A layman's guide to Sulawesi crocodiles, lizards, and turtles

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2021

Sulang Language Data and Working Papers: Topics in Lexicography, no. 36

Sulawesi Language Alliance
http://sulang.org/

SulangLexTopics036-v1

LANGUAGES

Language of materials : English

ABSTRACT

This paper is an entry-level guide for identifying the crocodile, lizard, and turtle species that you may encounter on the island of Sulawesi, Indonesia. I have aimed for complete coverage within each family except for geckos and skinks, for which I highlight only a few common or easily identified species. Along the way I also mention certain beliefs that Sulawesi people once held, or still do, about crocodiles and lizards.

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VERSION HISTORY

Version 1 [10 June 2021] Drafted April 2017; revised March, April and September 2020 and February and April 2021; formatted for publication April and June 2021.

A layman's guide to Sulawesi crocodiles, lizards, and turtles[1]

by David Mead

Sulawesi is known for being species poor when it comes to reptiles and amphibians (herpetofauna). In this guide I cover lizards, crocodiles, and turtles, and leave snakes, frogs, and toads for later. During the course of compiling an indigenous language dictionary, here is what to look for—both the animal (for confirmation) as well as the corresponding term in the local language:

one species of crocodile
one or two species of monitor lizards
one (or at most two) species of sailfin lizards (but absent in some areas)
up to four species of long-tailed agamas
one (or at most two) species of gliding lizards
possibly one species of forest dragon (iguana-like)
up to four species of hard-shelled turtles (semiaquatic) (most areas just one)
at most two species of soft-shelled turtles (aquatic) (but absent in most areas)
up to five species of sea turtles

If you are lucky, you may also encounter a kind of earless and nearly blind and legless lizard that is adapted to burrowing, although as non-specialists we may at first mistake it for a worm. Beyond that any other type of lizard will be a gecko (fifteen confirmed species on Sulawesi) or a skink (twenty-four confirmed species). In this guide I describe the basic body plan of geckos and skinks and highlight a few well-known or easily identified species. Beyond that, if you need to make identifications as the species level you will need to consult the specialist literature.

Along the way I also mention certain beliefs that Sulawesi people once held, or still do, about crocodiles and lizards.

Crocodiles

One crocodile species is known to occur on Sulawesi, the saltwater crocodile. A second species has been observed in the wild, but has not been identified taxonomically. Other species reported or suggested for Sulawesi must be considered doubtful.

[1] I would like to thank André Koch for answering numerous questions I had and pointing me toward (and providing me with) relevant resources. His kind assistance gave me the confidence I needed to complete this paper. Remaining errors in this paper are solely my responsibility.

1. saltwater crocodile, estuarine crocodile, Indo-Pacific crocodile = *buaya muara*, *buaya rawa*, *buaya berkatak* = *Crocodylus porosus* (Schneider, 1801)

The saltwater crocodile occurs from India to northern Australia and Micronesia, including throughout Indonesia. It is sometimes claimed to be the largest crocodile species: males average 14 to 16 feet long and some even exceed 20 feet. It has a relatively wide snout and broad body compared to other crocodiles. It is also one of only two crocodile species that regularly preys on humans (the other being the Nile crocodile).

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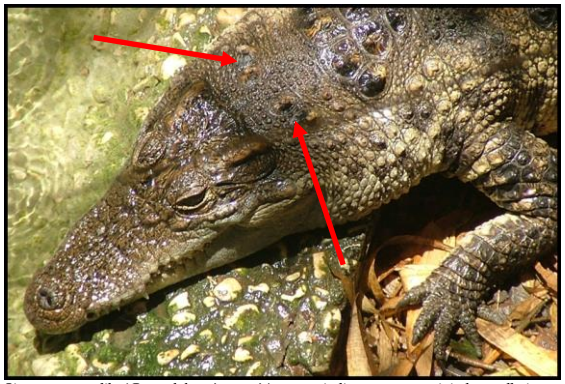
Saltwater crocodiles were abundant across Sulawesi a century ago, and continue to be found in scattered communities today.[2] However numbers have been in decline from loss of habitat, hunting, and the trade in live animals.

2. Unidentified *Crocodylus* sp.

Is it possible that Sulawesi is also home to a second type of crocodile, specifically a freshwater crocodile? There have been reports from Sulawesi of a crocodile with post-occipital scutes that are lacking in saltwater crocodiles (Cox 1992 and Platt and Lee 2000,



Siamese crocodile (*Crocodylus siamensis*); arrow indicates post-occipital scutellation.

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[2] For an overview of known locations on Sulawesi, see "Current Distribution of *Crocodylus porosus*" at https://crocodilian.com/cnhc/cst_cpor_dh_map.htm (accessed September 14, 2020).

reported in Platt, Tasirin, et al. 2007). You can think of post-occipital scutes as scaly knobs located on the neck just behind the bony platform that forms the top of the crocodile's head. See pictures above of a Siamese crocodile on the left with post occipital scutes indicated by red arrows, versus the 'naked neck' of a saltwater crocodile on the right.

This second crocodile species, however, has never been verified scientifically. Some have equated it with the Siamese crocodile (*Crocodylus siamensis*), the Bornean crocodile (*Crocodylus raninus*), the New Guinea freshwater crocodile (*Crocodylus novaeguineae*), the false or Malayan gharial (*Tomistoma schlegelii*) or a possible undescribed *Crocodylus* species (Platt, Tasirin, et al. 2007:13; Groombridge and Wright 1982:401; Ross 1998:69).

On the other hand, "saltwater crocodiles very happily walk to, or swim to, freshwater lakes well inland," and given the lack of scientific evidence otherwise, there is little reason to think that the vast majority of Sulawesi's 'freshwater' crocodiles are anything else (Naish 2012). Platt, Tasirin, et al. (2007:16) recommend an island-wide crocodile survey to determine current populations of the saltwater crocodile and to resolve the question of a freshwater crocodile species on Sulawesi.

Cultural notes

A fairly widespread belief that has been documented from Central, South, and Southeast Sulawesi is that people can give birth to crocodiles.[3] This belief sometimes takes the specific form that a woman can bear twins, one of which is human and the other crocodilian, that is to say, there was a particular person in the past or even in the present day who had (or has) a crocodile twin. Concomitant with this are beliefs that the crocodile population can be divided into those animals which are mere brutes versus those which are internally human, and that people can call on their crocodile relatives for certain favors such as help with capturing game, safety in crossing rivers, or healing. Koch and Acciaioli (2007:80) suggest that such beliefs arose and persisted because they make something dangerous in the natural world seem more benevolent.

In a short booklet, the anthropologist Alb. C. Kruyt discussed these and other notions people in the Pamona area held about crocodiles (Kruyt 1937, English translation Kruyt 2020). Other beliefs included:

- crocodiles are in communication with the gods of the underworld, and are sent as their emissaries or avengers (along with this, people can strengthen an oath by invoking to be seized by a crocodile if they are lying);

- people are reluctant to kill a crocodile in the belief that the crocodile community will take revenge;

[3] Among other places Pamona (Kruyt 1937), Wotu (Syuaib 2013), Tolaki (Treffers 1913), Sa'dan Toraja (Waterson 2009:xii) and Bugis and Makasar (Koch and Acciaioli 2007).

- persons in possession of a special crocodile 'skin' can convert between human and crocodile form;[4]

- crocodiles exemplify *par excellence* the stealthy and sudden way headhunters should ambush their victims;

- people can be possessed by crocodile spirits.

In Tolaki people explained the prevalence of a certain scaly skin disease as due to unbeknownst contact with pieces of a particular crocodile skin that had dried out, disintegrated, and blew away in the wind (Treffers 1913:233). Making sacrifices to a crocodile (as representative of a guardian spirit) was formerly also known among the Tolaki (Arsamid 1989:pers.comm.).[5]

Monitor lizards

Monitors (Indonesian *biawak*) are large, muscular, and relatively active lizards that are well known throughout Indonesia.

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Monitors from the island of Sulawesi can be divided into two basic types based on coloration. One type of monitor lizard has a nearly uniform black body and tail and is considered to be a distinct species (*Varanus togianus*). Other monitor lizards have a more

[4] More generally the belief is people can convert to various animals or even plants, so long as they possess the appropriate outerwear. As Adriani explains:

> In the animist view, inwardly the animal is no different from man, but its physique prevents it from walking, speaking, or using its hands, or forces it to swim, fly, crawl or jump. But if the animal can remove this outer shell (in the stories called its clothing), then its human form also emerges from it and it turns out to be entirely human. If its 'clothing' is now destroyed, it will permanently remain a person; otherwise, as often as it wants, it can return to its monkey, bird, snake, monitor lizard, gourd, or whatever other form. (Adriani 1925:146, English translation).

[5] Venerating crocodiles and making sacrifices to edifices of crocodiles is also reported from the Philippines (Van der Ploeg 2013:29).

typical coloring that includes dots or spots on the body and bands on the tail, and are considered, at least for the present, to belong to the widespread *V. salvator* species. In addition two other species have been documented from offshore islands but have a limited geographical distribution. This brings the total number of currently recognized monitor species of Sulawesi to four.

I describe all four species briefly below in prose. For additional information and pictures, see the online guide to monitor lizard species by Auliya and Koch (2020). This guide is written for non-specialists and covers the current eighty-one species of monitor lizards recognized worldwide, including the four species highlighted here.

1. Asian water monitor, Malayan water monitor, common water monitor = *biawak*, *biawak air* = *Varanus salvator* ssp. (Laurenti, 1768)

The Asian water monitor is distributed from Sri Lanka through Indonesia as far east as Obi Island in the Moluccas (Koch and Böhme 2010). Adults can grow upwards of six feet—next to komodo dragons, the largest lizards worldwide.

Asian water monitor (*Varanus salvator*) from Sri Lanka.

Asian water monitors of Sulawesi could, in a general way, be described as having spots on their bodies and bands on their tails. However when looking at individual specimens these body markings exhibit a high degree of variation, ranging from single light-colored scales to small dots to large light spots, sometimes with dark centers. Markings may be sprinkled about the body or arranged in transverse rows. Because of this variation and other complications—and despite genetic evidence pointing to their separate rank—herpetologists have as yet been unwilling to commit to the taxonomic status of these Sulawesi monitors.[6] See particularly Koch, Auliya, et al. (2007) for a detailed discussion.

Asian water monitors are terrestrial to semiaquatic, and may be found in coastal and wetland habitats. Juveniles may be more arboreal. It is likely that Makasar *panrugu*, "a kind of large blackish tree lizard, which with the tail included, can reach half a meter in

[6] The subspecies designation *V. salvator celebensis*, which you many come across in the literature or online, has in fact not been rigorously defined, and therefore not meaningful from the viewpoint of taxonomical classification.

length" (Cense 1979:513, English translation) are nothing other than juvenile monitor lizards.

2. Togian water monitor = *biawak togian* = *Varanus togianus* (Peters, 1872)

The Togian water monitor is found across mainland Sulawesi except for the northern peninsula, and in several offshore islands including Selayar, Buton, Wawonii, and the Togian Islands. Adults are uniformly black above, but have well-developed dark and light bands on the underside (see additional images in Koch, Ziegler, et al. 2013:40, Auliya and Koch 2000:171).

Varanus togianus from the Wakatobi Archipelago.

3. Banggai Island monitor, quince monitor = *biawak kuning, biawak banggai* = *Varanus melinus* (Böhme & Ziegler, 1997)

This monitor has a prominent yellow head and neck. It is endemic to the Sula Islands and may also occur in the Banggai Archipelago. It is closely related to the mangrove monitor *V. indicus* of eastern Indonesia.

4. Talaud mangrove monitor, Lirung monitor = *Varanus lirungensis* (Koch, Arida, Schmitz, Böhme & Ziegler, 2009)

The Talaud mangrove monitor has only recently been described as a distinct species (Koch, Arida, Schmitz, et al. 2009). It is black mottled with yellow. Adults have a light pink throat and a light colored belly with darker but faint crossbands. It is found in the Talaud Islands. The specific epithet *lirungensis* refers to the village of Lirung on Salibabu Island.

Cultural notes

Koch and Acciaioli (2007) document a belief among the Bugis and Makasar of South Sulawesi that people can be related to monitor lizards (similar to the crocodile twins discussed above) and that some monitors have human spirits.

Monitors have deeply forked tongues. The Bugis and Makasar expressions, *mallila pararang* (Said 1977:121) and *a'lila-padalle'* (Cense 1979:496)—literally 'to have a monitor tongue'—mean to speak disingenuously, similar if not identical to the English expression 'speak with a forked tongue.'

Sailfin lizards

Sailfin lizards, also known as sail-finned lizards and sailfin dragons (Indonesian *soa-soa*, *soa-soa layar*) are large lizards that can grow to over three feet long. They are recognizable not only from their size but also from the large fin along their back and tail.

Lophura amboinensis. From Johann Wagler *Descriptiones et Icones Amphibiorum*, three parts (1828–1833), Plate XXVIII. Courtesy of The Biodiversity Library biodiversitylibrary.org/page/43580192.

Sailfin lizards prefer wooded habitat near steams, rivers, and lakes. They are excellent swimmers and when threatened dive into water (the genus name *Hydrosaurus* literally means 'water lizard'). The experience of Albert Grubauer, an early explorer of interior Sulawesi, may be regarded as typical:

> A footpath … led us … to the banks of the great Wuáki River. There … we had the pleasure to observe one of the adventurous-looking giant comb lizards (*Lophura amboinensis*) strolling on land. The picture of the varanid in its sudden defense position with its raised comb and running as fast as it could towards the river was as amusing as it was beautiful. With great force the lizard threw itself headfirst into the deep splashing water, where it immediately disappeared in order to emerge again far from this location at a secluded spot on the river bank. (Grubauer 1913:152–153, English translation)

Sailfin lizards are not a type of monitor lizard or ‘varanid’ (Dutch *varaan*) as was once supposed, but are more closely related to the long-tailed agamas and gliding lizards discussed below. Nonetheless when consulting local language dictionaries I have sometimes encountered ambiguity as to which animal (monitor or sailfin lizard) is being described. Also a word of caution: while *soa-soa* is supported as the Indonesian word for sailfin lizard (e.g. Stevens and Schmidgall-Tellings 2004:s.v. “soa-soa”), in some localities people regard *soa-soa* as the Indonesian word for monitor lizard.

Sulawesi is home to two endemic species of sailfin lizards, *H. celebensis* and *H. microlophus*, which differ in regard to scalation and coloration. Color differences are most pronounced in adult males, less so in adult females, and hardly at all in juveniles. For more than a century these two species had been synonymized with the Amboina sailfin lizard *H. amboinensis* (Günther, 1873) (see illustration above), and only recently have they been re-recognized as distinct species (Denzer et al. 2020). A third type of sailfin lizard is present in the Talaud Islands, probably a species which also occurs on Halmahera or in the Philippines.

1. Sulawesi sailfin lizard = *soa-soa sulawesi* = *Hydrosaurus celebensis* (Peters, 1872)

According to Denzer et al. (2020:291), adult males have a mostly black head, neck, throat, shoulder, legs, and tail. The torso however is spotted black and yellow (or yellowish orange). Adult females have dark or light speckles on a gray, olive-brown, or greenish background. On the side of the neck and torso of both males and females are enlarged scales that occur singly or in small patches (the largest is a grouping of two to seven scales just behind the shoulder). In *H. celebensis*, these enlarged scales are flattened or only slightly keeled and are light colored in both sexes.

Male *Hydrosaurus celebensis* at Pattunuang, Bantimurung Bulusaraung National Park, Kabupaten Maros, Sulawesi Selatan, Indonesia.

H. celebensis is distributed across the central part of Sulawesi and into the eastern and southeastern peninsulas. It is also found in northern parts of the southern peninsula. Isolated populations of *H. celebensis* are also found just north of the city of Makassar in the watersheds of the Bantimurung and Pattunuang rivers, where they were possibly introduced by human agency; see distribution map in Denzer et al. (2020:293).

2. *Hydrosaurus microlophus* (Bleeker, 1860)

Denzer et al. (2020:292) describe adult males as dirty yellow with blackish legs and head, while adult females are more uniformly black or gray. Both sexes have a yellow patch on the throat extending from the lower jaw and onto the front part of the shoulders; the belly and undersides of the legs are also yellow. Enlarged scales occur in well-defined patches or elongated bands (one patch on the neck, others on the torso). These scales are more numerous and more pointed than in *H. celebensis*, furthermore they are light colored in females, but in males the largest scales are black or brown.

Male *Hydrosaurus microlophus*, Kabupaten Maros, Sulawesi Selatan, Indonesia.

Although sailfin lizards are semiaquatic, Denzer et al. (2020:290) report that during the dry season individuals near human habitation may retreat to trees to avoid hunting dogs.

H. microlophus is found across the southern peninsula of Sulawesi. It has been documented as far north as Palopo where it partly overlaps the range of *H. celebensis*. It may also occur in parts of western Sulawesi.

Cultural notes

In Pamona it was believed that when sailfin lizard (*kaliado*) eggs hatched, the mother would charge at the young; those that fled into the water became crocodiles, while those that fled into the bush became lizards (Kaudern 1921 II:220; Adriani 1928:243). In Makasar the story goes instead that crocodile eggs burst open; young that are flung into the water become crocodiles, while those that are flung into the brush or into trees become monitors (Cense 1979:496).

Long-tailed agamas

Long-tailed agamas are smaller and more agile cousins of sailfin lizards. They are delicately built with slender bodies, gangly legs, and long tails—two-thirds of their total body length can be in their tails. They are arboreal and active during the day, and may be spotted sunning themselves in foliage.

Long-tailed agamas are also known as crested lizards, due to the crests or spikes found on the back of the neck. They have also garnered the ominous-sounding name 'bloodsuckers,' due to a red or orange coloring that develops around the throat, head, or body of the males of some species during the mating season. In Indonesian these lizards go by the general name *bunglon*.

Some long-tailed agamas are able to rapidly change body color (e.g. in response to stress). From this has arisen the incorrect notion that long-tailed agamas are a type of chameleon. This misconception is reinforced by the fact that a number of well-known Indonesian-English dictionaries even translate *bunglon* as 'chameleon.' True chameleons occur only from Africa and the Mediterranean as far east as Sri Lanka.

1. green crested lizard = *bunglon jambul* = *Bronchocela cristatella* (Kuhl, 1820)

Green crested lizards have bright green bodies, sometimes tinged with blue around the head, and a dark ring around the eye. Lizards can change to brown when stressed.

Bronchocela cristatella.

Bronchocela cristatella in Singapore. © 2018 by budak via iNaturalist. CC BY-NC 4.0 International.

The green crested lizard is found from Burma through the Philippines and eastern Indonesia, including Sulawesi where it may have been introduced in the past. The specific epithet *cristatella* (Latin for 'little crest') refers to the well-developed crest on the back of its neck (a so-called nuchal crest).

2. maned forest lizard, maned forest agama, great crested canopy lizard = *bunglon surai* = *Bronchocela jubata* (L. Müller, 1928)

The maned forest lizard is found from Cambodia as far east as Bali and Sulawesi. It may have been introduced to Sulawesi in the past. Its body is medium green in color, but it can change to brown or black when threatened. The specific epithet *jubata* (from Latin *iuba* 'mane') refers to the well-developed crest on the back of its neck (nuchal crest) and a smaller crest along its back (dorsal crest).

Bronchocela jubata. © 2011 by A. Baihaqi. CC BY-SA 4.0 International.

3. Sulawesi bloodsucker = *bunglon sulawesi* = *Bronchocela celebensis* (Gray, 1845) [synonym *Calotes celebensis* (Boulenger, 1885)]

The Sulawesi bloodsucker is endemic to Sulawesi. It is distinguished from both *B. cristatella* and *B. jubata* by its smaller eardrum (tympanum), which is only a third to a half the diameter of the eye socket (orbit) (Hallermann 2005).

4. oriental garden lizard, eastern garden lizard, changeable lizard, bloodsucker = *bunglon, bunglon taman, bunglon kebun, bunglon sisir, londok = Calotes versicolor* (Daudin, 1802)

The oriental garden lizard distinguishes itself from other long-tailed agamas on Sulawesi by its brown to buff or gray coloring, sometimes tinged with olive.

Female *Calotes versicolor*.

Adult males have swollen cheeks and may also be colored with red and/or black, particularly during the mating season.

Male *Calotes versicolor*. © 2009 by J. M. Garg. CC BY 3.0 Unported.

The oriental garden lizard is native from Iran through China, Southeast Asia, Sumatra, and the Philippines. It has recently been introduced to Sulawesi.

Cultural notes

In the Pamona area of Central Sulawesi, children who suffered convulsions were treated by having them eat the removed and dried tail of a crested lizard (*soko*) (Adriani and Kruyt 1950–1951 II:268).

Gliding lizards

Gliding lizards are another type of slender-bodied agamid lizard. Including the tail they are about eight inches long. They are best known for and easily distinguished from other kinds of lizards by their extendable membranous ‘wings’ (technically patagia, singular patagium) by which they can glide from tree to tree.

Draco spilonotus at Lumpias Village, North Minahasa, North Sulawesi. © 2014 by A. S. Kono. CC BY-SA 3.0 Unported.

In English they are also known as flying lizards and flying dragons. In Indonesian they go by several names including *cekibar*, *cebikas*, and *kubin*, but the most popular term is *cicak terbang*.

Mainland Sulawesi is home to three species of gliding lizards. However they occupy distinct geographic regions, so that in any particular location you will encounter only one species (or at most two, if you happen to be in a zone of overlap)—see the distribution map in McGuire et al. (2007:189). Five additional species are limited to one or another of Sulawesi's offshore islands, bringing the total number of species for Sulawesi to eight.[7]

All eight species can be distinguished by the patterns of coloration of the (male) dewlap and patagia. For descriptions and photographs of these patterns, see McGuire et al. (2007). Because this article is complete in its coverage and available online, I simply list the eight different species below with notes about their geographic distribution, and refer the reader to their article for all other details.

1. Sulawesi lined gliding lizard = *Draco spilonotus* (Günther, 1872) – northern Sulawesi and along the Makassar Strait as far as Mamuju

2. Walker's flying lizard = *Draco walkeri* (Boulenger, 1891) – southern peninsula of Sulawesi and core of central Sulawesi

3. Beccari's flying lizard = *Draco beccarii* (W. Peters & Doria, 1878) – eastern and southeastern Sulawesi

4. Lazell's flying lizard = *Draco biaro* (Lazell, 1987) – Biaro Island next to Tahulandang Island

5. Sangihe flying lizard = *Draco caerulhians* (Lazell, 1992) – Sangihe Island

6. Iskandar's flying lizard = *Draco iskandari* (McGuire et al., 2007) – Tahulandang Island

7. Banggai flying lizard = *Draco rhytisma* (Musters, 1983) – Banggai Archipelago

8. Supriatna's flying lizard = *Draco supriatnai* (McGuire et al., 2007) – Togian Islands

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[7] Guides and websites that indicate the common flying dragon *Draco volans* (Linnaeus, 1758) is present on Sulawesi are reporting old information. *D. volans* was formerly considered to be widely distributed and comprise several subspecies. However as these subspecies have been elevated to distinct species, the range of *D. volans* (in its narrowed sense) has become restricted to Java and Bali (and for which a more appropriate common name is the Javan flying dragon). A similar story can be told regarding the lined flying dragon *D. lineatus*, at one time listed for Sulawesi but now restricted to Buru, Ambon, Ceram, and nearby islands of the Moluccas (McGuire et al. 2007:200).

Forest dragon

The crowned forest dragon (*Lophosaurus dilophus* Duméril & Bibron, 1837, synonym *Hypsilurus dilophus* Manthey & Schuster, 1999), also known as the Indonesian forest dragon and in the Indonesian language as *bunglon naga hutan*, is distinguished from other lizards in this guide by a row of conspicuous, individual spikes along its back.

The crowned forest dragon is found across the island of New Guinea and in some of the Moluccan Islands. However evidence for it (or a similar species) on Sulawesi is limited to a single image: "Nicolai Orlov provided a photograph depicting a *Hypsilurus* species from Sulawesi extremely similar to *H. dilophus*, and possibly even conspecific" (Manthey and Denzer 2006:25–26). If present on Sulawesi it could be due to the pet trade. If you see or hear tell of such a lizard, it would be worth investigating further.

Earless lizards

Earless lizards (family Dabamidae) are adapted to burrowing. They lack external ear openings. have cylindrical bodies and reduced eyes covered by thick scales, and are legless except for males which have rudimentary hind legs (used for grasping the female during mating). They are also called blind lizards and legless lizards, sometimes also (but less correctly) earless skinks, blind skinks, blindskinks and blind legless skinks (since they are no longer regarded as closely related to skinks). Appellations in the Indonesian context include *kadal buta*, *kadal tanpa kaki*, *kadal berbentuk cacing* and *kadal cacing*.

New Guinea blind lizard *Dibamus novaeguineae*. Photographed 2015 by Rafe Brown. CC PDM 1.0.

It would be impossible to confuse earless lizards with any other type of lizard of Sulawesi. Although wormlike in appearance they distinguish themselves from worms by their scales, by their dry rather than slimy touch, and by the fact that they cannot contract their bodies. Morphologically earless lizards are most similar to blind snakes (family Typhlopidae), and here there is genuine potential for confusion. Herpetologists can tell by the pattern of head scales, which are larger on the snout and jaw in earless lizards than in blind snakes. If the animal you are examining has flap-like hind legs (next to the vent) then that too would be a telltale sign that your specimen is an earless lizard (specifically a male).[8]

Mainland Sulawesi is home to two species of earless lizards—at one time considered a single species—but identification at the species level is best left to experts. Descriptions of both species (Greer 1985:148, 150) indicate that they are likely to be found in or under rotting logs on the forest floor. A third species has recently been described from the island of Manado Tua in North Sulawesi (Koppetsch et al. 2019). Because earless lizards have been little studied, presumably other species are still out there awaiting discovery.

1. New Guinea blind earless skink, New Guinea blind lizard = *Dibamus novaeguineae* (Duméril & Bibron, 1839)

This species is distributed from the southern Philippines and Sulawesi through Ternate, Halmahera and extreme western New Guinea.

2. *Dibamus celebensis* (Schlegel, 1858)

This species is endemic to Sulawesi. It was revalidated as a separate species by Greer (1985). It is very similar to the New Guinea blind lizard but has more midbody scale rows (26 to 30, versus the 22 to 26 rows of *D. novaeguineae*) and also a slightly longer body (maximum snout to vent length 188 mm, versus 158 mm in *D. novaeguineae*).

[8] Earless lizards can regenerate their tails (blind snakes cannot), and earless lizards have teeth in both jaws (blind snakes of Sulawesi only in the upper jaw). Because of my lack of experience, I don't know how useful these differences might be for identification in the field.

3. *Dibamus manadotuaensis* (Koppetsch, Böhme & Koch, 2019)

This species has four postocular scales, versus the three postocular scales of *D. novaeguineae* and *D. celebensis*.

Cultural notes

Uma people describe the *ule tawu* as a very small snake (less than 30 centimeters) which may—but still awaiting confirmation—turn out to be a kind of legless lizard or blind snake. "The root *tawu* means to cover with something, usually dirt. In fact, the *ule tawu* is an omen: If we are on a trip and we see one, it could be a good omen meaning that we will find the treasure we are after, even if it has been concealed or buried (*ratawu*) by others. Or it could be a bad omen meaning that one of our company will be *ratawu*, i.e., be buried" (Michael Martens 2017:pers.comm.).

Geckos and skinks compared

If you encounter a lizard on Sulawesi *and you have verified that it is not one of the species described above*, then it will either be a gecko or a skink. Fortunately for the novice, geckos and skinks differ significantly from each other in regard to body shape and other characteristics. Thus even though it may lie beyond our ability to identify a specimen at the genus or species level, we can nonetheless still determine the family (Gekkonidae or Scincidae) to which it belongs. Here are several ways to determine whether the lizard at hand is a gecko or a skink.

body:	Geckos have a flattened body shape and a distinct neck.	Skinks have an overall streamlined and usually tubular body shape. The head merges into the neck without or with only a slight constriction.
skin:	Geckos have tiny scales that give the skin a soft, velvety texture. Skin is shed in small patches.	Skinks have large shiny scales. The texture is smooth and tight. They shed their skin as a whole or in large pieces.
eyes:	Geckos cannot blink, and wash their eyelids with their tongues. Pupils narrow to vertical slits in bright light.	Skinks can blink their eyes. Pupils tend to be round.
feet:	Many geckos have broadened footpads with specialized hairs (setae) that allow them to climb on smooth surfaces.	Skink toes are long and narrow, not broadened or thickened in the middle.

activity:	Geckos tend to be active at twilight or night.	Skinks tend to be active during the day and can be found basking in sunny areas. (A few species are nocturnal.)
sound:	Geckos are well known for their vocalizations, including (depending on the species) chirps, barks, croaks, hisses, clicks, squeaks, squeals, whistles, wheezes, and sneezes.	Skinks are mostly silent. Some skinks make a defensive hissing sound.

In the Indonesian context small-sized geckos can be referred to as *cicak* or *cecak*, larger geckos as *tokek*, and skinks as *kadal*. However these terms are not unproblematic, and to be completely unambiguous you could refer to geckos as *kadal suku Gekkonidae* and skinks as *kadal suku Scincidae*. Some online and print resources use *bengkarung* as a cover term for skinks (or for small lizards generally). However this term properly refers to the Asian grass lizard (*Tachydromus sexlineatus*, also known as the *ular berkaki*), a kind of small lizard with an extremely long tail. This lizard is not a skink and does not occur on Sulawesi.

Geckos

According to a recent inventory (Koch 2011:395), there are fifteen described species of geckos on Sulawesi and its offshore islands, four undescribed species, and three uncertain species. Doubtless these numbers will change (and probably already have) as the geckos of Sulawesi become better known. Below I describe five of the most widely distributed species, and one which is notable for its large size.

For checklists of Sulawesi gecko species including information about distribution, see Iskandar and Tjan (1996) (now somewhat outdated) and Koch (2012).

If you decide to take pictures of a gecko in hopes of later identifying it, the most important features to document are: (a) coloration and patterning on the back; (b) coloration and patterning on the underside; (c) orientation of the nostrils in relation to the large scale at the tip of the nose; (d) coloration of the inside of the mouth and tongue; (e) pattern of scales (lamellae) on the underside of the fourth or longest toe of the hind foot. Be sure to take quality photographs with sufficient detail, preferably using diffuse natural lighting.

1. common house gecko = *cicak rumah* = *Hemidactylus frenatus* (Duméril & Bibron, 1836)

House geckos are well adapted to urban environments, where they hunt insects drawn to artificial lighting at night. In Indonesian they are known as *cicak* or *cecak* after the “chek,

chek, chek" sound that they make. The common house gecko is colored from gray to beige to light brown with a white underside.

Hemidactylus frenatus. © 2017 by Vengolis. CC BY-SA 4.0 International.

2. flat-tailed house gecko, frilled house gecko, Asian house gecko = *cicak ekor selimpat* = *Hemidactylus platyurus* (Schneider, 1792) [synonym *Cosymbotus platyurus* (Steindachner, 1867)]

The flat-tailed house gecko is a second species of house gecko found in Sulawesi. It is similar in size to the common house gecko (both grow to roughly five to six inches long including the tail). Its coloration is described as light gray mottled with darker gray.

Male *Hemidactylus platyurus*, Timor-Leste. © 2011 by Mark O'Shea. CC BY 3.0 Unported.

For the novice, the easiest way to identify the flat-tailed house gecko is from its flattened tail fringed with loose skin; there is also usually a dark stripe from the eye to the shoulder.

3. common four-clawed gecko, stump-toed gecko, tender-skinned house gecko, sugar gecko, Pacific gecko = *cicak gula* = *Gehyra mutilata* (Wiegmann, 1834)

The common four-clawed gecko grows from four to five inches long. Although it can be found outdoors, it is also adapted to human habitations. It is distinguished from other house geckos by its purplish- to pinkish-gray color, its relatively plump body, and its delicate skin. If you have keen eyes or a magnifying glass, you might also note that the

inner toe of each foot is missing (or nearly missing) the claw. Like other house geckos it communicates by making a chirping sound.

Gehyra mutilata from Barangay Dibuluan, Luzon Island, Philippines. Photo by Arvin C. Diesmos. CC BY 3.0 Unported.

The common four-clawed gecko is primarily an insectivore, but is also known to feed on flower nectar and loose grains of sugar, whence it has garnered the common names ‘sugar gecko’ and *cicak gula*.

In the Sa’dan Toraja dictionary, Tammu and Van der Veen (1972:295, 665) mention a kind of reddish lizard called *lelang* or *lelaa*, which sometimes falls into palm toddy and contaminates it, with the result that people who drink the palm wine throw up. Perhaps this gecko is the culprit.

4. tokay gecko = *tokek, tokek biasa* = *Gekko gecko* (Linnaeus, 1758)

The tokay gecko grows to about a foot long. Coloration is gray with red speckles, though they have the ability to somewhat blend in with their surroundings. Males are more brightly colored than females.

Tokay gecko. © 2011 by Owen Edwards. Released to the Public Domain (CC0).

Although described as an arboreal lizard, it is adapted to human habitations. Anyone who has spent time in rural Indonesia has at one time or another been awakened by the male’s mating call, described as a load croak or bark.

5. monarch gecko, marbled gecko, spotted house gecko, warty house gecko = *tokek berbintik* = *Gecko monarchus* (Schlegel in Duméril & Bibron, 1836)

The monarch gecko is a medium-sized gecko that grows to around eight or nine inches long including the tail. It is colored gray to grayish-brown and can be recognized from the paired black spots along its back and from the four black spots which form a broad 'W' at the back of the head. It can be found in forest habitats, near rock crevices, and in human habitations. The monarch gecko is widely distributed from Thailand through Indonesia and Papua New Guinea.

Female Gekko monarchus from oil-palm plantation in Upper Seruyan, Central Kalimantan, Indonesia. © 2011 by Wibowo Djatmiko. CC BY-SA 3.0 Unported.

6. green-eyed gecko, Smith's green-eyed gecko, large forest gecko = *tokek hutan*, *tokek mata hijau* = *Gecko smithii* (Gray, 1862)

I mention the green-eyed gecko not because it is particularly common on Sulawesi but because it is the largest gecko species in Southeast Asia—adults can grow to fourteen inches long. It can be identified from its large size, green eyes, and rows of white dots along its back. It has a call similar to that of the tokay gecko.

Gekko smithii, Bilit, Sabah, Malaysia. © 2012 by Bernard Dupont. CC BY-SA 2.0 Generic.

Previously this gecko was thought not to occur east of the Wallace line, but specimens were recently discovered in eastern Sulawesi, the Togian Islands, and the Gorontalo

region of northern Sulawesi (Koch, McGuire, et al. 2009; Koch 2012:177). It prefers undisturbed forest habitats and is unlikely to have been introduced by human agency.

Cultural notes

If a house gecko chirps while people are talking, this confirms that the person who is speaking is right. This belief is known from Pamona (Adriani and Kruyt 1912–1914 I:266), Balantak (Naram 2021:56), and Kulisusu. But if a house gecko falls and lands on someone, it portends that something unfortunate will happen to that person's family (also known in these same three cultures).

If a house gecko is heard chirping while someone is preparing to go on a journey, in Pamona this is considered a good omen, signifying that the traveler will be lucky; if a house gecko chirps over the head of someone as they are departing, he or she must sit down first (Adriani and Kruyt 1912–1914 I:266).

People in the Kulisusu area say when you hear a tokay gecko at night, to count alternately after each call *waho* ('rain'), *oleo* ('sun'), *waho*, *oleo*, etc. An odd number of calls predicts that tomorrow's weather will be rainy, an even number of calls that it will be sunny. A belief that tokay geckos can predict the weather is also reported from Java (Wessing 2006:205).

Skinks

According to a recent inventory (Koch 2011:395), there are twenty-four described species of skinks on Sulawesi and its offshore islands, twenty undescribed species, and seven uncertain species. Doubtless these numbers will change (and probably already have) as the skinks of Sulawesi become better known. For checklists of Sulawesi skink species including information about distribution, see Iskandar and Tjan (1996) (now somewhat outdated) and Koch (2012).

In the following presentation I concentrate on species which are either common (such as the emerald tree skink), or which would be unmistakable if encountered (such as the Pacific bluetail skink). No description of Sulawesi skinks would be complete without mentioning the commonly encountered mabuyas or sun skinks. However since distinguishing between Sulawesi's mabuya species can be challenging, I begin by offering help in a special subsection devoted to just these lizards. Between the mabuyas and other skinks, in total I cover only eleven species; beyond these you will need to consult the specialist literature.

If you encounter an unidentified skink and want to take photographs for later identification, the most important features to capture are the patterns along the side, the back, and the belly; the top of the head, the head profile, and the throat. Include close-ups in

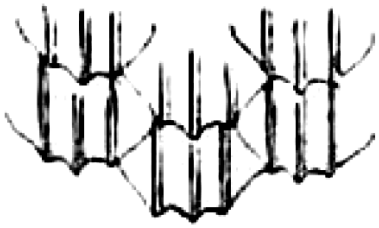
sufficient detail to be able to see scale details and do scale counts. Photographs taken with diffuse natural lighting are preferable.

Mabuyas

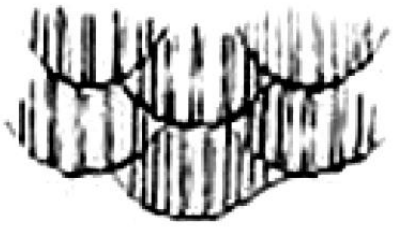
Skinks of genus *Eutropis* can be referred to in a general way as Asian mabuyas (in this sense opposed to African and New World mabuyas).[9] They have also garnered the name sun skinks. Mabuyas are easy to distinguish from other kinds of skinks by their brown to bronze coloring, their large size (adults can reach over a foot long), and their stout and somewhat angular bodies. They are active during the day, when they may be found on the ground (descriptions often mention sunlit areas of the forest floor) and the lower parts of trees; they also tend to be common around human habitations.

Male *Eutropis* cf. *multifasciata* from near Lospalos, East Timor. © 2011 by Stephen Richards. CC BY 3.0 Unported.

Distinguishing *between* Sulawesi's five species of mabuyas however is not so simple. For the novice, a preliminary division can be made by capturing a specimen and closely examining its body scales, such as along its back. The most likely case is that each scale will have three keels—a prominent keel in the middle and a secondary keel on each side; see the illustration below on the left. Having three keels (the technical term used by herpetologists is 'tricarinate') is characteristic of three mabuya species of Sulawesi: *E. multifasciata*, *E. rudis*, and *E. macrophthalma*. See descriptions below.



Tricarinate scales of *Mbuia rudis*. Source: George Albert Boulenger, *Catalogue of the Lizards in the British Museum (Natural History)*, 2nd ed., vol. III, 1887, Plate XI, Figure 3a. Public Domain.



Mutli-keeled scales of *Mbuia multicarinata*. Source: George Albert Boulenger, *Catalogue of the Lizards in the British Museum (Natural History)*, 2nd ed., vol. III, 1887, Plate XI, Figure 2a. Public Domain.

[9] From *mabouya*, apparently the native word for 'lizard' on one or more of the Caribbean Islands. The genus name *Eutropis* is from Greek *eu-* 'good' + *tropis* 'keel' (in reference to the well-keeled scales).

Another possibility is that the scales will have five keels (quinquecarinate) or rarely seven keels (septicarinate), a characteristic of *E. rugifera*. Finally the scales of *E. multicarinata* have multiple keels, see the illustration above on the right.

1. East Indian brown mabuya, many-lined sun skink, common sun skink, many-striped skink = *kadal kebun* = *Eutropis multifasciata* (Kuhl, 1820) [synonyms *Mabuya multifasciata* (Kuhl, 1820), *Eutropis multifasciatus* Hecht et al., 2013)

The many-lined sun skink is distributed from India through southern China, Southeast Asia, and the Philippines. It also occurs in western Indonesia as far east as Sulawesi and Halmahera Island in the Moluccas. It has been described as having smooth scales. Its color is brown with a darker band on the side, and sometimes additional, narrow bands on the back. Close up, body scales can be seen to have three keels.

Female *Mabuya multifasciata* from Darmaga, West Java. © 2005 by W. A. Djatmiko. CC BY-SA 3.0 Unported.

2. rough-scaled brown skink, rough mabuya, rough mabuya skink, black-banded ground skink = *kadal serasah cokelat* = *Eutropis rudis* (Boulenger, 1887)

The rough-scaled brown skink is known from Sumatra, Borneo, Java, Sulawesi, the Sulu Islands of the Philippines, and the Nicobar Islands of India. It has been described as brown or olive brown with a dark brown, light-edged band on each side running from the tip of the nose to the base of the tail. Scales have three raised keels, giving the skink's body a rough appearance.

Rough-scaled brown skink (Eutropis rudis), Niah Caves NP, Sarawak, Malaysia. © 2007 by Bernard Dupont. CC BY-SA 2.0 Generic.

A consistent difference between the rough-scaled brown skink and the many-lined sun skink described above is that the former has only 28 to 32 midbody scale rows versus 30 to 34 rows in the latter.

3. *Eutropis macrophthalma* (Mausfeld & Böhme, 2002) [synonym *Eutropis grandis* (Howard, Gillespie, Riyanto & Iskandar, 2007)]

Eutropis macrophthalma was first described from two specimens that originated from the pet trade in Java (Mausfeld and Böhme 2002). After Howard et al. (2007) described *E. grandis* from Sulawesi, it was realized these were the same species and they were synonymized (Amarasinghe, Thammachoti, et al. 2018). This species thus appears to be indigenous to Sulawesi, assuming the two pet-trade 'Javan' specimens originally came from Sulawesi.

Eutropis macrophthalma from Bitung City, North Sulawesi, Indonesia. © 2014 by abizid via iNaturalist. CC BY-NC 4.0 International.

Eutropis macrophthalma from North Buton Regency, Southeast Sulawesi, Indonesia. © 2018 by Iman Akbar. CC BY-NC 4.0 International.

E. macrophthalma is similar in coloration to the preceding two species, including dorsal stripes and side bands. However it is somewhat distinguished by its slightly larger size and by the fact that it prefers forest habitats and is unlikely to be seen around human habitations:

> "Habitat ranged from undisturbed forest remote from human settlement to moderately disturbed forest near settled areas. … In contrast to *E. rudis* and *E. multifasciatus*, *E. grandis* was never detected in secondary

> forest, plantations or other human-made habitats. Adults of *E. grandis* were infrequently observed foraging or basking on the forest floor and on logs, usually in proximity to forest canopy gaps. They were highly alert, retreating rapidly if approached, and would readily climb trees to heights in excess of 5 m to evade capture" (Howard et al. 2007:607).

The way to securely identify this lizard would be to capture a specimen, confirm that scales have three keels, then do a scale count: *E. macrophthalma* has only 25 to 27 midbody scale rows, versus the 28 to 32 of *E. rudis* and the 30 to 34 of *E. multifasciata*.

4. rough-scaled sun skink, Nicobar Island skink, Nicobar sun skink, Sulawesi bronze bush skink = *Eutropis rugifera* (Stoliczka, 1870)

The rough-scaled sun skink is the smallest of Sulawesi's mabuya species, growing to only about 8 inches long. In its most distinctive color morph, it is dark brown in front shading to orangish brown in the rear, with broken yellow stripes running the length of the body (Baker and Lim 2008). However some individuals are plain brown in color, and the usual coloring is somewhere between these extremes (see additional pictures in Amarasinghe, Poyarkov, et al. 2017:107, 110). To confirm an identification one should examine the scales, which have five (or rarely seven) keels.

Male rough-scaled skink (Eutropis rugifera) from Niah Caves NP, Sarawak, Malaysia.

This skink garnered the name Nicobar Island skink because the first description was based on a specimen collected there. Later it was realized that specimens collected from Thailand, peninsular Malaysia, Sumatra, Borneo, Java, Bali, and the Philippines were also this species. Barley, Datta-Roy, et al. (2014:8, 9) refer to specimens collected on Sulawesi, without giving a more specific locality.

5. many-keeled mabuya = *Eutropis multicarinata* (Gray, 1845)

Many-keeled mabuyas inhabit the Philippines and the Palawan Islands, and have also been confirmed from the Talaud Islands. Reports of their occurrence in northern Sulawesi require confirmation (Koch 2012:213). These skinks are characterized by having scales with multiple keels (see illustration above).

Eutropis multicarinata borealis from mid-elevation, Mt. Cagua, Luzon Island, Philippines.

However, what was originally thought to be a single species (*E. multicarinata*) has recently been recognized to be a species complex in which several subspecies have been elevated to species status; in addition several new species have been recognized in the smaller-statured *E. indeprensa* complex (specimens of these lizards were at one time thought to be juvenile *E. multicarinata*) (Barley, Desmos, et al. 2020). Once the dust has settled from these major taxonomic revisions to Philippine mabuyas, we may well find out that the many-keeled mabuyas of the Talaud Islands (and northern Sulawesi, if they occur there) are in fact not *E. multicarinata* but rather one or another closely related species.

Other skinks

6. emerald tree skink, green tree skink, emerald green skink = *kadal hijau sulawesi*, *kadal pohon hijau* = *Lamprolepis smaragdina* (Lesson, 1830)

The first time I saw a skink in Indonesia, I was sitting on the front porch of a house and noticed a bright green lizard making its way down the trunk of a nearby tree. As I approached to take a closer look, it saw me and retreated back up the tree.

I'm sure the lizard was an emerald tree skink. This skink is recognizable from its bright green color and relatively large size: individuals can grow to ten inches long (body 4 inches, tail 6 inches).

There is also a color variant in which the skin is mottled brown and silver, while some individuals are green in front and brown/silver in back. As its green color would suggest,

the emerald tree skink is arboreal. Reportedly they may even have a preferred tree where the same individual can be seen from day to day.

Male *Lamprolepis* cf. *smaragdina*, from Lautém District, East Timor.

The emerald tree skink is distributed from New Guinea as far west as Lombok and Sulawesi. It does not occur west of the Wallace Line. The English common name 'green tree skink' as well as the related *kadal pohon hijau* should probably be avoided as both of these expressions can refer to other skink species.

7. Pacific bluetail skink = *kadal ekor biru* = *Emoia caeruleocauda* (De Vis, 1892)

Juveniles of the Pacific bluetail skink have black and yellow to cream colored stripes along the body but their most distinguishing feature is the vibrant blue tail. As the lizards mature the tail turns brown and eventually even the stripes fade into the grey-brown body of adulthood. If there is a local word for a lizard with a blue tail—for example Pamona *tologana* (Das 1993:129), Padoe *bonggi-bonggilo* (Lara et al. 1991:10) and Luwu'-Rongkong *baccilo* (Vail 1991:7)—it is almost certainly this species.

Pacific bluetail skink (*Emoia caeruleocauda*), Manado, North Sulawesi.

The Pacific bluetail skink is widespread from Indonesia to New Guinea and various Pacific island groups. Bluetail skinks of Sulawesi have sometimes been misidentified as the very similar *Emoia cyanura* (Lesson, 1830), a species which does not occur here.

8. redtail emo skink, red-tailed swamp skink = *kadal ekor merah* = *Emoia ruficauda* (Taylor, 1915)

The redtail emo skink is a small lizard with a body length (snout to vent) of just over 2 inches, with black and yellow body stripes and a striking red tail. It was thought to be endemic to the island of Mindanao in the Philippines. However this species, or something very close to it, was also recently observed on Banggai Island (Koch 2012:205, photograph on page 159). If people where you work know about a red-tailed lizard, it would be worth following up.

Emoia ruficauda in Kiamba, Sarangani, Philippines. © 2020 by kier5147 via iNaturalist. CC BY-NC 4.0 International.

9. mangrove skink, littoral skink, littoral whiptail-skink = *kadal pantai* = *Emoia atrocostata* (Lesson, 1826)

The mangrove skink is mostly gray or gray-brown with a faint black band along the side of the body. The throat has been described as bluish, while the belly can range in color from greenish to yellow or orange. Scales on the back are not keeled. This skink is notable from its habitat: you are most likely to encounter it in vegetation near beaches, along rocky coastlines, and in mangrove forests. It is semiaquatic and can even be found hunting in tidal pools.

Mangrove skink (*Emoia atrocostata*), Sarawak, Malaysia. © 2012 by Bernard Dupont. CC BY-SA 2.0 Generic.

The mangrove skink is widely distributed throughout Indonesia. It ranges from Vietnam to several Pacific island chains.

10. Sulawesi water skink, Sulawesi spiny water skink = *kadal duri sulawesi*, *kadal salak sulawesi* = *Tropidophorus baconi* (Hikida, Riyanto & Ota, 2003)

Members of genus *Tropidophorus* are known as water skinks or waterside skinks because of their semiaquatic habit. They may be observed on rocks near or in the middle of streams, or even partly submerged.

Tropidophorus baconi, location not specified. © 2019 by Fatahabib92 via iNaturalist. CC BY-NC 4.0 International.

In the early twentieth century the Sulawesi water skink was assigned to *T. grayi* (Günther, 1861) of the Philippines, until it was recently recognized as its own (albeit closely related) species (Hikida et al. 2003). Both the Philippine and Sulawesi species are dark colored with strongly keeled scales that are raised at the tips, giving the lizards a rough feel somewhat comparable to that of a snakeskin fruit (*buah salak*). They are relatively large skinks that can grow from eight to eleven inches long.

The Sulawesi water skink is also referred to as *T. apulus* in the pet trade industry (a misspelling of *T. aphilus*), but both names are incorrect. At present *T. baconi* has been recorded from the southern and central parts of the island (see distribution map in Hikida et al. 2003:30). Its close cousin, the spiny water skink of the Philippines, has been described as ‘common’ but ‘secretive,’ that is, rarely seen, and the same may be true of the Sulawesi spiny water skink.

11. bar-lipped sheen skink, brown sheen skink = *Eugongylus rufescens* (Shaw, 1802)

The bar-lipped sheen skink may be Sulawesi’s largest skink—if indeed it occurs here.

This skink grows up to 15 inches long (body 6 inches, tail 9 inches). The body is brown, with an iridescent sheen in bright light. On the lips are several dark vertical bands against a lighter background. This skink is active at night, and is said to scurry about with a sinuous, snake-like motion.

Bar-lipped sheen skink (*Eugongylus rufescens*). © 2018 by congonaturalist via iNaturalist. CC BY-NC 4.0 International.

Bar-lipped sheen skink (*Eugongylus rufescens*), Pityiliu Island, Manus Province, Papua New Guinea. © 2010 by J. Q. Richardson. CC BY-NC 4.0 International.

The bar-lipped sheen skink is known from the Moluccas through New Guinea, Australia, and the Admiralty and Solomon Islands. It is also reported for the Talaud Islands and northern Sulawesi. However it was not encountered during a recent herpetological expedition to the Talaud Archipelago (Koch, Arida, Riyanto and Böhme 2009:146), and records from northern Sulawesi also require confirmation (Koch 2012:209). No other *Eugongylus* skink—commonly called mastiff skinks or short-legged giant skinks because of their size—is reported for Sulawesi.

Cultural notes

In the days when the Pamona used to break off and grind down young people's teeth as a rite of passage, the stumps would be blackened by having the initiates chew on leaves of the *sakoti* plant followed by application of soot obtained from coconut shells (*uka*). During this time the young person was forbidden to laugh, "because if the tree skink (*wuloa*) saw this laughter, he would think that he was being laughed at, and then the black would not stick to the teeth" (Adriani and Kruyt 1950–1951 II:441, English translation).

Moslems in Central Sulawesi told the story that one time when Muhammad was being pursued, lizards covered up the prophet's tracks with their bodies so that his enemies lost his trail. For this reason they held skinks (*wuloa*) in high esteem, and believed a person would be punished in the hereafter for killing one (Adriani and Kruyt 1912–1914, I:310–311).

The Behoa people of Central Sulawesi discarded baby teeth in the bush “for the skinks (*buleli*’) to use” (Kruyt 1918–1920 II:111).

A kind of large skink in the Pamona area, called *wuloa gata*, is known for making a strong rasping sound (Dutch *sterk blazen*). The expression *mo’inosa mpowuloa gata*—literally to have the breath of this kind of lizard—means to respond or act in haste (Adriani 1928:961; Tiladuru 2017:342).

In Pamona, to have ‘a skink in the belly’ (*wuloa ri komponya*) is a euphemism for being pregnant (Tiladuru 2017:342).

Hard-shelled turtles

For years it was thought that Sulawesi was home to only two turtle species. However a new species, endemic to northern and central Sulawesi, was described for the first time in 1995. It is also recognized that the red-eared slider, introduced through the pet trade, has become established in Sulawesi, bringing the total to four hard-shelled turtle species on Sulawesi. These four species can easily be distinguished from each other by coloration of the shell and head.

1. Southeast Asian box turtle, Amboina box turtle = *kura-kura batok* = *Cuora amboinensis* (Daudin, 1802)

The Southeast Asian box turtle has a rather plain shell (carapace), described as blackish brown to olive brown. Identifying characteristics include the three yellow stripes on its head and black blotches on its underside (plastron). It is semi-aquatic and prefers standing water including man-made habitats such as backyard ponds, drainage ditches, and rice paddies.

Amboina box turtle at Kuala Lumpur Butterfly Park.

Plastron of male *Cuora amboinensis kamaroma*. © 2007(?) by Torsten Blanck. CC BY-SA 3.0 Unported.

The Southeast Asian box turtle is distributed from eastern India through Southeast Asia, the Philippines and most of Indonesia. The subspecies found in the Philippines, Sulawesi and the Moluccas is *Cuora amboinensis amboinensis* (Daudin, 1802). This subspecies is sometimes specifically referred to as the Wallacean box turtle, the East Indian box turtle, or the Sulawesi lowland box turtle.

2. Forsten's tortoise, Sulawesi tortoise, Celebes tortoise = *kura-kura sulawesi, kura-kura forsteni, kura-kura darat forsteni = Indotestudo forstenii* (Schlegel & Müller, 1845)

Forsten's turtle is rare. It has been reported from the island of Halmahera in the Moluccas and from limited locations in central and northern Sulawesi;[10] It prefers moist forest habitats and is most active during morning and evening twilight hours. Its shell, somewhat elongated, is cream to yellow or yellow brown (a common description is 'caramel colored') with distinct large black blotches on all segments (scutes). There are also often small dark spots or streaks on the crown of the head.

Indotestudo forstenii in the wild. Photo Credit: Sulawesi Chelonian Conservation /Christine Light. Used with permission.

Forsten's tortoise is rated as Critically Endangered on the IUCN Red List of Threatened Species, but continues to be excessively collected for the pet trade industry.

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[10] From Morowali Nature Reserve; from the Palu and Kulawi valleys and as far south as the village of Gimpu; from the Tolitoli and Buol areas of Central Sulawesi province; and from adjoining areas of Gorontalo province (Mardiastuti 2008; Ives et al. 2008; Riyanto et al. 2008).

3. Sulawesi forest turtle = *kura-kura hutan sulawesi*, *kura-kura paruh betet* = *Leucocephalon yuwonoi* (McCord, Iverson & Boeadi, 1995)

The Sulawesi forest turtle has an orange-brown shell that is ridged along its crest, and distinctive brown and white coloration about the head with some sexual dimorphism: the heads of mature males tend to be more white than brown, and conversely for females.[11] The underpart of the shell (plastron) is not hinged. The Indonesian name *kura-kura paruh betet* refers to the upper jaw which is strongly hooked in males, less so in females. Turtles are active at night; they prefer heavy vegetation near clear running water.

Sulawesi forest turtle (*Leucocephalon yuwonoi*). Photo credit: Turtle Conservancy/Maximilian Maurer. Used with permission.

This species first came to the attention of researchers via the animal trade industry. In the early 1990s was it determined—with the help of a trader in Jakarta—that specimens originated from Sulawesi. The Sulawesi forest turtle is known only from Gorontalo province and portions of Central Sulawesi province including the Palu and Poso riversheds (see distribution map in Hagen et al. 2009:3).

The Sulawesi forest turtle is rare and considered one of the twenty-five most endangered turtles worldwide. Despite being banned from international trade, it continues to be illegally exported to China and Europe. It has proved difficult to breed in captivity.

4. red-eared slider, red-eared terrapin = *kura-kura brazil*, *kura-kura brasil*, *kura-kura telinga merah*, *kura-kura slider* = *Trachemys scripta elegans* (Wied-Neuwied, 1839)

The red-eared slider is a popular species in the turtle pet trade industry. Due to release of pets into the wild, these turtles have become established in various parts of Indonesia including Sumatra, Java, Kalimantan, Papua, and even Sulawesi.

[11] The generic epithet *Leucocephalon* is compounded from Greek *λευκός* (leukos) 'white' + *κεφαλή* (kephalē) 'head.'

Red-eared slider (*Trachemys scripta elegans*).

The red-eared slider is a medium-sized turtle. Its shell can be up to a foot long. It is recognizable from the red patches (less commonly yellow) on the sides of its head. It is semiaquatic and prefers to stay near water except when searching for new territory or a place to lay eggs.

The red-eared slider has been confirmed for Sulawesi by specimens found in markets in Makassar and Palu. These specimens had been captured by farmers in rice paddies (Platt, Lee, et al. 2001).

Soft-shelled turtles

Softshell turtles (also soft-shelled turtles, Indonesian *labi-labi*, *kura-kura berpunggung lunak*) are known for their shells that are flexible and leathery, particularly around the edges. They are also recognizable from their three-toed feet and their peculiar, elongated snouts (useful for breathing while the rest of the body is submerged).

Softshell turtles have a nearly worldwide distribution, but they are rare on Sulawesi—in fact until a few years ago were assumed to be absent. If you come across a softshell turtle in the wild on Sulawesi it could be an exciting find—and worth documenting with photographic evidence.

1. Asiatic softshell turtle, Southeast Asian softshell turtle = *bulus* = *Amyda cartilaginea* (Boddaert, 1770)

The Asiatic softshell turtle or *bulus* is a well-known species from western Indonesia (Sumatra, Borneo, Java, Bali), and further west as far as Bangladesh. It is an aquatic species that prefers still, freshwater habitats. Juveniles have brown or black shells and

yellow dots, but these distinctive characteristics fade into the drab greenish brown coloration of adulthood. Adults can grow to more than fifty pounds.

Juvenile *Amyda cartilaginea* from Borneo. © 2009 by Wibowo Djatmiko. CC BY-SA 3.0 Unported.

Adult *Amyda cartilaginea* near Bengkuku, Sumatra. © 2018 by Deni Parlindungan. CC BY-NC 4.0 International.

In the early 2000s a breeding population of the Asiatic softshell turtle was verified in a pond near the Central Sulawesi town of Palopo—where adult turtles were regularly being harvested for human consumption—while several other individuals were located in the possession of a reptile trader in Palu (Koch, Ives, et al. 2008). It is possible this turtle has also been introduced by human agency into other places around Sulawesi: the Lindu and Poso lakes of Central Sulawesi and the Aopa swamp of Southeast Sulawesi have all been mentioned as possibilities.

2. *Pelochelys* sp.

Pelochelys is a genus of giant softshell turtles (Indonesian *labi-labi raksasa*). In Indonesia it is represented by three species: *P. cantorii* west of the Wallace Line (but not in Java; also the Philippines and as far west as India), and by *P. signifera* and *P. bibroni*, from respectively the northern and southern lowlands of New Guinea. Individuals from all three species have been known to grow over three feet long and weigh more than two hundred pounds. They prefer the slow-moving water of major lowland rivers.

Cantor's giant softshell turtle *Pelochelys cantorii*.

Based on fossil[12] and other evidence, Samedi and Iskandar (2000) and others have speculated that giant softshell turtles might occur on Sulawesi. There is also a *Pelochelys* specimen that turned up at a market in the city of Makassar (as communicated by Anders Rhodin, reported in Webb 2002). It is exciting to think that the specimen Rhodin encountered could have come from a hitherto overlooked population in the wild—perhaps even a new species—that would help fill in the distributional gap of giant softshell turtles between Borneo and New Guinea. However it is also possible that the Makassar specimen had been brought to market from outside of Sulawesi (Hoser 2014:61). The hunt for giant softshell turtles on Sulawesi is still on.

Sea turtles

Five species of sea turtles ply the waters off the coast of Sulawesi and its nearby islands. These are the green sea turtle, the hawksbill sea turtle, the loggerhead sea turtle, the Pacific ridley sea turtle, and the leatherback sea turtle. Perhaps because sea turtles are flagship species in marine conservation efforts, there is no shortage of information on the internet regarding how to identify sea turtles by species. This identification generally hinges on the pattern of scales (scutes) on the top part of the shell (carapace), underside (plastron), and head. If the following pictures and small amount of information are insufficient, you should consult a print or online guide.

1. green sea turtle = *penyu hijau* = *Chelonia mydas* (Linnaeus, 1758)

The green sea turtle has four large scutes along the side of its carapace. Between its eyes and above the beak, it has one pair of prefrontal scales on its snout.

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[12] "Fossil, presumed late Pliocene, trionychid material from Cabenge, Soppeng District, Southwest Sulawesi, ca. 115 km northeast of Makassar had been reported by Hooijer (1954, 1958), which was cited by Whitten et al. (2002) as "*Chitra ?indica*". According to Webb and van Dijk (2004), however, these fossil remains are consistent with *Pelochelys* although an exact determination is impossible" (Koch, Ives, et al. 2008:124).

2. hawksbill turtle = *penyu berparuh elang* = *Eretmochelys imbricata* (Linnaeus, 1766)

Like the green sea turtle, the hawksbill sea turtle has four large scutes along the side of its carapace. Between its eyes and above the beak, it has *two* pairs of prefrontal scales on its snout.

3. loggerhead sea turtle = *penyu sisik semu* = *Caretta caretta* (Linnaeus, 1758)

The loggerhead sea turtle has five (sometimes six) scutes along the side of its carapace. The first scute is smaller than the others.

4. Pacific ridley sea turtle, olive ridley sea turtle = *penyu lekang* = *Lepidochelys olivacea* (Eschscholtz, 1829)

The Pacific ridley sea turtle usually has six or more scutes along the side of its carapace. The specific epithet *olivacea* refers to its drab olive color. The Pacific ridley is the smallest of Indonesian sea turtles, growing to only about two feet in carapace length.

NOAA Fisheries.

5. leatherback sea turtle = *katung*, *penyu berpunggung belulang* = *Dermochelys coriacea* (Vandelli, 1761)

The leatherback sea turtle is easily identified by its lack of body scutes—rather its carapace is flexible (leathery) with five ridges running the length of the body.

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