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NOTES ON GEOGRAPHIC DISTRIBUTION

First records of *Osteochilus flavicauda* Kottelat & Tan, 2009 (Cypriniformes, Cyprinidae, Labeoninae) from Indonesia

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Abstract. Two specimens of *Osteochilus flavicauda* were found in 2023 from Bangka Island and Belitung Island, within the Bangka-Belitung Islands Province, Indonesian Archipelago. These specimens represent the first record of the species from Indonesian islands and the country. These new records extend the known geographic range to the southeast, beyond the mainland sites of Johor, Malaysia, and Pattani, Thailand. These findings represent a significant range extension and contribute to the understanding of the ichthyofauna in undersampled regions of Sundaland.

Key words. Bangka-Belitung Province, biogeography, Indonesian Archipelago, new record, Sundaland

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INTRODUCTION

Osteochilus Günther, 1868 is a genus of cyprinid fish (Cypriniformes, Cyprinidae, Labeoninae), currently comprising approximately 30 valid species distributed throughout South and Southeast Asia, including India, Myanmar, Laos, Thailand, Malaysia, Indonesia, and southern China (Fricke et al. 2025a, 2005b; Froese and Pauly 2025). Species of this genus are primarily found in lotic environments and are morphologically characterized by a subterminal mouth and thick, folded lips, adaptations associated with scraping and adhering to substrates in moderate to fast-flowing freshwater habitats (Karnasuta 1993; Yang et al. 2012).

Osteochilus flavicauda Kottelat & Tan, 2009 is a relatively recently described species, which is endemic to the Malay Peninsula and more specifically from Peninsular Thailand and Malaysia (Johor) (Kottelat and Tan 2009; Ahmad 2019; Fricke et al. 2025b). It is morphologically similar to *O. microcephalus* (Valenciennes 1842) and shares with it a black midlateral stripe (Kottelat and Tan 2009). Specimens exhibiting, in life or when recently preserved, a yellow caudal fin, instead of a red one, were previously misidentified as *O. microcephalus*. Upon re-examination of this species complex, Kottelat and Tan (2009) recognized those specimens with a yellow caudal fin as representing a distinct species and described them as *O. flavicauda*.

Osteochilus flavicauda is listed as Least Concern in the IUCN Red List (Ahmad 2019; Fricke et al. 2025b). At the time of its description, this species was regarded as endemic to the eastern drainages of the Malay Peninsula, with confirmed records from rivers in Johor (Malaysia) and southern Thailand (Pattani) (Ahmad 2019; Fricke et al. 2025b). It has not been recorded from the west coast of the peninsula nor from Indonesian territory, including Sumatra, Borneo, or other islands of the Indonesian archipelago (Kottelat and Tan 2009).

In this study, we report the first confirmed record of *O. flavicauda* for Indonesia, based on specimen collected from Bangka and Belitung Islands. This new record represents a significant geographic range extension of the known distribution of the species and contributes to the understanding of the ichthyofauna in undersampled regions of Sundaland. We provide photographs of the collected specimen, a distribution map, and notes on habitat and observed morphological features.

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METHODS

In Badau Subdistrict, Belitung District, Belitung Island, within the Bangka-Belitung Islands Province, Indonesia, on 12 May 2023, several specimens of *Osteochilus flavicauda* were collected. However, only one specimen was preserved as voucher material (Figure 1a, b), and the remaining specimens were released back into the collecting site. Before these specimens were released, their external features were examined and validated by Veryl Hasan. The vouchered specimen was preserved in 10% formalin for 10 days and subsequently transferred to 70% ethanol for permanent preservation. The specimen is deposited in the Ichthyological Collection of the Natural History Museum of Universitas Airlangga (ANMH), under voucher number ANMH 101. The second specimen refers to a specimen observed and photographed on 12 September 2024 in Cambai Village, Central Bangka District, Bangka Island, within the Bangka-Belitung Islands Province, Indonesia (Figure 1c). The specimen was not preserved, but its identification was based on photographs and features useful for species identification (e.g. number of tubercles at the tip of the snout) which was observed and provided by one of the fishermen (Muhammad Ilmi) and validated by Veryl Hasan. The photograph validation followed the guidelines proposed by Campos et al. (2023), which include the submission of the original, unedited image, associated metadata (date, time, and precise coordinates), and information on image ownership and photographer attribution. A photograph of the specimen, for which researcher Veryl Hasan holds ownership, was provided by local fishermen.

The identification of the specimens of *O. flavicauda* was based both on examined material, on collected specimens that were released back into the collecting site, and on literature (e.g. Kottelat and Tan 2009). Information on the other congeners was based only on literature (e.g. Kottelat and Tan 2009). The identification of the specimens was based on the analysis of external morphological characters, body proportions, and live coloration, as proposed by Kottelat and Tan (2009). Morphometric measurements of the preserved specimen were taken with digital calipers (0.1 mm accuracy) and expressed as percentages of standard length (SL), following standard methodology for Cyprinidae. The distribution map was generated based on previously published records (e.g. Kottelat and Tan 2009; Ahmad 2019; Ahmad et al. 2023), and the two new occurrences reported herein. The base map of the Indonesian Islands was processed using QGIS v. 3.28 and adjusted to match the geographic scale of the occurrence points.

RESULTS

***Osteochilus flavicauda* Kottelat & Tan, 2009**
Figure 1; Table 1

New records. INDONESIA — Bangka-Belitung Islands Province • Belitung Island, Belitung District, Badau Subdistrict, upstream of the Cerucuk River; 02°47′S, 107°51′E; 12.V.2023; V. Hasan leg.; scoop net; 1 ♂, 125.0 mm SL, ANMH 101 • Bangka Island, Central Bangka District, Cambai Village; 02°15′S, 106°09′E; 12 .IX.2024; obs. (photograph provided by local fishermen, validated by V. Hasan); 1 spec. (Figure 1c).

Identification. The specimens were identified as *O. flavicauda* based on the diagnostic morphological features proposed by Kottelat and Tan (2009). According to Kottelat and Tan (2009), *O. flavicauda* is diag-

Figure 1. *Osteochilus flavicauda*. **a.** Live male. **b.** Recently preserved male (125 mm SL; voucher ANMH 101), upper Cerucuk River, Belitung Island, within the Bangka-Belitung Islands Province, Indonesia, 12 May 2023 (photo: V. Hasan). **c.** Photograph of live specimen provided by local fishermen, Cambai Village, Bangka Island, within the Bangka-Belitung Islands Province, Indonesia, 12 September 2024 (validated by V. Hasan).

Table 1. Morphometric and meristic characters of *Osteochilus flavicauda*.

	Present study (ANMH 101)	Kottelat and Tan (2009)	
		Holotype	Paratypes
Morphometric data			
Standard length – SL (mm)	125.0	96.4	125.3–149.3
Percent of SL			
Predorsal length	47.2	49.0	44.8–48.0
Preanal length	77.6	77.5	77.0–80.3
Prepelvic length	52.8	52.8	50.7–53.8
Head length	23.9	24.7	21.0–23.3
Snouth length	9.9	10.5	8.8–11.0
Eye diameter	4.9	5.8	4.4–4.9
Meristic data			
Dorsal-fin rays (unbranched)	4	4	
Dorsal-fin rays (branched)	12½	12½	
Scale at origin above later line	9	8-9	
Anal-fin rays (unbranched)	3	3	
Anal-fin rays (branched)	5½	5½	
Pelvic-fin rays	8	8	
Caudal-fin rays (principal rays)	10+9	10+9	
Caudal-fin rays (branched)	9+8	9+8	
Lateral line scales	31+2	30–31+2–3	
Predorsal scales	10	10	

nosed mainly by body moderately deep, dorsal profile strongly arched in front of dorsal fin origin with a concavity at nape. Its ventral profile is arched, but less than dorsal profile. In addition, *O. flavicauda* share with *O. waandersii* (Bleeker, 1853) and *O. kerinciensis* Tan & Kottelat 2009 the presence of a black midlateral stripe ending at the posterior extremity of the median caudal-fin rays, which distinguish these three species from all other congeners. *Osteochilus flavicauda* is distinguished from *O. waandersii* and *O. kerinciensis* by having a single tubercle at the tip of the snout (vs. three), caudal, anal, pectoral and pelvic fins yellow (vs. red), and midlateral stripe with very contrasted edges, obvious, and continued until eye by a faint grayish patch on opercle (vs. faint, especially anteriorly, with blurry edges, ending at upper extremity of gill opening at level of upper margin of eye). All these diagnostic features mentioned above are present in the photographed, collected specimens that were released, and the preserved specimen examined here (Figure 1). To ensure the accurate taxonomic identification of the specimens herein examined, we consulted Dr. Tan Heok Hui (Lee Kong Chian Natural History Museum, Singapore), an expert working on the genus *Osteochilus*, who confirmed the specimens' identification as *O. flavicauda*.

Geographic distribution. The presence of *Osteochilus flavicauda* was previously known from its original description, restricted to Johor State in southern Peninsular Malaysia and Pattani Province in southern Thailand (Kottelat and Tan 2009), and subsequently, the species was also recorded for central Malaysia, specifically in Tasek Bera—a peat-swamp ecosystem located at 03°05'N, 102°38'E, in the southwestern part of Pahang State, approximately 25.6 km from the nearest town, Bahau, in the neighboring state of Negeri Sembilan (Ahmad et al. 2023). In the present study, we report two additional localities for *O. flavicauda*, both corresponding to insular sites within the Indonesian Archipelago (Figure 2): the Cerucuk River on Belitung Island and a headwater tributary near Cambai Village on Bangka Island, both within the Bangka-Belitung Islands Province, Indonesia. These new island records are located approximately 550 km southeast of Pattani (the nearest previously known locality) and demonstrate that the species inhabits both continental and island drainages across the Sundaland region, thereby extending its known geographic range.

Ecological notes. At the collecting site on Belitung Island, several specimens of *Osteochilus flavicauda* were collected in sympatry with *Gymnochanda verae* Tan & Lim, 2011, an endemic species of Belitung (Fricke et al. 2025b), as well as several other native fishes, including *Mastacembelus notophthalmus* Roberts, 1989, *Barbucca diabolica* Roberts, 1989, *Rasbora einthovenii* (Bleeker, 1851), and *Osteochilus spilurus* (Bleeker, 1851) (Fricke et al. 2025b). *Osteochilus flavicauda* was relatively common at this collecting site, although its abundance was lower than that of the most prevalent species on Belitung Island, such as *O. spilurus*. At the col-

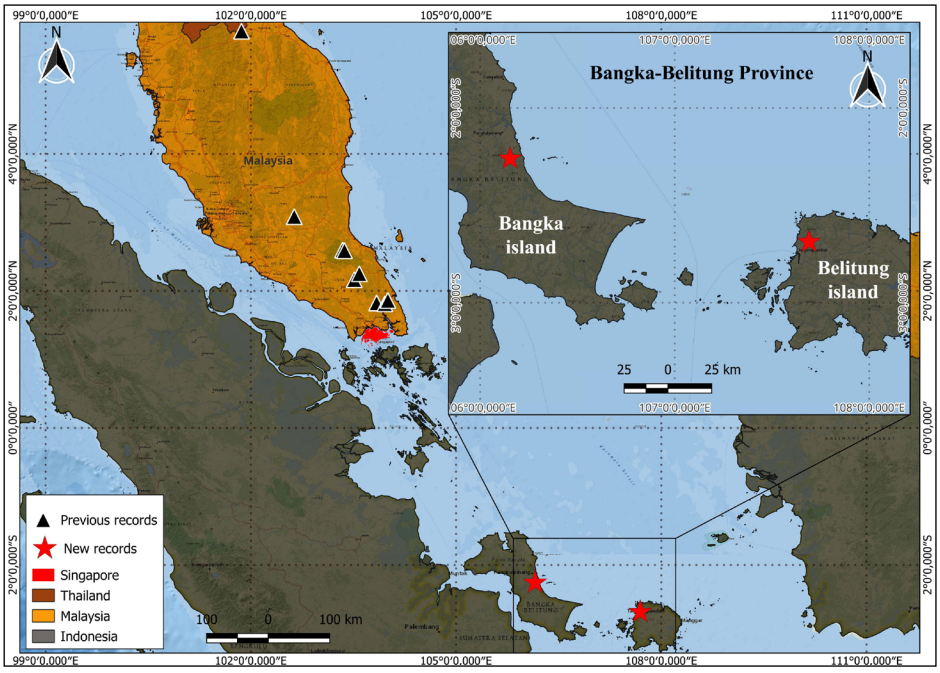

Figure 2. Known distribution of *Osteochilus flavicauda* in Sundaland. Black triangles = literature records from the Malay Peninsula and Thailand based on Kottelat and Tan, (2009), Ahmad (2019) and Ahmad et al. (2023); and red stars = new insular records from Bangka-Belitung Islands Province, Indonesia reported in this study.

lecting site on Bangka Island, only a single specimen of *O. flavicauda* was obtained. It occurred in sympatry with the endemic fighting fishes *Betta chloropharynx* Kottelat & Ng, 1994 and *B. schalleri* Kottelat & Ng, 1994 (Fricke et al. 2025b), as well as with *Clarias nieuhofii* Valenciennes, 1840, *M. notophthalmus*, and *Barbodes sellifer* Kottelat & Lim, 2021. The occurrence of *O. flavicauda* in sympatry with regional endemic species suggests that it is an established component of the native ichthyofauna of the Bangka and Belitung Islands, rather than an accidental introduction.

DISCUSSION

The new records published here for *Osteochilus flavicauda* have all the diagnostic features as proposed by Kottelat and Tan (2009 (see identification section for details). Although the second specimen was not physically preserved, high-resolution photographic documentation, along with georeferenced metadata and validation procedures, supports the reliability of the record (Campos et al. 2023). In addition, the remaining specimens collected on Belitung Island, which were released back into the collecting site, had their external features examined and validated by Veryl Hasan.

Previously, *O. flavicauda* was known only from southern Peninsular Malaysia (Johor) and southern Thailand (Pattani), with a later record from central Malaysia in the peat-swamp ecosystem of Tasek Bera (Kottelat & Tan 2009; Ahmad 2019; Ahmad et al. 2023). Until this study, *O. flavicauda* was believed to be confined to the eastern drainages of Peninsular Malaysia and the extreme south of Thailand (Kottelat and Tan 2009; Ahmad 2019; Ahmad et al. 2023). The two new records presented here constitute the first confirmed occurrences of *O. flavicauda* in Indonesia, from Bangka and Belitung Islands, both within the Bangka-Belitung Islands Province. These findings extend the known geographic range of the species by approximately 550 km southeastward and represent insular occurrences for a species previously considered restricted to continental environments (Figure 2).

Given that the species was recorded in two separate localities, both spatially and temporally separated, accidental occurrence is unlikely. Instead, these records indicate the presence of an established population in the Bangka-Belitung Islands Province, Indonesia (Figure 2). Furthermore, this report represents the first confirmed record of the species for Indonesia. The newly documented sites are mid-sized lowland streams with clear to slightly tannic water, sand–gravel substrates, and moderate currents, exhibiting physical conditions comparable to those described from Johor and Pattani (Kottelat and Tan 2009; Ahmad 2019). These records from rivers on Bangka and Belitung islands indicate that viable populations can persist outside the continental Malay Peninsula, in medium-sized lotic environments with environmental characteristics similar to previously described habitats (Kottelat and Tan 2009; Ahmad, 2019). This environmental similarity suggests that comparable habitats across the region may also harbor overlooked populations. Consequently, continued sampling in such environments could reveal a broader distribution than previously recognized. These findings, therefore, lend support to recent studies showing that the ichthyofauna of the Sunda Archi-

pelago islands remains undersampled (Hasan et al. 2023a), with considerable gaps in the documentation of freshwater fish diversity (Hutama et al. 2016). This pattern underscores the need for renewed field surveys and a critical taxonomic reassessment of presumed endemism in the region.

From a biogeographic perspective, the occurrence of *O. flavicauda* on Bangka Island and Belitung Islands, within the Bangka-Belitung Islands Province, Indonesia, probably reflects the connectivity of paleodrainages during Pleistocene periods of lower sea level, when land bridges linked Sumatra, Borneo, and the Malay Peninsula across the Sunda Shelf (Voris 2000; Pubellier and Morley 2014). Phylogeographic studies support this idea. For example, populations of *Osteochilus vittatus* (Valenciennes, 1842) from Sumatra with the northern Sunda paleo-system, those from Malaysia align with the Malacca system, and those from Java and Borneo cluster with the eastern Sunda system (Imron et al. 2024). Genetic similarity between eastern Peninsular Malaysian and Sumatran populations has likewise been attributed to ancient river connections (Tan et al. 2012). This shared paleodrainage history further supports the hypothesis that *O. flavicauda* may also occur on Sumatra. A photograph tentatively identified as *O. flavicauda* from Sumatra has been published on iNaturalist (observation id 152813191; https://www.inaturalist.org/observations/152813191), although some contributors have alternatively identified it as *O. waandersii*, and there is currently no consensus on the identification of this specimen. Therefore, additional studies are required to confirm the accurate identification of this iNaturalist observation, as well as the occurrence of the species in Sumatra.

Such records are critically important for conservation because freshwater fish distribution data underpin occurrence maps, conservation status assessments, and regional checklists (Hasan et al. 2024). Documenting previously unsampled areas such as the Bangka and Belitung islands (Bangka-Belitung Islands Province) helps fill major knowledge gaps and supports conservation decisions (Valen et al. 2024). The case of *Mastacembelus notophthalmus* Roberts, 1989—listed as Least Concern yet seldom recorded and poorly understood in population terms (Hasan et al. 2023b)—highlights the need for extensive sampling in underexplored areas, including smaller islands of the Bangka-Belitung Islands Province and other parts of the Indonesian Archipelago. Similarly, the new records of *O. flavicauda* suggest that the species is more widespread but underdocumented, reinforcing the call for additional fieldwork, particularly on Sumatra's main island, where the species may also occur. The shared paleodrainage history further supports the hypothesis that *O. flavicauda* may have a broader distribution than previously recognized.

These findings fit within a broader biogeographic and conservation context. Sundaland is one of the world's most threatened biodiversity hotspots, having experienced a rapid increase in threat levels over recent decades (Sholihah et al. 2020). Analyses indicate that up to 16 freshwater fish species in Sundaland may face extinction by 2050, primarily due to the conversion of natural habitats into agricultural areas (Giam et al. 2012). Considering that freshwater ecosystems are among the most imperiled globally, with nearly one-quarter of freshwater fauna at risk of extinction (Sayer et al. 2025), conducting comprehensive sampling in understudied areas of Sundaland is both urgent and essential. Future efforts should prioritize expanding regional ichthyological surveys, strengthening taxonomic and molecular capacities for species identification, and integrating new occurrence data into conservation planning and habitat management.

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ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

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Author contributions

Conceptualization: VH. Data curation: VH, ABA. Formal analysis: RFO, CTSF, VH, ABA, FPO. Funding acquisition: VH. Investigation: VH, RFO, CTSF, ABA, FPO. Methodology: VH, RFO, FPO. Project administration: VH.

Data Validation: VH. Visualization: VH, RFO, CTSF, AFS, FSV, ASK, ABA, DS, FPO. Writing – original draft: VH, RFO, CTSF, FPO. Writing – review and editing: VH, RFO, CTSF, AFS, FSV, ASK, ABA, DS, JS, FPO.

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Data availability

All data that support the findings of this study are available in the main text.

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