Bio Palembanica 3(1): 33-39 (2026)
This journal is available online at: https://ejournal.uigm.ac.id/

First Record of *Zenarchopterus gilli* (Beloniformes: Zenarchopteridae) in Lampung Province, Sumatra, with Notes on Its Distribution in Indonesia

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Received 3 March 2026 | Accepted by *Ayu Karlina*: 2 April 2026 | Published online 30 June 2026.

Abstract
This study reports the first confirmed record of *Zenarchopterus gilli* from Lampung Province, southern Sumatra, Indonesia, based on field surveys conducted on 7 November 2025 in the Petengoran Mangrove Area, Pesawaran Regency. Several individuals were observed in shallow estuarine waters along mangrove creeks and tidal channels, and species identification was verified through diagnostic morphological characters, including the elongated lower jaw and distinctive modifications of the male anal-fin and dorsal-fin rays. The specimens conform to published descriptions of *Z. gilli*. Previously, the species had been recorded from northern Sumatra, Java, Bali, Lombok, Kalimantan, Sulawesi, Halmahera, Komodo, Maumere and Raja Ampat, but not from Lampung. This new record fills a geographic gap in its distribution in western Indonesia and suggests that the species likely has a broader and continuous coastal distribution across Sundaland, highlighting the need for further surveys in underexplored estuarine and mangrove habitats.

Keywords: estuarine, Indonesia, Lampung Province, mangrove, *Zenarchopterus gilli*.

Introduction

Indonesia is recognized as one of the world's centers of aquatic biodiversity, particularly within the Sundaland region, where extensive estuarine and mangrove ecosystems support diverse fish assemblages (Kottelat 2013; Iqbal *et al.* 2026). Sumatra harbors a rich ichthyofauna shaped by complex geological history, historical sea-level fluctuations, and dynamic coastal processes that influence estuarine connectivity (Tomascik *et al.* 1997; Setiawan *et al.* 2019). Despite numerous ichthyological surveys conducted across the island, many estuarine and mangrove habitats remain insufficiently explored, resulting in gaps in species distribution data (Iqbal *et al.* 2018a, 2024; Arifah *et al.* 2025).

Mangrove ecosystems provide structurally complex and nutrient-rich habitats that support diverse fish assemblages, particularly species adapted to estuarine and brackish conditions (Laegdsgaard & Johnson 2001; Arceo-Carranza *et al.* 2024). Among these, members of the family *Zenarchopteridae* (Beloniformes), commonly known as halfbeaks, are frequently associated with shallow coastal waters, estuaries, mangrove creeks, and lower reaches of rivers (Reznick *et al.* 2007; Lovejoy 2000; Lovejoy *et al.* 2004). These fishes typically occupy surface waters, where they exploit

abundant food resources such as small invertebrates and organic matter derived from mangrove productivity (Oya *et al.* 2002). The ecological characteristics of mangrove environments, such as fluctuating salinity, tidal influence, and dense root systems, offer shelter, feeding opportunities, and nursery grounds for zenarchopterid species (Guedes *et al.* 2024).

Lampung Province, situated at the southernmost tip of Sumatra, constitutes one of the important mangrove regions in Indonesia, encompassing extensive coastal and estuarine environments (Qurniati *et al.* 2024). These ecosystems provide structurally complex habitats characterized by tidal influence, salinity gradients, and high primary productivity, which collectively support diverse fish assemblages (Ariyanti *et al.* 2023). Such environmental conditions may significantly influence the occurrence, persistence, and distribution patterns of members of the family *Zenarchopteridae* in western Indonesian waters (Kottelat *et al*.1993). In this study, we document the first record of *Zenarchopterus gilli* from Lampung Province and provide updated information regarding its distribution in Indonesia.

Methods

Field observations were conducted at estuarine and mangrove habitats in Lampung Province, southern Sumatra, Indonesia. The study site was located in the Petengoran Mangrove area, within the Mangrove Forest Ecotourism Park of Petengoran, Gebang Village, Padang Cermin District, Pesawaran Regency, Lampung Province, Indonesia. The Petengoran mangrove area covers approximately 11 hectares and is predominantly dominated by *Rhizophora mucronate* (Wakhidah & Istiqomah 2025). This mangrove stand represents a relatively compact coastal ecosystem characterized by dense vegetation structure, where *R. mucronata* forms the principal canopy component. The species plays a significant ecological role in shoreline stabilization, sediment trapping, and providing habitat for various aquatic and terrestrial organisms. Survey locations comprised mangrove creeks, tidal channels, and shallow brackish-water zones along river mouths and adjacent coastal margins (Fig. 1). These habitats were selected because they represent typical environments inhabited by members of the family *Zenarchopteridae*, including species of *Zenarchopterus*.



Figure 1. The mangrove forest of the Petengoran mangrove area, a typical habitat where *Zenarchopterus gilli* is found in Lampung Province (Photograph: Muhammad Iqbal).

Several individuals of *Zenarchopterus gilli* were documented through visual surveys conducted in shallow estuarine and mangrove waters. Observations were made opportunistically along tidal channels and mangrove creeks, particularly in surface waters where halfbeaks are commonly encountered. Individuals were photographed in situ using a digital camera to capture diagnostic morphological characteristics. Photographic documentation and the collected specimen served as voucher material for species verification.

Identification of *Zenarchopterus gilli* was conducted using external morphological characteristics observed from photographs and the collected specimen. Diagnostic features evaluated included overall body form, elongation of the lower jaw, fin placement and configuration, and coloration patterns.

Species determination was verified through comparison with regional identification keys, original species descriptions, and authoritative sources such as Froese & Pauly (2000) and relevant taxonomic literature on *Zenarchopteridae*. The record of *Z. gilli* from Lampung Province was integrated with other documented occurrences of this species in Indonesia. All verified records were compiled to generate a preliminary species list for Lampung Province. Distributional data were compared with published reports from other regions of Indonesia to evaluate potential range extensions or new provincial records (Fig. 2). This study is descriptive and aims to provide baseline occurrence data to support future, more comprehensive surveys.

Results and Discussion

Field surveys conducted on 7 November 2025 in the Petengoran mangrove area, Pesawaran Regency, Lampung Province, documented the presence of *Z. gilli* in shallow estuarine waters. Several individuals were observed in surface waters along mangrove creeks and tidal channels, particularly during mid to high tide conditions. A limited number of male specimens were collected to confirm species identification through morphological examination.

Comparison with regional identification keys, original species descriptions, and authoritative references verified the specimens as *Z. gilli*. This finding represents the first confirmed record of *Z. gilli* from Lampung Province, southern Sumatra. Prior to this study, the species had been documented from northern Sumatra (Aceh and North Sumatra), Java, Bali, Lombok, Sulawesi, Halmahera, Kalimantan, Komodo, Maumere, and Raja Ampat (Table 1).

Table 1. Record of *Zenarchopterus gilli* from Lampung Province and a summary of its known localities in Indonesia. Note, NA is Not Available.

No.	Location	Date	Sources	Cordinates
1	Pulau Weh, Aceh Province	2003	Allen & Adrim 2003	5°49'N, 95°18'E
2	Pandaratan, Tapanuli Tengah, North Sumatra	Mar-Apr 2018	Pulungan *et al.* 2020	1°43'N, 98°47'E
3	Petengoran mangrove area, Pesawaran, Lampung Province	Nov 2025	This survey	5°34'S, 105°14'E
4	Sangalaki Island, Kalimantan	2003	Allen & Adrim 2003; Allen & Erdmann 2024	2°09'N, 118°31'E
5	Pulau Pari, Seribu Islands. North Jakarta	2014	Oktaviyani & Wibowo 2020	5°51'S, 106°36'E
6	Pulau Parang, Karimunjawa, Central Java	Jun & Sep 2012.	Pribadi *et al*. 2013; Maharani *et al.* 2020	5°44'S, 110°14'E
7	Kondang Buntung, Malang, East Java	Feb 2020	Putra 2020	8°26'S, 112°40'E
8	Northwest nd South Bali, Bali Province	1999, Jul & Aug 2025	Kottelat & Lim 1999; iNaturalist 2026	8°08'S, 114°32'E
9	Gerupuk, Lombok, West Nusa Tenggara	Jul 1996, Aug 1997	GBIF 2023	8°54'S, 116°20'E
10	Sulawesi (undetailed)	1999	Kottelat & Lim 1999	NA
11	Minahasa Utara, North Sulawesi	Nov-Dec 2023	iNaturalist 2026	1°44'N, 125°09'E
12	Bitung, North Sulawesi	Jan, Jul & Oct 2000	Kimura & Matsuura 2003; GBIF 2023	1°26'N, 125°11'E
13	Togean and Banggai, Central Sulawesi Province	2003	Allen & Adrim 2003	0°20'S, 121°55'E; and 1°35'S, 123°20'E
14	Halmahera (undetailed)	1999	Kottelat & Lim 1999	NA
15	Komodo Island, East Nusa Tenggara Province	2003	Allen & Adrim 2003	8°44’S, 119°25’E
16	Maumere, East Nusa Tenggara Province	2003-2004	Allen & Adrim 2003; Kuiter & Tonozuka 2004	8°36'S, 122°12'E
17	Raja Ampat, Papua Barat Daya Province	2009	Allen & Erdmann 2009	0°05S, 130°40'E

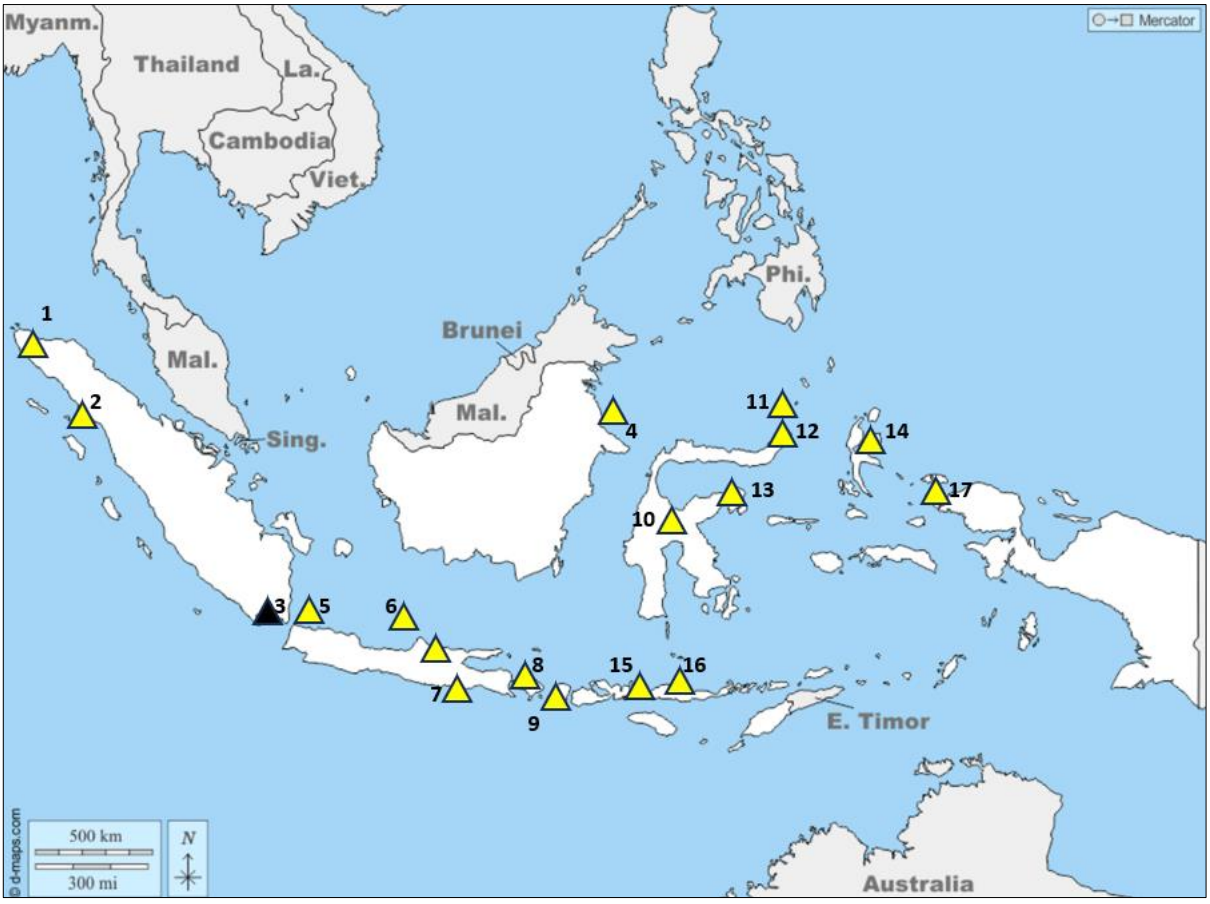


Figure 2. Map of Indonesia illustrating the known distribution of *Zenarchopterus gilli*. Yellow circles represent previously known records, and the black circle represents the recent record from Petengoran mangrove area of Lampung Province. The numbers on the map correspond to the sites listed in Table 1.



Figure 3. A male specimen of *Zenarchopterus gilli* collected on 7 November 2025 in the Petengoran Mangrove Area, Lampung Province (Photograph: Muhammad Iqbal).



Figure 4. Diagnostic characters of the anal and dorsal fin rays of *Zenarchopterus gilli* (based on a specimen from Lampung Province): males possess a markedly enlarged and elongated sixth anal-fin ray extending to the caudal-fin tip in adults, and an elongated fourth dorsal-fin ray that is distally thickened and recurved toward the caudal-fin base (Photograph: Muhammad Iqbal).

Species identification was confirmed through evaluation of diagnostic morphological features, including: elongated lower jaw characteristic of zenarchopterids; slender, laterally compressed body form; fin placement and configuration consistent with published descriptions; and distinct coloration pattern observable in situ and in the collected specimen (Fig. 3). Diagnostic features of the anal and dorsal fin rays of *Zenarchopterus gilli* include a markedly enlarged and elongated sixth anal-fin ray in males, extending to the tip of the caudal fin in adults, as well as an elongated fourth dorsal-fin ray that is distally thickened and recurved toward the base of the caudal fin (Fig. 4). These diagnostic characteristics conform to descriptions of *Z. gilli* in the relevant literature (Iqbal *et al*. 2018b, 2019; Kottelat *et al.* 1993; Froese & Pauly 2000).

The present record fills a geographic gap in the known distribution of *Z. gilli* along the western Indonesian archipelago. This species has a broad distribution extending from Madagascar and the Seychelles across the Indian Ocean to India (Andaman Islands), and further into the Indo-Pacific region, including Thailand, Viet Nam, Malaysia, the Philippines, Singapore, and Indonesia. Its range continues eastward to Micronesia (Guam, Federated States of Micronesia, and Palau), Papua New Guinea, northern Australia (from the Kimberley coast of Western Australia to the Mary River in Queensland), and Fiji (Weber & de Beaufort 1922; Collette 1974; Boseto *et al.* 2021). Although the species has been reported from both western (e.g., Aceh, North Sumatra and Java) and eastern Indonesia (e.g., Sulawesi and Papua), no previous documentation existed for Lampung Province. Biogeographically, Lampung occupies a strategic position at the southern tip of Sumatra, influenced by both Indian Ocean and Java Sea systems. The occurrence of *Z. gilli* in this region suggests: a broader and likely continuous coastal distribution across Sundaland; possible under-sampling of estuarine and mangrove habitats in southern Sumatra; and connectivity among coastal populations facilitated by larval dispersal and coastal current systems. Given the species' association with shallow coastal and estuarine habitats, its absence from previous records in Lampung likely reflects limited survey effort rather than true absence.

Acknowledgments
We gratefully acknowledge Universitas Indo Global Mandiri (UIGM) for its support of the field survey conducted in November 2025 in Lampung Province, Sumatra. We also sincerely thank the editor of Bio Palembanica and the anonymous reviewers for their valuable and constructive comments.

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