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# New records of Endangered Slender Walking Catfish, *Clarias pseudonieuhofii* Sudarto, Teugels & Pouyaud, 2004 (Siluriformes, Clariidae) from Central Mahakam River, East Kalimantan, Indonesia

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**Abstract.** Clariidae, commonly referred as air-breathing or walking catfishes, are a family of catfish distributed in Africa, Asia Minor, the Indian subcontinent, and Southeast Asia. Some species are highly valuable as food fish. As part of ongoing ichthyofaunal surveys in the Central Mahakam River, East Kalimantan, Indonesia, we present our findings from *Clarias* specimens collected from Central Mahakam River. We document *C. pseudonieuhofii* Sudarto, Teugels & Pouyaud, 2004, in the Central Mahakam River, Kutai Kartanegara Regency, East Kalimantan, which is located approximately 1200 km from the type locality in West Kalimantan.

**Key words.** Air-breathing fish, distribution, fish fauna, Southeast Asia, morphology

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## Introduction

The fish family Clariidae Bonaparte, 1846, often known as air-breathing or walking catfishes, is a group widely found in Africa, Asia Minor, the Indian subcontinent, and Southeast Asia. Some species are of high economic importance as food fish. *Clarias gariepinus* (Burchell, 1822), is currently Indonesia's second most-produced freshwater aquaculture commodity, trailing only tilapia. Farming of *Clarias* Scopoli, 1777 was established because these species can be easily farmed in areas with limited space and scarce water supplies (Gustiano et al. 2021). Many catfish species probably have significantly greater aquaculture potential than *C. gariepinus* (Teugels 1996).

The family Clariidae can be recognized by the distinctive structure of its respiratory system, specifically a suprabranchial organ formed by the expansion of the second and fourth epibranchials (Teugels and Adriaens 2003). Currently, the family contains 14 genera. Of these, 12 are found in Africa and three occur in India to Southeast Asia. The genus *Clarias* is one of the genera in Asia and is known as the world's most widespread genera of fish. Species of *Clarias* are distinguished by an elongated body with long dorsal and anal fins, no adipose fin, a mouth with bands of filiform teeth on the premaxillary and vomerine, small eyes, a bony top and sides of the head or only covered by very thin skin, four pairs of barbels, six soft rays in the pelvic fins and only two hard rays in the pectoral fins, and two swim bladders.

Following a systematic review of Southeast Asian *Clarias* (Sudarto and Pouyaud 2005), 10 species are recognized from Indonesia (Gustiano et al. 2020). They are *C. nieuhofii* Cuvier & Valenciennes, 1840; *C. pseudonieuhofii* Sudarto, Teugels & Pouyaud, 2004; *C. intermedius* Teugels, Sudarto & Pouyaud, 2001; *C. meladerma* Bleeker,1846; *C. leiacanthus* Bleeker, 1851; *C. olivaceus* Fowler, 1904; *C. batrachus* Linnaeus, 1758; *C. microstomus* Ng, 2001; *C. pseudoleiacanthus* Sudarto, Teugels, & Pouyaud, 2003; and *C. kapuasensis* Sudarto, Teugels, & Pouyaud, 2003. *C. nieuhofii* and *C. pseudonieuhofii* are the *Clarias* species with cylindrical and extremely elongated bodies in Southeast Asia (Sudarto et al. 2004). One additional species not included in the above publication is *Clarias nigricans* described by Ng (2003).

Until now, detailed information on the population status of *C. nieuhofii* has been lacking. Consequently, it is currently assessed as Least Concern in the IUCN Red List (Ng 2019). Weber and de Beaufort (1913) were the first to report *C. nieuhofii* in East Kalimantan, followed by Christensen (1992). For nearly three decades thereafter, surveys of the Mahakam River in East Kalimantan failed to find this species (Haryono 2006; Nasution et al. 2008; Kasim et al. 2015; Jusmaldi et al. 2019; Auliansyah et al. 2021; Batubara et al. 2025). Mahakam River, the second-largest river in Kalimantan, extends approximately 920 km and drains an area of 77,700 km$^2$ (Christensen 1992). As part of an ongoing catfish diversity survey of the Mahakam River, we report *Clarias* specimens collected from the Central Mahakam River. We found that *C. nieuhofii* maintains a substantial population in the Central Mahakam River. Confirming its occurrence after more than three decades without records, except those of Suyatna et al. (2021). *Clarias nieuhofii* is typically found in blackwater habitats such as swamps, streams, and rivers associated with peat-swamp forests. However, its primary habitat has undergone severe degradation due to human activities, with major consequences for population persistence. This species is an important food fish in peat swamps and contributes significantly to local food security and livelihoods. Nevertheless, unregulated harvesting, without restrictions on season or size, poses a serious threat to future population stability. The results of this study also showed the presence of *C. pseudonieuhofii*,

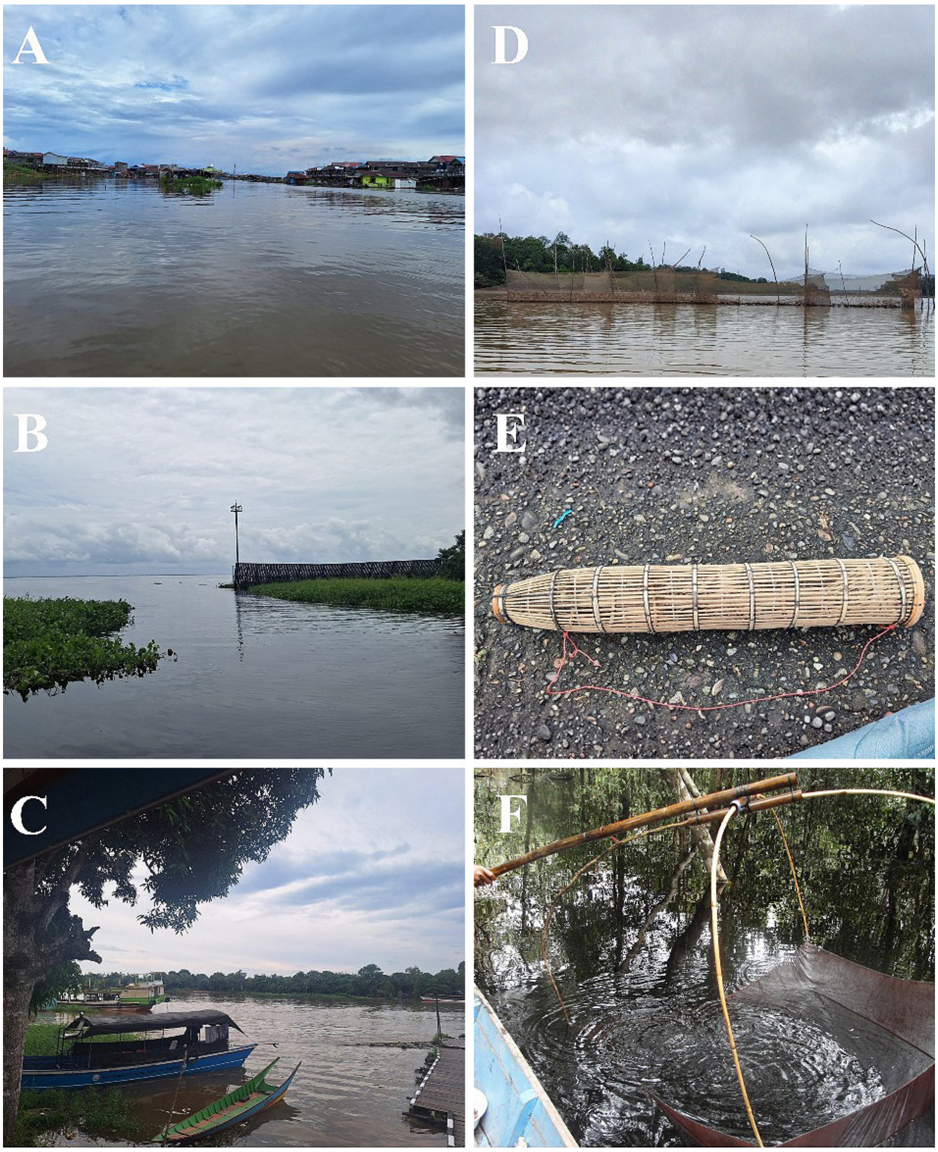


**Figure 1.** Three habitat localities: A. Melintang Lake, B. Semayang Lake, C. Muara Wis; Traditional equipments used to collect fish samples: D. pangilar; E. bubu; F. anco.

which is an endemic species from West Kalimantan, namely a sympatric species, as a new record. *Clarias pseudonieuhofii* has been assessed for the IUCN Red List of Threatened Species as Endangered (Ng 2019). In this study, we offer the first records of *C. pseudonieuhofii* in the Central Mahakam River, East Kalimantan, which has not been previously recorded there. We determined its identity based on morphological traits.

# Methods

Ichthyofaunal surveys were conducted during the dry season (August 2024) and in the rainy season (February 2025). Fifteen specimens of *Clarias* catfish were collected from three different localities: Semayang Lake, Melintang Lake, and Kota Bangun District (Figure 1). Fish samples were collected using "bubu", a fish trap made from bamboo or wire; "pangilar", a fence embedded in the water in the form of a cage; "banjur", a net pulled together to trap fish; and "anco", a manual fish-lift net (Figure 1). The fishing gear was installed in the evening, and the harvest took place the next day. Prior to fixation, fresh coloration of all specimens was documented with a digital camera. All samples were preserved in 10% formalin then transferred to 70% ethanol for long-term storage. Fish were measured point-to-point using digital dial calipers following the protocol of Teugels (1986). Subsequently, fish specimens were deposited in the laboratory of Ecology and Animal Systematics, Faculty of Mathematics and Natural Sciences, Mulawarman University (EAS-MSC-UNMUL), and the Marine Science and Fisheries Faculty, University of Hasanuddin, Makassar (MSFUH). Species identification followed the taxonomic keys of Kottelat et al. (1993) and Sudarto and Pouyaud (2005), Sudarto et al. (2004), Ng (2003), and Ng et al. (2011).

# Results

Family Clariidae Bonaparte, 1846
Genus *Clarias* Scopoli, 1777

***Clarias pseudonieuhofii*** **Sudarto, Teugels & Pouyaud, 2004**
Figure 2, Table 1

**New records.** INDONESIA — **East Kalimantan** • Kenohan District, Central Mahakam River, Semayang Lake; 00°11′15″S, 116°27′19.8″E; alt. ± 2 m a.s.l.; 8.II.2025; R. Gustiano, Haryono, Rusdianto leg.; 1♂, 364 mm SL, MSFUH 1965 • Muara Wis District, Central Mahakam River, Melintang Lake; 00°16′47.28″S, 116°26′26.484″E; ± 2 m a.s.l.; 7.II.2025; R. Gustiano, Haryono, Rusdianto leg.; 2♀,1♂, 143–192 mm SL, EAS-MSC-UNMUL 035 • Kota Bangun District, Fish market; 00°07′31.08″S, 116°26′57.12″E; ± 8 m a.s.l.; 7.IV.2025; T. Harefa leg. 1♀,1♂, 161–180 mm SL, MSFUH 1966.


**Figure 2.** *Clarias pseudonieuhofii* Sudarto, Teugels, & Pouyaud, 2004. **A.** MSFUH 1966, 161 mm SL, collected in Melintang Lake, Muara Wis District, Kutai Kartanegara Regency, East Kalimantan. **B.** MZB 10966, 311 mm SL, holotype .

**Table 1.** Morphometric measurements of newly collected specimens of *Clarias pseudonieuhofii* from central Mahakam River in East Kalimatan, Indonesia.

| | MSFUH 1965 | MSFUH 1966 | MSFUH 1966 | EAS-MSC-UNMUL 035 | EAS-MSC-UNMUL 035 | EAS-MSC-UNMUL 035 |
|---|---|---|---|---|---|---|
| Standard length (mm) | 161 | 180 | 143 | 187 | 192 | 364 |
| **As % standard length** | | | | | | |
| Maximal body depth | 11.7 | 12.5 | 11.9 | 13.1 | 12.3 | 12.9 |
| Caudal peduncle depth | 5.3 | 5.0 | 4.6 | 4.4 | 4.1 | 4.8 |
| Head length | 19.0 | 19.0 | 18.4 | 20.3 | 19.1 | 19.0 |
| Predorsal length | 26.8 | 26.0 | 27.3 | 28.6 | 26.3 | 25.7 |
| Preanal length | 39.1 | 39.9 | 41.0 | 41.9 | 42.8 | 43.5 |
| Prepelvic length | 36.6 | 34.1 | 35.4 | 36.6 | 35.9 | 36.2 |
| Prepectoral length | 15.8 | 15.0 | 16.0 | 16.1 | 14.2 | 14.8 |
| Dorsal fin length | 74.6 | 68.6 | 72.0 | 73.2 | 71.3 | 70.4 |
| Length between occipital process and dorsal fin | 7.2 | 6.9 | 7.8 | 8.0 | 6.2 | 7.1 |
| Pectoral spine length | 5.9 | 6.3 | 6.8 | 5.8 | 6.3 | 5.2 |
| Pectoral fin length | 8.4 | 9.8 | 9.4 | 10.3 | 10.0 | 7.9 |
| Pelvic length | 5.3 | 6.1 | 5.2 | 5.2 | 5.6 | 5.2 |
| Anal fin length | 58.1 | 56.8 | 58.9 | 58.5 | 58.3 | 58.4 |
| Head width | 13.8 | 13.6 | 13.3 | 14.6 | 13.5 | 14.1 |
| **As % head length** | | | | | | |
| Snout length | 22.4 | 22.3 | 21.0 | 21.7 | 24.5 | 23.8 |
| Interorbital width | 41.4 | 42.0 | 38.1 | 42.2 | 41.1 | 41.4 |
| Eye diameter | 5.6 | 5.9 | 5.8 | 6.8 | 5.1 | 6.6 |
| Occipital process length | 10.1 | 14.5 | 11.2 | 13.1 | 13.3 | 9.7 |
| Occipital process width | 35.0 | 39.1 | 37.8 | 37.1 | 35.8 | 33.9 |
| Frontal fontanelle length | 11.5 | 15.1 | 12.9 | 14.6 | 15.3 | 16.1 |
| Frontal fontanelle width | 5.0 | 5.5 | 5.2 | 5.6 | 5.5 | 5.4 |
| Premaxillary toothplate width | 27.3 | 26.3 | 27.5 | 24.6 | 26.4 | 25.6 |
| Vomerine toothplate width | 19.4 | 21.8 | 20.0 | 22.9 | 20.5 | 18.4 |

**Identification.** Morphometric measurements indicate that the six specimens we collected from Central Makakam confirm that they are *C. pseudonieuhofii* (Table 1). *Clarias pseudonieuhofii* differs from all other Southeast Asian *Clarias* species except the slender walking catfish group (*C. nieuhofii*, *C. nigricans*, *C. gracilentus* Ng, Hong & Tu (2011)) by its anguilliform body and relatively short (HL, 16.5–21.1% SL) and narrow (HW, 12.7–14.3% SL) head. *Clarias pseudonieuhofii* differs from *C. nieuhofii* by its shorter anal fin (56.8–58.9 vs. 59.7–66.8% SL), where posterior of anal fin reaches the beginning of the caudal fin in *C. pseudonieuhofii*, while exceeds the caudal fin and even merges with it in *C. nieuhofii*. Our specimens of *C. pseudonieuhofii* differ from *C. nigricans* by its longer head length (18.4–21.1 vs. 17.4–18.3% SL), shorter the length between occipital process and dorsal fin (6.1–8.0 vs. 8.1–9.8% SL), head width (12.7–14.6 vs 11.7–12.3% SL), and shorter snout length (21.7–24.5 vs. 29.2–34.9% HL). Our specimens of *C. pseudonieuhofii* differ from *C. gracilentus* by its longer head width (13.3–14.6 vs. 11.9–12.9% SL) and shorter snout length (21.0–23.8 vs. 23.0–31.5% HL).

In living specimens of *C. pseudonieuhofii*, the skin is dark brown to black, with darker pigmentation on the dorsal body surface, and the fins are paired. The ventral surface is light brown. Overall, this species closely resembles *C. nieuhofii*, hence the species epithet.

Previously, *C. pseudonieuhofii* was only known from the upper basin of the Kapuas River, in West Kalimantan, near Sentarum Lake (Sudarto et al. 2004). Our new records document this species in the Central Mahakam River, Kutai Kertanegara Regency, East Kalimantan (Figure 3).

# Discussion

Prior to the identification of *Clarius pseudonieuhofii* (Sudarto et al. 2004), *C. nigricans*, *C. gracilentus*, all *Clarias* species in Southeast Asia with an anguilliform or slender body and a short, small head were known as *C. nieuhofii* (Kottelat et al. 1993; Teugels et al. 1998). Based on recent specimens from the Central Mahakam River, we concur that *C. pseudonieuhofii* is distinguished from *C. nieuhofii* by the length of its anal fin.

Further investigation of samples from the Central Mahakam River reveals that *C. nieuhofii* and *C. pseudonieuhofii* are sympatric-in this river.

They share the same environment, with a balanced abundance ratio. Consequently, our study provides the first confirmed record of *C. pseudonieuhofii* in the Mahakam River system. Until now, only *C. gariepinus* has been cultivated, with fingerling obtained from the outside the area. Farmers justify this

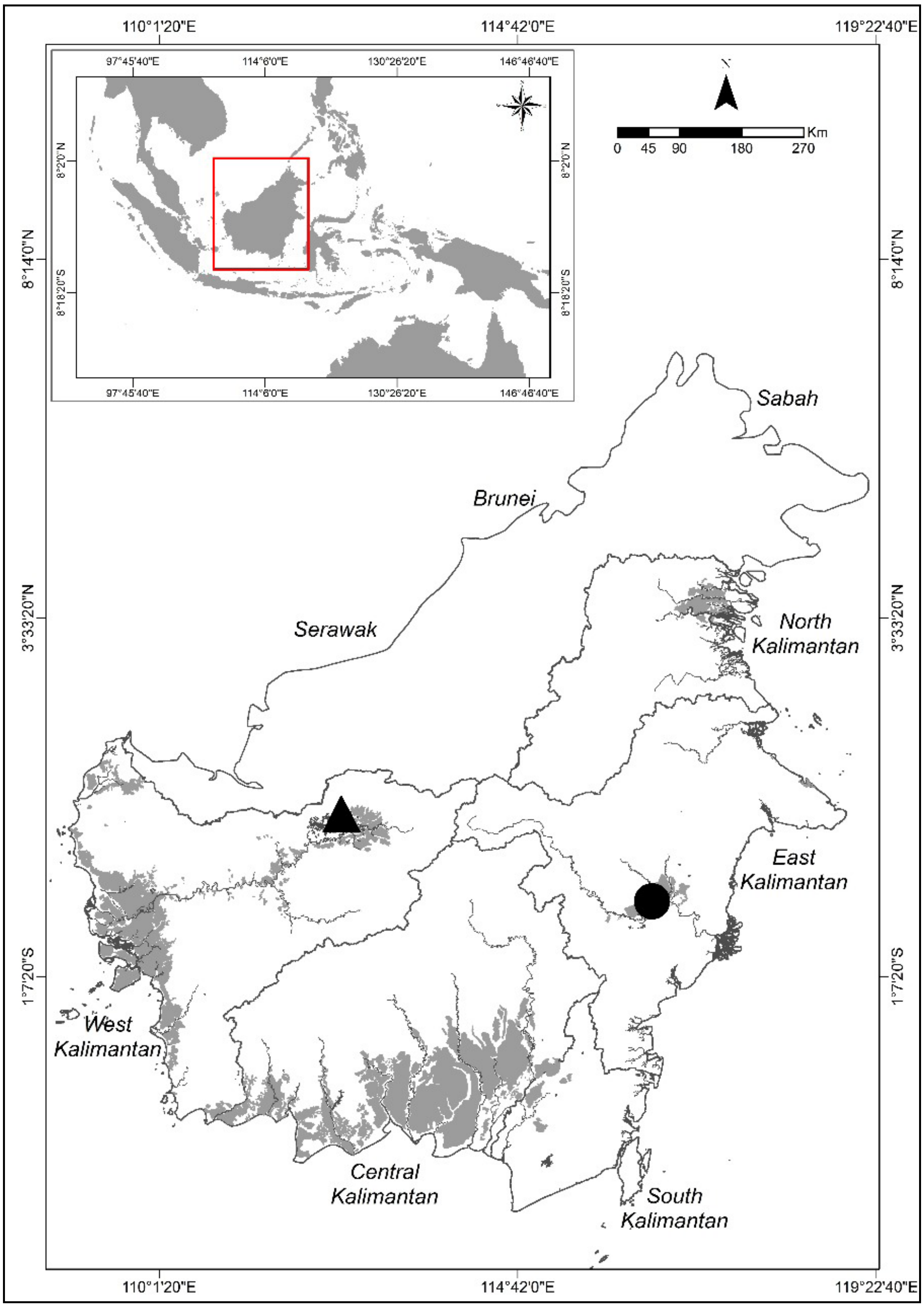


**Figure 3.** Geographic distribution of *Clarias pseudonieuhofii*: ● = new records; ▲ = previously known occurrence (type locality).

because *C. garipinus* is technically easier to maintain in a cage, adapts well to the feed provided, and is more cost effective and efficient for trade because to its greater size.

The Mahakam River has been reported to have a high amount of endemism, ranging from 46% (Popta 1906) to 23% (Molengraaf and Weber 1921; Taki 1978; de Beaufort 1951). The ichthyofauna of the Mahakam River is particularly notable for its high diversity of indigenous species. Its high degree of endemism also suggests that the basin has either been isolated from other systems for a long period or has a unique ecology that supports speciation (Gustiano 2003). This biogeographic pattern is closely linked to the evolutionary history of the Mahakam River, which was not hydrologically connected to the major river systems of the Sunda Shelf region during the Pleistocene epoch (Molengraaf and Weber 1921; de Beaufort 1951; Rainboth 1996). According to McConnell (1987), the Oriental region, which includes the Indian subcontinent, Southeast Asia's mainland, and the Indonesian Archipelago islands (Sumatra, Java, and Kalimantan), was periodically connected to the mainland during intervals of lowered sea levels in the Pleistocene glaciations.

Kottelat (1995) reported that 23 of the 82 species (28%) collected from the Mahakam Basin were previously undescribed by science. Our findings support his hypothesis, that a significant number of species in the Mahakam River remain scientifically unclassified (Kottelat 1995; Gustiano and Pouyaud 2005). The occurrence of *C. pseudonieuhofii* provides concrete evidence supporting this proposition. The type locality of this species is characterized by peat-swamp forest, which is like the habitat of specimens collected from East Kalimantan, specifically from Lake Semayang and Melintang. Lake Semayang, about 1,200 km from the type locality, spans approximately 13,000 ha on the left bank of the Mahakam River and is adjacent Lake Melintang, which occupies approximately 11,000 ha on the right bank of Mahakam.

Lake Semayang is one of the largest wetlands in Kalimantan. It supports a highly diverse aquatic biota and provides abundant water supplies for a range of community activities. The lake's ecosystem constitutes a rich reservoir of genetic resources and represents an ecologically significant region with considerable economic potential for multiple sectors. Therefore, this area needs to be properly managed regarding fishing and habitat protection from damaging activities, especially for threatened fish such as *C. pseudonieuhofii.*

According to de Beaufort (1951), species occurring in the rivers of eastern Sumatra and Kalimantan but absent from Mahakam River, East Kalimantan are likely recent Pleistocene migrants, while currently inhabiting the Mahakam River may represent relics of earlier colonization events. Studies on the fish families such as Cyprinidae (Bănărescu 1992), Bagridae (Dodson et al. 1995), and Pangasiidae (Gustiano 2003) support the hypothesis of an ancient river that once connected the major rivers of Java, Sumatra, and Kalimantan, excluding the Mahakam River in East Kalimantan.

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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: RG. Data curation: RG, HH, JJ, TH. Funding acquisition: HH, RR, TH. Methodology: RG, NN, TH. Validation: RG. Visualization: RG, HH, JJ, TH. Writing – original draft: RG. Writing – review and editing: RG, TH, NN, JJ.

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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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