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# A NEW SPECIES OF WATER SNAKE GENUS *HYPSISCOPUS* (SERPENTES: HOMALOPSIDAE) FROM SULAWESI, INDONESIA

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## ABSTRACT

We describe a new species of water snake genus *Hypsiscopus* that was formerly placed in the genus *Enhydris* from Towuti Lake, South Sulawesi, based on six specimens collected in 2003 and a specimen collected in 2019. The new species has several significant differences from other species in the genus *Hypsiscopus* (*H. matannensis*, *H. plumbea,* and *H. murphyi*) in possessing laterally compressed tail, higher number of scale rows in mid body, higher number of ventral scales, lower number of subcaudal scales, and distinct color pattern. The new species is likely distributed only in the Towuti Lake, and has higher level endemicity compared to *H. matannensis*. Further studies on the population and distribution are needed to evaluate its conservation status.

**Key words**: *Hypsiscopus,* Lake Towuti, new species, Sulawesi, water snakes

## INTRODUCTION

The family Homalopsidae (water snakes) have been generally recognized as a valid monophyletic group (Bernstein et al., 2021; Fukuyama et al., 2022) and consisted of 29 genera and 57 described species (Uetz et al., 2023). Formerly, most species of the homalopsid snakes belonged to the genus *Enhydris* Sonnini & Latreille, and further the genus was divided into 15 genera by Murphy and Voris (2014). One of the divided genera is *Hypsiscopus* Fitzinger. *Hypsiscopus* is characterized by possessing several morphological characters: absence of rostral appendages, most ventral scales wider than dorsal scales, nasals in contact, smooth dorsal scales, first upper labial not in contact with loreal, scales at mid-body are 19-21 rows, and uniform dorsal pattern (Murphy & Voris, 2014). Three species are listed in this genus, *H. plumbea* (Boie, 1827), *H. matannensis* (Boulenger, 1827), and *H. murphyi* (Bernstein et al., 2022). The *H. murphyi* is widely distributed in Indochina, *H. plumbea* occurs in from Indochina, southern part of Thailand, Malay Peninsula, Greater Sunda Islands to Sulawesi (Bernstein et al., 2022)

and *H. matannensis* is restricted to South and Southeast Sulawesi (Iskandar, 1979; De Lang & Vogel, 2005), and according to recent information its distribution includes eastern and northern peninsular of Sulawesi (Bernstein et al., 2022). The molecular studies recognized these three species are nested in a monophyletic group together with the unnamed species from Towuti Lake (Sulawesi) (Alfaro et al., 2008; Bernstein et al., 2021; Fukuyama et al., 2022).

The population of the unnamed species was first mentioned in De Lang & Vogel (2005) as a paddle-tailed water snake from Lake of Towuti that possibly a new taxon (Iskandar, *pers. comm.*) and followed by several molecular studies that revealed the unnamed species in its phylogenetic position within genus *Hypsiscopus* (Bernstein et al., 2021; Fukuyama et al., 2022). We examined additional specimens of *Hypsiscopus* available, and based on the distinct several morphological characters, here we describe *Hypsiscopus* sp. from Lake Towuti as a new species.

## MATERIALS AND METHODS

We examined seven specimens of *Hypsiscopus* sp. from Lake Towuti, South Sulawesi Province and compared these specimens to specimens of *Hypsiscopus plumbea* and *H. matannensis* (see Appendix 1). The specimens were collected using net and tweezers during the study of freshwater biota in Lake Towuti. The record of scale terminology and measurements are modified from Murphy et al. (2005) and are presented in Table 1. Measurements of the head were made with calipers to the nearest 0.1 mm. A string was used to determine the snout-vent length (SVL = from the tip of the snout to the posterior margin of the anal plate) and the tail length (TL = from the posterior edge of the cloacal plate to the tip of the tail). The following head measurements were recorded: dorsal distance among jaw angel (HW) and distance from tip of snout to angle of jaw (HL). Color descriptions of the new species are based on the examination of alcohol-preserved specimens. Sex is determined by carefully dissecting on the tail base with one longitudinal cut, on one side only to see a hemipenis and the muscles that belong to it. We followed Savage (1973) in determining loreal character and followed Dowling (1951) in counting ventral scales and determining first dorsal scale row in the neck. All specimens are deposited at the Museum Zoologicum Bogoriense (MZB), Research Center for Biosystematics and Evolution, National Research and Innovation Agency of Indonesia (BRIN).

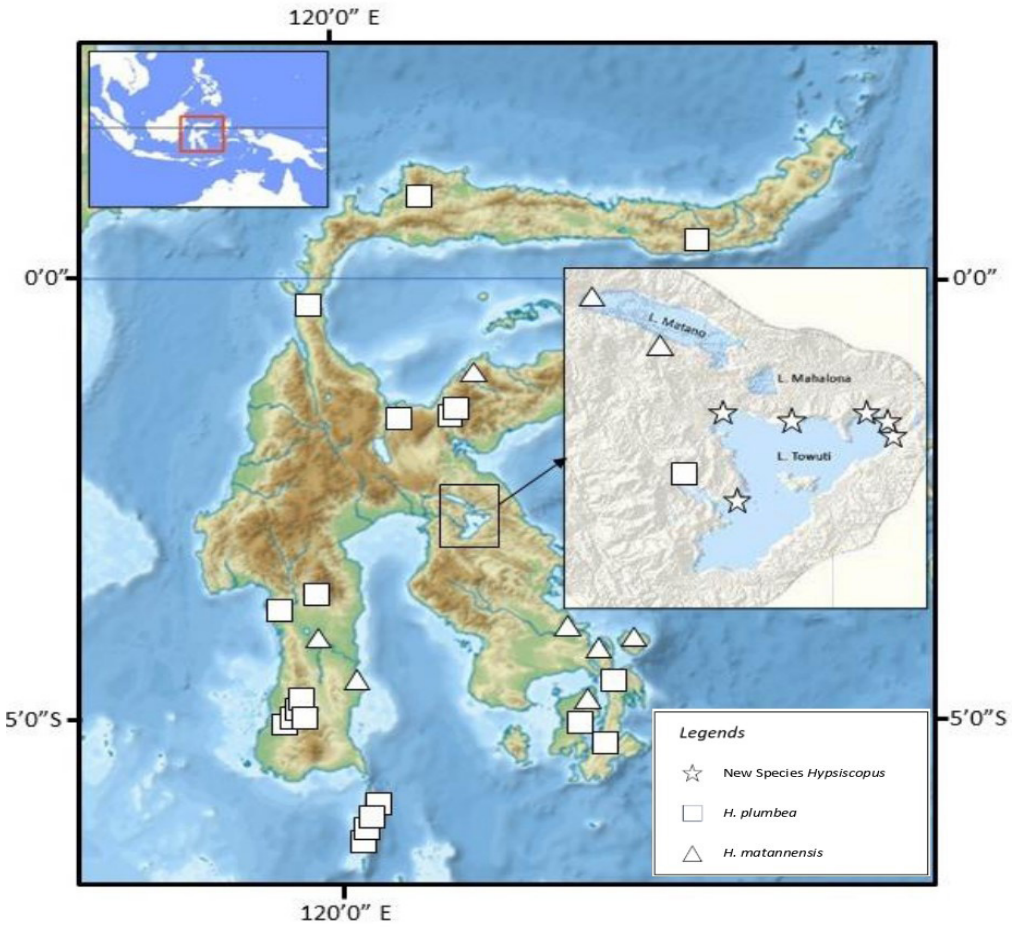


**Figure 1.** Maps represent locality of the new species of *Hypsiscopus* from Towuti Lake (indicated by star), *H. matannensis* (triangle), *H. plumbea* (square). Figure modified from Google Earth and Sirimorok & Rusdianto (2020)

## RESULTS

Morphological analyses from meristic characters produced distinct characters from other species of *Hypsiscopus* (Table 1). Based on these morphological results, we conclude that the specimens collected from Towuti Lake represent a new, distinct species, which we describe below:

### Systematics

***Hypsiscopus indonesiensis* sp. nov.**

**Synonymy:**

"Paddle-tailed water snake from Lake of Towuti.": De Lang and Vogel, 2005: 53.

"Lake Towuti Sulawesi": Alfaro et al. 2008: 578 (Table 1), 579, 580 (Table 2), 583, 587.

*Hypsiscopus* sp.: Bernstein et al., 2021: 2, 4 (Fig. 1), 5 (Fig. 2), 7 (Fig. 3), 9, 10.

*Hypsiscopus* sp. "Lake Towuti": Fukuyama et al., 2022: 753 (Fig. 1).

**Holotype.** MZB Oph 3561 (male) collected by Bhakti Nugraha on 20th April 2003 from Lengkona Bay, Towuti Lake, South Sulawesi.

**Paratypes.** MZB Oph 3560 (female) collected on 20th April 2003 from Lengkona Bay, Towuti Lake, South Sulawesi; MZB Oph 3558 (female) collected on 20th April 2003 from Lengkona Bay, Towuti Lake, South Sulawesi; MZB Oph 3557 (female) collected on 21th April 2003 from Tominanga Bay, Towuti Lake, South Sulawesi; MZB Oph 3559 (female) collected on 21th April 2003 from Bakara Gulf, Towuti Lake, South Sulawesi. All these specimens were collected by Bhakti Nugraha. MZB Oph 6350 (male) collected in 18th October 2019 by Ayu S. Nurinsiyah and Ristiyanti M. Marwoto from Hola-hola, Towuti Lake, South Sulawesi Province (02°48'13.33" S 121°27'33.38" E, with elevation 321 above sea level).


**Figure 2**. Dorsal view of male holotype of *Hypsiscopus indonesiensis* **sp. nov.** (MZB Oph 3561)


**Figure 3**. Ventral view of holotype of *Hypsiscopus indonesiensis* **sp. nov.** (MZB Oph 3561)

**Figure 4.** Lateral view of holotype of *Hypsiscopus indonesiensis* **sp. nov.** (MZB Oph 3561)

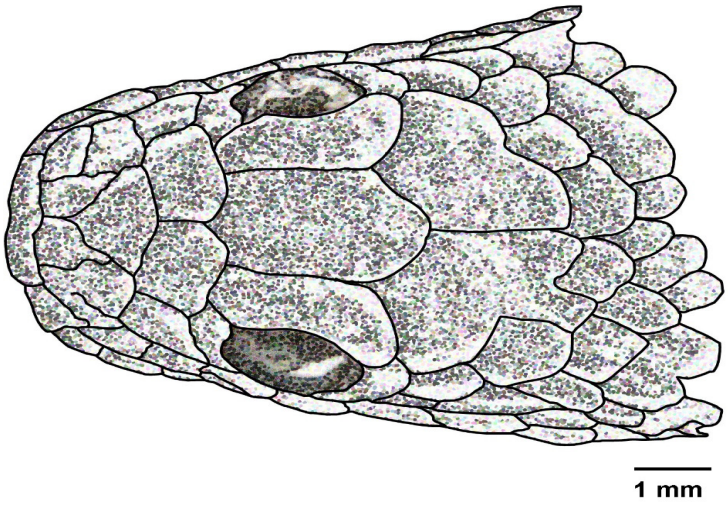


**Figure 5.** Dorsal view head of holotype of *Hypsiscopus indonesiensis* **sp. nov.** (MZB Oph 3561)

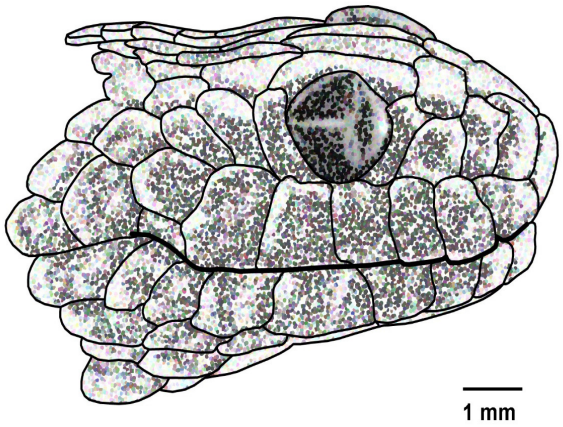


**Figure 6.** Lateral view head of holotype of *Hypsiscopus indonesiensis* sp. nov. (MZB Oph 3561)

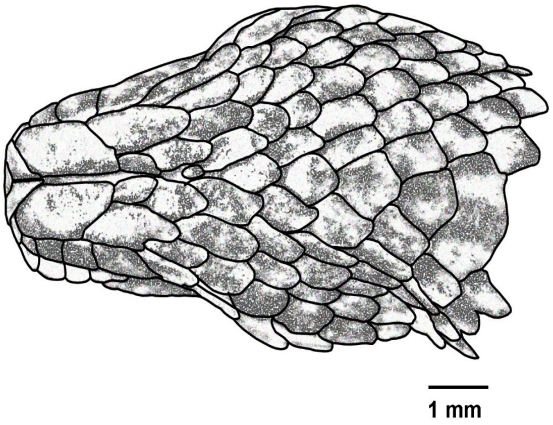


**Figure 7.** Ventral view head of holotype of *Hypsiscopus indonesiensis* **sp. nov.** (MZB Oph 3561).

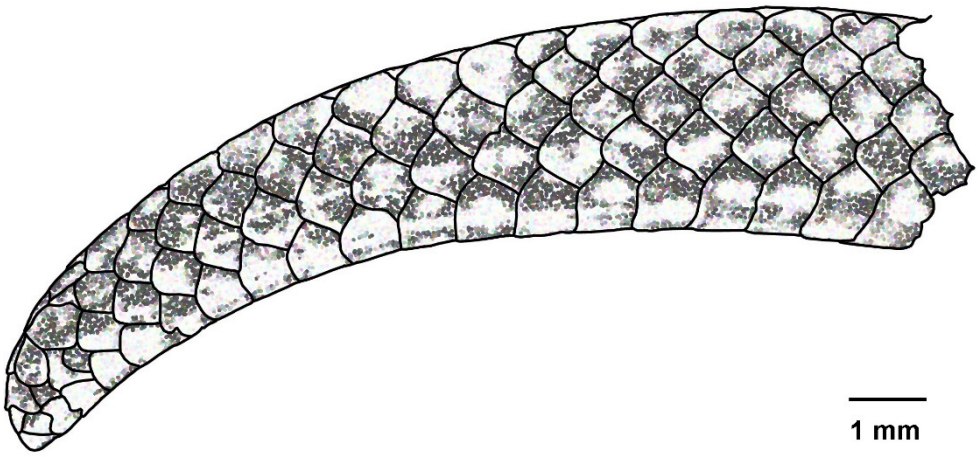


**Figure 8.** Lateral view of compressed tail of holotype of *Hypsiscopus indonesiensis* **sp. nov.** (MZB Oph 3561)

**Figure 9.** Dorsal view of head of male paratype *Hypsiscopus indonesiensis* **sp. nov.** (MZB Oph 6350) (scale 10 mm). Photograph by Farits Alhadi

**Figure 10.** Ventral view of head of male paratype *Hypsiscopus indonesiensis* **sp. nov.** (MZB Oph 6350) (scale 10 mm). Photograph by Farits Alhadi

**Figure 11.** Lateral view of head of male paratype *Hypsiscopus indonesiensis* **sp. nov.** (MZB Oph 6350) (scale 10 mm). Photograph by Farits Alhadi

**Figure 12**. Dorsal view of body of male paratype *Hypsiscopus indonesiensis* **sp. nov.** (MZB Oph 6350) (scale 10 mm). Photograph by Farits Alhadi.

**Figure 13.** Ventral view of body male paratype *Hypsiscopus indonesiensis* **sp. nov.** (MZB Oph 6350) (scale 10 mm). Photograph by Farits Alhadi.

**Figure 14.** Ventral view of tail of male paratype *Hypsiscopus indonesiensis* **sp. nov.** (MZB Oph 6350) (scale 10 mm). Photograph by Farits Alhadi

***Etymology.*** The specific epithet is the name of the country where the new species was found.

***Diagnosis.*** The new species is assigned to the genus *Hypsiscopus* based on possession of several morphological characters, small body size (SVL <700 mm), internasal(s) do not contact loreal, upper labials 2–3 or 2–4 usually contact with loreal, lower labials 1–5 usually contact the anterior chin shields, relatively short tails (10–17 % of SVL) (Murphy & Voris, 2014) and molecularly nested in the genus *Hypsiscopus* (Bernstein et al., 2021; Fukuyama et al., 2022). *Hypsiscopus indonesiensis* **sp. nov.** is diagnosable from all congeners by having laterally compressed tail, high number of scale rows (24–25 in the neck, 25–27 in the mid body, 20–22 in near the vent),

high number of ventral scales (152–159), blotched pattern on the dorsum and mottled pattern on the ventrum.

***Description of Holotype.*** A small size of water snake with a head that is distinct from the neck, and laterally compressed tail. Body (SVL) 450 mm and Tail Length 65 mm (see Table 1). Rostral pentagonal, mental single triangular, nasal cleft extending from nostril to 1st upper labial and internasal (right side), rostral and internasal (left side). Internasal single triangular, not in the contact with the rostral, and surrounded by nasals and prefrontals. Nasals in a pair meet each other in median and separate internasal to rostral. Loreal scale single, wider than height, in contact with 2nd&3rd upper labials, prefrontals and preocular. Pre-, post- and supra-ocular are single, pre- and postocular are higher than width, and supraocular longer than width. Prefrontal scales paired in contact with frontal, supraocular, preocular, loreal, nasal and internasal. Frontal single enlarge, with length is shorter than distance of interorbital. Parietal is a paired and not longer than frontal. Anterior chin shields in a pair meet each other in metal grove and contact with first five lower labials (right side) and first four labials (left side). Posterior chin shields in a pair and very distinct, not larger than anterior chin shields, does not meet each other in metal grove, and in contact with 5th&6th lower labials (right side) and 4th&5th lower labials (left side). Gular scales counts are 8, including single small accessory scale that present in metal grove. Preventral scales are 3, present between gular and 1st ventral scale. Upper labial scales are 8, in posterior undivided, 4th and 5th upper labials in contact with eye. Lower labial scales are 10 (right side) and 9 (left side). Temporal scales enlarge and plate-like. Ventral scales are 159, anal scale is divided and subcaudal scales 41 pairs. Scales are smooth, and few scales at ventral of the head are tuberculate. Dorsal scale rows in the neck 24, in the mid body 25 and in near the vent 19.

***Coloration.*** Color in preserved specimen: dorsum grey-brown with black blotch in irregular pattern. Lateral of head are bark brown with indistinct white pale in every single scale, particularly in upper labials and lower labials. Distinct blotch begins occurred in the neck and intensively in dorsum mid body and caudal. Ventral scales are dark brown with two or three white pales in irregular position, posterior of ventral darker than anterior. The subcaudal scales in anterior and posterior are dark brown with consistent inconspicuous pale coloration.

The coloration in life and preserved specimen are not much different. The dorsal color is grey or dark brown with distinctive blotch irregular pattern along the body, this pattern sometimes in regular that caused rings pattern that may be incomplete dorsally or laterally. There is no pattern in dorsal of the head, the color is dark grayish brown. Lateral of the head is inconspicuous brown or grey, combined by white marking in posterior or central most of every single scale. Lower labials are grey or dark brown with inconspicuous pale color in central and posterior scales. Posterior of upper labial are pale brown. Upper labials are white pale. Lower side of head with similar pattern as lateral side, or brighter than dorsal with numerous

combinations of brown, gray and white pale in every single scale. Brown streaks extend from 1st to 3rd of ventral and divided into some inconspicuous brown streaks in further ventrals. Ventrals are heavily white paled that occurred in every single of ventral, combined by brown and gray background. Base of tail is dark brown with white pales.

***Variation.*** The largest specimen measured was female with SVL 625 mm and tail length 80 mm, and the smallest is male specimen with total length 288 mm and tail length 45 mm. Variation of scales in the head: MZB Oph 3558 (female) has internasals in paired, while all other specimens are single internasal. Nasal cleft extending from nostril to inter nasal and 1st upper labial in both sides, but for the holotype (MZB Oph 3561) this nasal cleft extending from nostril to 1st upper labial and internasal (right side), rostral and inter nasal (left side). Preocular in holotype (MZB Oph 3561); MZB Oph 3557and MZB Oph 3559 are single in both sides, but MZB Oph 3560 and MZB Oph 3558 are double, in at least one side. Postocular varied in three categories; single in both side (holotype MZB Oph 3561 and MZb Oph 3557), double in at least one side (MZB Oph 3558 and MZB Oph 3559), and double in both side (MZB Oph 3560). Gular scales varied between 7-8, while preventral scales 3-4. Upper labials are similar in all specimens, either in total sum (8 scales) or number in contact to eye (4th&5th upper labials). Lower labial scales varied in both sides, among 9 and 10; 10 and 10; 10 and 11. Scale rows at neck 24 (male) and 27 (female), scale rows at mid body 25 to 27 (no differences in sex), and scale rows near vent 19 (male) and 21 (female). Ventral scales in male 159 (holotype MZB Oph 3561 and paratype MZB Oph 6350), while in female 152—156. Subcaudal scales are 39—41 pairs in males (holotype MZB Oph 3561 and paratype MZB Oph 6350), and 36—37 pairs in females. Sum of ventral scales and subcaudal scales show differences in sex. Coloration pattern in male and female of *Hypsiscopus indonesiensis* **sp. nov.** is mostly similar, however they are different in scale counts of subcaudal and ventral (Table 1).

***Comparison.*** *Hypsiscopus indonesiensis* **sp. nov.** is distinguished from *H. plumbea H. matannensis,* and *H. murphyi* in having distinct blotch pattern on the dorsum, conspicuous combination of white pale markings, brown and dark gray in lateral and ventral side (vs patternless/uniform in *H. matannensis*, *H. plumbea,* and *H. murphyi*). *Hypsiscopus indonesiensis* **sp. nov.** also has compressed tail while the other *Hypsiscopus* have cylindrical tail. The new species also has higher scale rows at mid body (25—27 vs 21—23 in *H. matannensis*, 19 in *H. plumbea* and *H. murphyi*) and higher ventral scale counts (152—159 vs 122—143 in *H. matannensis*, 116—133 in *H. plumbea,* 122—136 in *H. murphyi*). In addition, *Hypsiscopus indonesiensis* **sp. nov.** has differences ventral and subcaudal scales in sex (males have higher scale account than females) while *H. matannensis* and *H. plumbea* are not significant different in sex between male and female.

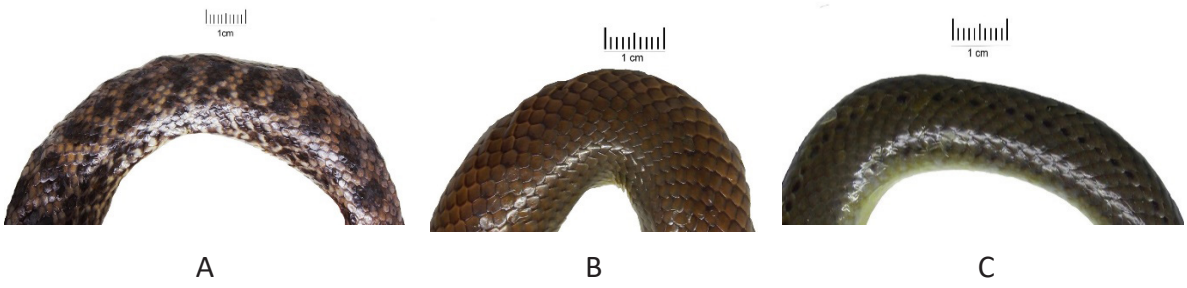


**Figure 15**. Comparison of dorsal color pattern: A. *Hypsiscopus indonesiensis* **sp. nov.**, B. *Hypsiscopus matannensis,* C. *Hypsiscopus plumbea*

The differences of scale accounts and other characters between these three species and *Hypsiscopus* new species present in Table 1.

**Tabel 1.** Comparison of morphological characters of *Hypsiscopus indonesiensis* **sp. nov.** with *H. matannensis*, *H. plumbea* and *H. murphyi.*

| Species | *H. indonesiensis* **sp. nov** | *H. matannensis* | *H. plumbea* | *H. murphyi* (Bernstein et al., 2022) |
|---|---|---|---|---|
| Characters | n = 7 (♂ = 2; ♀ = 5) | n = 13 (♂ = 8; ♀ = 5) | n = 22 (♂ = 12; ♀ = 10) | Holotype ♂(1), Paratypes ♀=17, ♂=5, Unsexed=5 |
| SVL males (mm) | 288 mm and 450 mm | 370–640 mm | 202–560 mm | Total length 355.9 mm (holotype) |
| SVL females (mm) | 433–625 mm | 270–564 mm | 200–555 mm | - |
| Tail Length males (mm) | 45 mm and 65 mm | 53–85 mm | 38–87 mm | - |
| Tail Length females (mm) | 63–80 mm | 40–81 mm | 34–79 mm | - |
| Head Length males (mm) | 14.8 mm and 19.1 mm | 17.4 mm | 22.5–25 mm | - |
| Head Length females (mm) | 18.8–24.5 mm | 17.2–32.0 mm | 22.7–31 mm | - |
| Head Width males (mm) | 6.1 mm and 10.3 mm | 10 mm | 11.5–14.3 mm | - |
| Head Width females (mm) | 9.6–14.6 mm | 15.5–21.4 mm | 15.2–19.9 mm | - |
| Scale rows at the neck | 24–25 | 19–23 | 19 | 19 |
| Scale rows at mid body | 25–27 | 20–23 | 19 | 19 |
| Scales rows near vent | 20–22 | 17–21 | 16–18 | 15–17 |
| Ventral males | 159 | 130–143 | 126–133 | 122–136 |
| Ventral females | 152–156 | 122–140 | 116–130 | - |
| Subcaudal males | 39–41 (pairs) | 35–48 (pairs) | 38–46 (pairs) | 22–42 pairs |
| Subcaudal females | 36–39 (pairs) | 22–47 (pairs) | 32–44 (pairs) | - |
| Internasals | single/double | single/double | single/double | single, triangular, not in contact with loreals |
| Nasals | contact each other & separated internasals to rostral | contact each other & separated internasals to rostral | contact each other & separated internasals to rostral | crescent-shaped nares |

| | | | | |
|---|---|---|---|---|
| Loreal | single | Single | Single | Single |
| Preocular | single/double | single/double | single/double | Single, rarely double |
| Postocular | single/double | single/double | single/double | Double, rarely single |
| Supraocular | single | Single | Single | Single |
| Anterior chinshields | a pair (contact in mental groves) | a pair (contact in mental groves) | a pair (contact in mental groves) | 2 |
| Posterior chinshields | a pair (doesn't contact each other/ in mental grove) | a pair (doesn't contact each other/in mental grove) | a pair (doesn't contact each other/in mental grove) | 2 |
| Species | *H. indonesiensis* **sp. nov** | *H. matannensis* | *H. plumbea* | *H. murphyi* (Bernstein et al., 2022) |
| Gular scales | 7 to 8 | 7 to 9 | 6 to 8 | - |
| Preventrals | 3 to 4 | 2 to 3 | 1 to 2 | - |
| Upper labial scales in contact with the eye | 4th & 5th | 4th & 5th or 4th & 4th or 3rd & 4th | 4th & 5th, or 4th & 4th | 4–5, rarely 3–5 |
| Upper labials | 8 | 7 to 9 | 8 | 8, rarely 9 |
| Posterior upper labials undivided into small scales | Yes | Yes | Yes | |
| Lower labial scales | 9 to 11 | 10 to 11 | 9 to 11 | 10, rarely 8, 9 , or 11 |
| Temporal scales enlarged and plate–like | yes | yes | yes | Yes |
| Anal scales | divided | divided | divided | divided |
| Body pattern | blotched | plain | plain | uniform olive green, with darker, gray scale margins. |
| Tail shape | compressed | rounded | rounded | rounded |

***Distribution.*** The species was found only from Towuti Lake, South Sulawesi. Although Matano Lake, Towuti Lake, and Mahalona Lake are relatively nearby, *Hypsiscopus indonesiensis* **sp. nov.** is only recorded from Towuti Lake.

**Figure 16.** The habitat of *Hypsiscopus indonesiensis* **sp. nov.** in Hola-Hola site, Towuti Lake

***Natural History.*** *Hypsiscopus indonesiensis* **sp. nov.** were collected from the habitat type stony, shady area, with water depth about 10–15 cm and 1 m distance from the land.

## DISCUSSION

Snake diversity in Sulawesi has been evaluated for many decades together with intensive fieldworks and improvement on herpetological studies in Indonesia. In Den Bosch (1985) listed 55 species of snakes (non–sea snakes) in Sulawesi. Twenty years later, De Lang & Vogel (2005) revised some doubtful records and concluded that the number of land snakes in Sulawesi are 52 species. Since then, seven species of snakes have been decribed from Sulawesi (Uetz et al. 2023), and here we add a new species to list of snake of Sulawesi, bringing the number of land snakes in Sulawesi become 60 species. According to De Lang & Vogel (2005) 42% of land snakes in Sulawesi are endemic while Koch (2012) mentioned a much larger, approximately 60% endemicity of land snake in Sulawesi. Compared to Sundaland Islands, diversity of snakes in Sulawesi is much lower, however the endemicity is higher. Sumatra has 127 species of land snakes, of which 16% are endemic (David & Vogel, 1996) whereas Borneo has 133 species (23% are endemic) (Stuebing et al., 2014), Java and Bali (110 species, 6.4% are endemic),

and Lesser Sunda Islands (29 species, 27.6% are endemic) (De Lang, 2011). This high level of endemicity and relatively low species richness is likely related to long period of isolation of Sulawesi from other Greater Sunda Islands (Whitten et al., 1987).

De Lang & Vogel (2005) noted the taxonomic comments on the *Enhydris* (former genus of *Hypsiscopus*) and suggested further study to evaluate taxonomic status of Sulawesian *Enhydris* due to limitation of specimens that potentially could mislead in the morphological studies. Here, we added information from additional specimens and our findings show the consistency in the separation on the morphological characters among three species of *Hypsiscopus* which is concordant with published molecular data (i.e. Alfaro et al. 2008; Bernstein et al., 2021; Fukuyama et al., 2022). The existence of this new taxon from Towuti Lake has been long recorded from several publications (i.e. De Lang & Vogel, 2005; Alfaro et al. 2008; Bernstein et al., 2021; Fukuyama et al., 2022). However, none of them formally described this species. The distinct morphological character of possessing a flat tail of *Hypsiscopus indonesiensis* **sp. nov**. was previously mentioned in Murphy & Voris (1994), and followed by Iskandar (*pers. comm*.) in De Lang & Vogel (2005) as a paddle–tailed water snake from Lake of Towuti Lake. This character of possessing a flat tail in *Hypsiscopus indonesiensis* **sp. nov**. is likely similar to "paddle–tailed" (Iskandar (*pers. comm*.) in De Lang & Vogel (2005) and "tail laterally compressed" in Murphy & Voris (1994). Possession of compressed tail was mentioned in other genus of water snake, such as *Enhydris chanardi* (Murphy & Voris, 2005) and *Homalophis gyii* (Murphy et al., 2005).

Sulawesi is an island in the Indo–Australian Archipelago, and it is well known as unique geological history and biodiversity hotspot for many species, along with the patterns of endemism in certain taxa (von Rintelen, 2011; Utama et al., 2022). This island contains several fragmented ancient lakes during the Pliocene, including the Lake Matano and Lake Towuti, and Lake Mahalona between these two big lakes, connected with a very limited river system (Utama et al., 2022). These immense fragmentations could be responsible for the allopatric speciation of ancestral *H. matannensis* and *H. indonesiensis* **sp. nov.** The occurrence of the widespread species of *H. plumbea* and its interaction with two other endemic species in the Lake Matano, Mahalona and Towuti need further investigation to describe the geohistorical distribution of genus *Hypsiscopus* in Sulawesi.

## ACKNOWLEGMENTS

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## APPENDIX

***Specimens examined:***

– *H. matannensis* : MZB Oph 3055 from Desa Ahelisawah, kota Kendari, Southeast Sulawesi; MZB Oph 3083, 3084 & 3085 from Muara sungai Lawa, Matano Lake, South Sulawesi; MZB Oph 2320 from Abelisawa km 8 Kendari Southeast Sulawesi; MZB Oph 1682 from Raha, Muna Island, Southeast Sulawesi; MZB Oph 2304 from Marawo, Ulu Bangka, Poso, Central Sulawesi; MZB Oph 2325 from Bonepate, Tonre, Bone, South Sulawesi; MZB Oph 2642 from Kawasan Wisata Moramo, Southeast Sulawesi; MZB Oph 3530 from Matano Lake, Komplek Inco, Jl. Jawa Sorowako, Luwu, South Sulawesi; MZB Oph 2948 from Tanjung Peropa, Southeast Sulawesi; MZB Oph 3632 from Tempe Lake, Tana Sitolo, Sengkang, South Sulawesi; MZB Oph 3105 & 3106 from Desa Lampeapi, Wawonii Island, Southeast Sulawesi;

– *H. plumbea* : MZB Oph 2134 from Karawang, West Java; MZB Oph 5224 from Kaki Gunung Butak, Malang, East Java; MZB Oph 1905 from Desa Maccorowalie, Kab. Pinrang, South Sulawesi; MZB Oph 2304 from Poso, Central Sulawesi; MZB Oph 3636 from Desa Lende, Kec. Sinenpa, Kab. Donggala, South Sulawesi; MZB Oph 3695 from Sungai Tudeng Maros, South Sulawesi; MZB Oph 3207 from Toli–toli, Central Sulawesi; MZB Oph 3380 from Selayar Island, South Sulawesi; MZB Oph 4058 from Kampung Tallo, Makassar, South Sulawesi; MZB Oph 2312 from Dudepo, Bolaang Mongondo, North Sulawesi; MZB Oph 3000 from Siloam River, Camp Site Maligono, North Buton, Buton Islands, Southeast Sulawesi; MZB Oph 3637 from Desa Lende, Kec. Sinenpa, Kab. Donggala, South Sulawesi; MZB Oph 6100 from Desa Rompegading, South Sulawesi; MZB Oph 1681 from Badjo Raha, Southesat Sulawesi; MZB Oph 6119 from Low Camp, Gunung Katopasa, Kec Ulu Bangka, Kab. Tojo Una–una, Central Sulawesi; MZB Oph 2042 from Sungai Rawan, Slope of Lantimojong Mt., Luwu, South Sulawesi; MZB Oph 2823 from Buton Island, Southeast Sulawesi; MZB Oph 3448 from Bantimurung, South Sulawesi; MZB Oph 3379 from Pusong Bridge, Selayar Island, South Sulawesi; MZB Oph 3376 from Desa Galung, Kec. Barru, South Sulawesi; MZB Oph 3054 from Desa Timampu, Kec. Towuti, Kab. Luwu utara, South Sulawesi; MZB Oph 3377 from Desa Pabatuang, Selayar Island; MZB Oph 3380 from Approximately 20 km South Banteng, Selayar Island; MZB Oph 3695 from Sungai Tudeang, Maros, South Sulawesi.