, lacking the abdominal blotches characteristic of populations 1 and 3. More often, there is some dark pigmentation on each of the plastral scutes, although it is generally disorganized and very variable. The dorsal parts of the head are creamy-white, sometimes grading into pinkish in the nasal region.

Population 3.

"*Indotestudo forstenii*"

Nuchal seute: The series of nine live specimens examined and measured included five with nuchal scutes and

four without. The series was otherwise homogeneous and the tortoises were almost certainly of similar provenance, stated as "Sulawesi." Other, larger samples examined in commercial shipments and in hobbyists' live collections during the last fifteen years have similarly shown virtual numerical parity of individuals with and with

out a nuchal seute. The nuchal configuration is actually more complex than can be accurately represented by a present/absent dichotomy. When present, the nuchal is quite different from the long, narrow, parallel-sided nuchal of *I. elongata*, usually displaying a relatively short, posteriorly widened and anteriorly tapering form, with slightly convex or bowed sides. In other individuals the nuchal is reduced in both length and width. The "nuchal absent" condition may incorporate examples in which the anterior pair of marginals has a broad median line of contact, and others in which the anterior marginals meet at a single point (if at all), being substantially separated by an anterior extension of the first vertebral.

Plastral seute ratios: In *I. forstenii*, the pectoral scutes are strongly narrowed, as is typical of many species of *Geochelone*

Identification Key for *Indotestudo*

i Nuchal seute long and narrow, parallel-sided; interhumeral suture shorter (sometimes much shorter) than interpectoral suture in adults (ratio 0.59-1.0) I. elongata

1' Nuchal seute absent or, if present, relatively short and usually wedge-shaped, posteriorly widened; interhumeral suture usually longer (often considerably longer) than interpectoral suture 2

2 Nuchal seute absent. Interhumeral suture usually 1.0-1.4 times length of interpectoral suture. Background color of carapace and plastron mid-brown, darker markings not clearly delineated, not intense black or highly contrasting; crown of head white to pink, with no dark markings I. travancorica

2' Nuchal seute present or absent. Interhumeral suture 1.63-2.73 times length of interpectoral suture. Background color of carapace light cream, pale yellow to greenish, darker markings intense black, sharply delineated, usually large and extensive on all carapace scutes and pectorals and abdominals of plastron (at least); small dark spots and streaks frequently present on crown of head I. forstenii

but not of other forms of *Indotestudo*. In ten commercially imported specimens examined, the hum/pect ratio ranged from 1.63 to 2.73 (mean 2.10). In the holotype of *I. forstenii* (RMNH 3811) the ratio is 1.93 (i.e., outside the known range of variation of *I. travancorica*). The two British Museum specimens have ratios of 1.87 and 1.96 respectively, again absolutely typical for *I. forstenii* as established by our live series and considerably outside the range for *I. travancorica*.

Coloration: Background color cream, pale yellow, or whitish, not brown as in *I. travancorica*.

The characteristic dorsal pattern consists of large, intensely black blotches on each of the carapace scutes. These sharp-edged markings may be so large as to occupy 80-90 percent of the area of a scute. Those on the costals, however, typically consist of a block of black pigment occupying most of the upper and mid-section of each scute, with a sprinkling of small, disconnected or connected spots and other markings in the lower part of the scute. On the plastron, a single bold, intensely black marking, roughly square in shape in most specimens, is present on each of the abdominals, and there is a much smaller one on the lateral part of each of the pectorals. Sometimes additional spots are present on other scutes, and on the other hand occasional specimens have significantly reduced pigmentation. The holotype (RNHM 3811; photographs shown in Hoogmoed and Crumly 1984) is so dark-possibly from varnish-that it is difficult to distinguish the original dark markings, but it appears that the plastron may have the typical arrangement of black pigmentation, and the upper part of the carapace appears almost uniformly black also. On the other hand, the two specimens in the British Museum, which I have examined, have unusually reduced dark pigment, although they do show the typical black abdominal blotches and some black pigment on the scutes of the carapace. As mentioned above, they correspond to our concept of the Sulawesi tortoises in key morphological parameters.



Above: Dorsal views of two specimens of *I. forstenii*, showing relatively immaculate head and characteristic wedge-shaped nuchal scutes.

Facing page: Plastral views of adult *I. forstenii*, showing characteristic form and separation of pectoral and abdominal blotches and shortened interpectoral seams, as well as variable occurrence of spotting on the humeral and femoral scutes.

The majority of the live specimens examined had some dark markings on the dorsum of the head, although these were occasionally absent. In the other two forms, the dorsum of the head is immaculate.

Other Considerations

1. Das (1995) characterized *I. elongata* as having the highest point of the shell at Vertebral 111, contrasting with *I. travancorica*, in which the highest point is at Vertebral 11.

There is certainly a tendency in this direction (well illustrated, for example, in Plate 1 of Das,

1991), but it is not a reliable character. All *Indotestudo* tend toward flat-topped shells, and the highest point may be as far back as Vertebral IV. However, there is a strong tendency for *I. forstenii* to be flatter than its congeners. It appears also to be a little smaller. The record sizes for *I. elongata* and *I. travancorica* are both about 33 cm, while *I. forstenii* rarely exceeds 28 cm. The largest specimens of *I. elongata* are males, and although the plastral concavity is inconspicuous in younger adult males, it becomes very deep and occupies the major part of the surface of the plastron in very large individuals.

2. The highly disjunct geographic range distribution of the genus *Indotestudo* probably represents a relictual distribution. In tropical and subtropical Asia, the genus *Manouria* is more specialized for tropical humid forests, with *Indotestudo* occupying mesic evergreen forests as well as higher altitudes up to 450 in the case of *I. travancorica* (Das, 1995). In India, Moll (1989) reported that *I. elongata* occupied "sal forests" (forests dominated by *Shorea robusta*) in hilly and mountainous areas, while further east, Thirakhupt and van Dijk (1994) reported *I. elongata* in nearly all areas surveyed in western Thailand except for cool high forests and deforested areas.

There is little doubt that *I. travancorica* represents a relictual outlier of a once continuous population spread through eastern and southern India, the range having been disrupted by

probably a late Pleistocene phenomenon." Today, *I. elongata* is rare and scattered within the Indian and Nepalese sections of its range (reports summarized by Moll, 1991), giving the impression that the overall retreat continues, although in Bangladesh, Thailand, and Indo-China it may still be reasonably abundant. In Burma it is now rare according to Platt (1999).



In Malaysia and Indonesia, the (originally) widespread rainforests of the southern Malay Peninsula as well as of Sumatra and Borneo constitute typical habitat for *Manouria* rather than *Indotestudo*. although such forests may well be

relatively recent in development. Many tortoises are able (over geological time) to cross short oceanic barriers, such as those that separate the Sunda Islands, with ease, and with this ability there is no fundamental reason why Wallace's Line-a fundamental barrier to many animal groups, passing between Borneo and Sulawesi-should not have been crossed passively by dispersing *Indotestudo*. The range ultimately became massively discontinuous as the more western islands developed moist tropical forests more suitable for *Manouria* than *Indotestudo*.

The tortoises do not appear to be widespread on Sulawesi even though commercial export in recent years has been considerable. E Yuwono (pers. comm.) reported that most of these tortoises were collected in the area between Palu and Poso, i.e., in the central part of the island, near the base of the long, irregular northwestern peninsula. Steven Platt of the World Conservation Society (New York) recently visited this area and found some shells of *I. forstenii* but no live specimens. He described the habitat as being hilly and rocky although not precipitous. Yuwono recently visited Halmahera and made widespread enquiries about tortoises, but local people expressed complete ignorance of any turtle

Today, *I elongata* is rare and scattered within the Indian and Nepalese sections of its range,,,,, although in Bangladesh, Thailand and Indo-China it may still be reasonably abundant

species apart from *Cuora amboinensis*, which was abundant and widespread. Indeed, only a single specimen of *I. forstenii* has been reported from Halmahera, and perhaps this locality was in error. Unfortunately, the specimen is the holotype.

A report by van de Bunt (1990) is very confusing. It alludes to the large-scale

export of *Testudo* (= *Indotestudo*) *forstenii* from Sumatra, with the strong implication that the animals originated on the island of Sumatra, although the local vernacular *hura-hura* referred both to true tortoises and to the widespread *batagurid*

Cuora amboinensis. Conceivably there is a population of *indotestudo* on Sumatra, although if this is so, it is more probably *I. elongata* than true *I. forstenii*. The confusion continues today. Indonesian tortoises exported to Miami, Florida, have recently been confiscated by U.S. Fish and Wildlife authorities on the grounds that they key out to *I. elongata* rather than the species indicated

on the export permits (*I. forstenii*). This is a reflection of the inadequacy of available keys, which emphasize the unreliable nuchal scute character, and the erroneous synonymization of *I. travancorica* with *I. forstenii*.

Nevertheless, the result has been that wildlife exporters in Indonesia have successfully lobbied the national [C.I.T.E.S. authorities](#) to list both *I. elongata* and *I. forstenii* as species legal for commercial export from Indonesia.

Conclusions

1. Examination of substantial numbers of live tortoises of the genus *Indotestudo*, commercially imported with the reported origin "Sulawesi, Indonesia," confirms that these tortoises are different in several characters from available populations of *I. elongata* and *I. travancorica*, while they fall within the documented range of variation of the few known museum specimens of *Indotestudo forstenii* from definite localities



Anterior view of adult *I. travancorica*. Note absence of nuchal scute.

in the Indonesian islands of Sulawesi and neighboring Halmahera.

2. Comparison of samples of living Sulawesi tortoises with samples of *Indotestudo* from Southeast Asia and southwestern India ("*I. elongata*" and "*I. travancorica*") reveal subtle but distinct differences in shell and head coloration and constant differences in relative proportions of the anterior plastral scutes of all three populations. They also confirm that *I. elongata* is characterized by the presence of a narrow, parallel-sided nuchal scute, that *I. travancorica* lacks a nuchal, and that *I. forstenii* has a short, wedge-shaped nuchal scute in approximately 50 percent of individuals.

3. Even though the nuchal scute character-decisive in separating *I. elongata* from *I. travancorica*-is only useful to characterize series or populations rather than individuals of *I. forstenii*, it is clear that the morphological and chromatic differences documented above are sufficient to justify reversal of the synonymization of *I. travancorica* with *I. forstenii* as proposed by Hoogmoed and Crumly (1984) and to reinstate *I. travancorica* as a valid species of tortoise.

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