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First specimen-based record and preliminary assessment of the fisheries status of *Otolithoides pama* (Hamilton, 1822) (Perciformes: Sciaenidae) from the west coast of Peninsular Malaysia, Strait of Malacca

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Abstract

Otolithoides pama (Hamilton, 1822), commonly known as the pama croaker, is reported here from the west coast of Peninsular Malaysia based on recent specimens collected during ichthyofaunal surveys in Bagan Datuk, Perak (January 2024; n = 1) and Muar, Johor (June 2019; n = 3 and April 2025; n = 8). This represents the first voucher specimen-based distributional record of the species in Malaysian waters, where no locally deposited specimens have previously been documented. Historically, five preserved specimens of *O. pama* have been held in overseas institutions since 1922, highlighting a century-long gap in local representation. The species is widely distributed across the Bay of Bengal, from Pakistan and India to Bangladesh and Myanmar, with recent records extending to the Andaman Sea (Thailand). The twelve newly collected Malaysian specimens, including one juvenile and seven pre-adults (standard length 158–325 mm), suggest possible dispersal into the Strait of Malacca via the East Indian Ocean Current. Diagnostic features include a large body, small eyes, conical snout, large terminal mouth, short and weak second anal spine, and a pointed caudal fin. Morphometric and meristic analyses are provided, along with a phylogenetic tree based on the mitochondrial COI gene, supporting the monophyly of the species with observed intraspecific variation. This study marks a significant update to the known distribution of *O. pama* and contributes to the national ichthyological records with the first locally curated specimens.

Key words: croaker, tidal ebb, distribution range extension, adaptation, ichthyofauna

Introduction

The family Sciaenidae, commonly known as croakers or drums, comprises a diverse group of demersal fishes that are widely distributed across tropical and subtropical marine and estuarine ecosystems (Trewavas, 1977; Chao, 1986; Sasaki, 2001). These fishes play an important role in both commercial and artisanal fisheries throughout Southeast Asia, including Malaysia (Chong *et al.*, 2010). Nevertheless, many sciaenid species remain taxonomically ambiguous due to overlapping morphological characteristics, insufficient species descriptions in regional checklists, and frequent misidentifications in landing surveys.

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The genus *Otolithoides*, under the family Sciaenidae, comprises a small but morphologically distinct group of large-bodied croaker species inhabiting the Indo-West Pacific region (Mohan *et al.*, 1984; Talwar, 1995). Currently, it includes two recognized species: *O. pama* (Hamilton, 1822) and *O. biauritus* (Cantor, 1849). Both species are demersal, commonly occurring in estuarine and shallow coastal environments with muddy or silty substrates. They are characterized by an elongate and compressed body, a large oblique mouth with well-differentiated teeth, and a distinctive carrot-shaped swim bladder with branched appendages traits that distinguish them from related genera such as *Otolithes* and *Panna* (Sasaki, 1989; 2022). *Otolithoides biauritus* is more widely distributed and economically significant, particularly in South and Southeast Asia, whereas *O. pama* has a more restricted range and is less frequently recorded (Mohan, 1981; Talwar, 1995). Despite their commercial value, members of *Otolithoides* are often underreported or misidentified in landing surveys due to morphological similarities with other large sciaenids. This has led to gaps in species-level biodiversity records and highlights the need for specimen-based documentation and integrative taxonomic approaches that combine morphological and molecular data.

Otolithoides pama (Hamilton, 1822), commonly known as the Pama croaker and locally as Selampai Payau, is a large-bodied sciaenid species of considerable economic importance in countries such as Bangladesh, India, and Myanmar (Mohan, 1984). It inhabits estuarine and coastal waters, typically over muddy or silty substrates, and is usually caught using trawls and gillnets (Mohan, 1991). Despite its commercial value and its distribution across the northern Indian Ocean and western Indo-Pacific, confirmed records of *O. pama* in Malaysian waters are lacking (Fricke *et al.*, 2025), with no specimen-based validation to date.

This study presents the first specimen-based record of *Otolithoides pama* from the west coast of Peninsular Malaysia, specifically from the Strait of Malacca where a region characterized by its narrow continental shelf, high sediment load, and tidal mixing (Keller & Richards, 1967). The Strait of Malacca is not only one of the busiest shipping routes in the world but also supports diverse coastal fisheries that rely heavily on demersal species (Mohan, 1984; 1991). The southern section of the strait receives freshwater input from major rivers and experiences prolonged tidal ebb periods (Jagerroos, 2016), creating estuarine environments favorable for species such as *O. pama*. These habitats are further characterized by silty or muddy substrates, which provide optimal conditions for croaker species. In contrast, the northern section is influenced by seasonal monsoons and sediment transport from the Andaman Sea, resulting in variations in habitat suitability along the coast.

This study aims to: (1) confirm the occurrence of *Otolithoides pama* in Malaysia through voucher specimens and morphological verification; (2) describe its key distinguishing features to ensure accurate identification; and (3) provide preliminary insights into its fisheries status based on occurrence records and habitat observations. Understanding its distribution and status will support more effective management of sciaenid stocks in Malaysia and enhance biodiversity documentation for the Strait of Malacca.

Methods and Materials

Meristic and morphometric characters examined. Specimens were collected during multiple sampling periods in June 2019, January 2024, and April 2025 from several fish landing ports along the Strait of Malacca, specifically Muar and Bagan Datuk, as illustrated in Fig. 1. Identification was conducted by comparing their morphological characteristics and genetic markers with voucher specimens archived at Universiti Malaya (UMKL12895), Universiti Malaysia Terengganu (UMTF11527–UMTF11530), and Universiti Sains Malaysia (USMFC (48) 00020). Institutional acronyms follow Sabaj (2025). This study analyzed *Otolithoides* specimens from both recent field collections and institutional reference collections (Hanafi *et al.*, 2022; 2023). Species verification was further supported by descriptions and identification keys from previous studies (Trewavas, 1977; Mohan, 1984; Sasaki, 2001; Fricke *et al.*, 2025).

Morphological data. Following Hanafi *et al.* (2023), measurements were taken using digital calipers and recorded to the nearest 0.1 mm (Fig. 2). A total of 12 voucher specimens were deposited in the collections of Universiti Malaya (UMKL), Universiti Malaysia Terengganu (UMTF), and Universiti Sains Malaysia (USMF) (Table 1). Counting and measuring procedures followed Hubbs and Lagler (2004), while morphological descriptions of *Otolithoides* were based on Trewavas (1977), Chao (1978), Chao *et al.* (2019), Sasaki (1989), and Hanafi *et al.* (2022, 2023). Specimens were preserved and photographed according to the procedures outlined in Seah *et al.* (2015). Gill raker counts included rudimentary rakers on the first right gill arch (Hanafi *et al.*, 2022, 2023).

FIGURE 1. Sites of collection samples of *O. pama* species in West Coast of Peninsular Malaysia WCPM (Sites: Bagan Datuk, Pasar Awam Muar, Parit Tiram Muar, Sungai Muar, Teluk Intan, Sungai Kuala Perak).

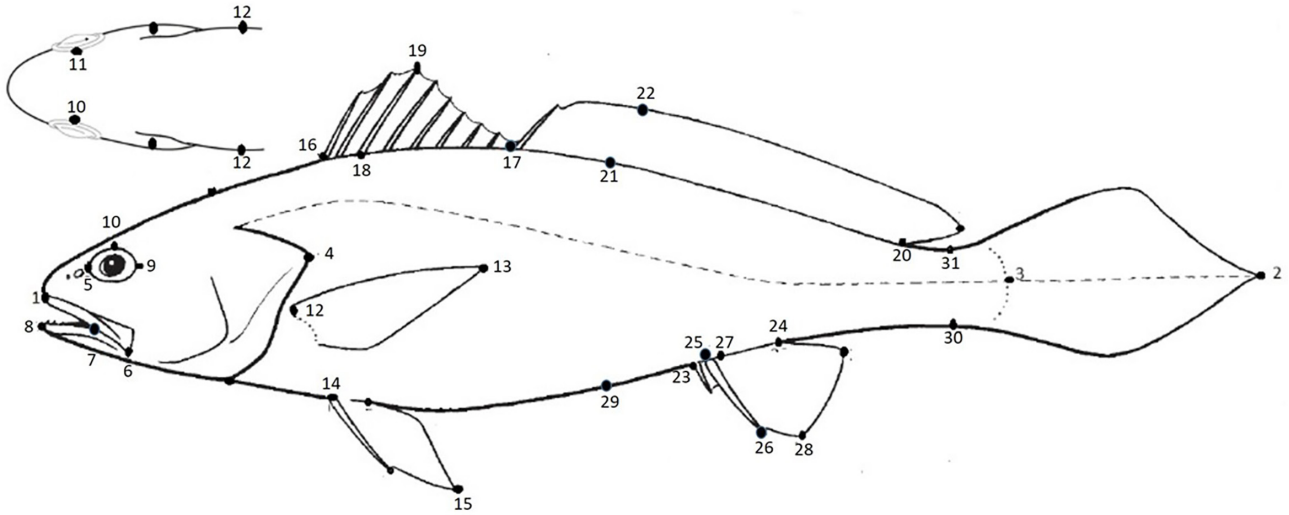

FIGURE 2. Measurements were based on a truss network protocol, anchored at thirty-one homologous anatomical landmarks with the exception of gill raker length (Hanafi *et al.*, 2023).

Molecular analyses. The cytochrome c oxidase I (COI) gene was used to infer phylogenetic relationships for 22 *Otolithoides* individuals in this study, integrated with sequences from the GenBank database. Genomic DNA was extracted using a G-spin™ Total DNA Extraction Kit (iNtRON Biotechnology, Inc., Seongnam, South Korea). The COI gene region was amplified and sequenced using the primers COI F1: 5′-TCAACCAACCACAAAGACATTGGCAC-3′ and COI R1: 5′-TAGACTTCTGGGTGGCCAAAGAATCA-3′ (Ward *et al.*, 2005). Each polymerase chain reaction (PCR) was performed in a 50 µl volume containing 20 µl sterile water, 2 µl genomic DNA, 25 µl Master Mix (NEXpro™, Korea), and 1.5 µl of each primer (10 mM). PCR cycling conditions followed Lo *et al.* (2017).

TABLE 1. Taxa, vouchers, locality and GenBank accession numbers of specimens of *Otolithoides pama* used in the phylogeny analysis.

Sampling Date	Locality	Latitude & Longitude	Field_Tag No	Ind.	*Scientific Name*	TL (Mm)	SL (mm)	Weight (G)	IUCN Status	Fisheries	Record	Otolith	Device	Collector
19/10/1922	Bagan Datuk, Perak	3°56'32.3"N 100°36'49.2"E	ANSP 77821	3	*Otolithoides pama* (Hamilton 1822)	-	-	-	DD	C	database record		-	GBIF
15/10/1922	Teluk Intan, Perak	4°01'33.2"N 101°01'16.7"E	CAS 30862	5	*Otolithoides pama* (Hamilton 1822)	-	-	-	DD	C	database record		-	GBIF
18/10/1922	Kuala Perak River, Perak	4°00'37.8"N 100°44'51.8"E	CAS 30863	3	*Otolithoides pama* (Hamilton 1822)	-	-	-	DD	C	database record		-	GBIF
27/10/1922	Muar, Johor	2°02'58.9"N 102°34'01.9"E	CAS 30864	4	*Otolithoides pama* (Hamilton 1822)	-	-	-	DD	C	database record		-	GBIF
15/10/1922	Teluk Intan, Perak	4°00'37.4"N 101°00'40.2"E	FMNH 47415	2	*Otolithoides pama* (Hamilton 1822)	-	-	-	DD	C	database record		-	GBIF
26/6/2019	Parit Tiram, Muar River	2°03'23.2"N 102°34'20.4"E	UMKL12895	3	*Otolithoides pama* (Hamilton 1822)	296.78-301.68	257.33-267.25	-	DD	C	specimen based record		Gill net	Hakim & Rasul
19/1/2024	Bagan Datuk	3°59'26.6"N 100°46'49.6"E	UMTF 11527	1	*Otolithoides pama* (Hamilton 1822)	185.84	150.86	56.4	DD	C	specimen based record		Trawl	Seah
11/4/2025	Pasar Awam Muar	2°03'08.6"N 102°34'16.9"E	UMTF 11528	1	*Otolithoides pama* (Hamilton 1822)	268.92	214.84	284.13	DD	C	specimen based record	Y	Gill net	Seah
11/4/2025	Pasar Awam Muar	2°03'08.6"N 102°34'16.9"E	UMTF 11529	1	*Otolithoides pama* (Hamilton 1822)	320.36	265.78	137.5	DD	C	specimen based record	Y	Gill net	Seah
11/4/2025	Pasar Awam Muar	2°03'08.6"N 102°34'16.9"E	UMTF 11530	1	*Otolithoides pama* (Hamilton 1822)	378.35	313.34	395.09	DD	C	specimen based record	Y	Gill net	Seah
14/4/2025	Muar River, near Muar Bridge	2°04'36.6"N 102°33'16.8"E	USMFC (48) 00020	5	*Otolithoides pama* (Hamilton 1822)	245.20-285.84	209.10-245.3	-	DD	C	specimen based record		Gill net	Hakim & Rasul

Amplifications were performed using an Applied Biosystems Veriti 96-Well Thermal Cycler (Applied Biosystems, Inc., Foster City, CA, USA). Sanger sequencing was conducted by MyTACG Bioscience Enterprise (Malaysia). All sequences were edited and aligned using MEGA v7.0 (Kumar *et al.*, 2018).

MEGA v7.0 was used to construct a Neighbor-Joining (NJ) phylogenetic tree (Kumar *et al.*, 2018). Kimura's two-parameter (K2P) model of substitution was applied to estimate genetic distances, and NJ bootstrap values were calculated with 1,000 replicates (Kimura, 1980). Model selection was automated using the Akaike Information Criterion (AIC) (Lefort *et al.*, 2017). The best-fit model identified was HKY85+G, incorporating a proportion of invariable sites and a gamma distribution with a shape parameter of 0.099. *Panna microdon* was used as the outgroup to root the tree. GenBank accession numbers for all sequences are provided in Table 2.

TABLE 2. Taxa, vouchers, locality and GenBank accession numbers of specimens of *Otolithoides* used in the DNA COI barcoding analysis.

No	Taxon	Museum ID	Own ID	Locality	Country	GenBank No.	Notes
1	*Otolithoides biauritus*	None		Kerala	India	PP565131	NCBI
2	*Otolithoides biauritus*	None		Islamabad	Pakistan	MF383188	NCBI
3	*Otolithoides biauritus*	None		Dhaka	Bangladesh	MF383187	NCBI
4	*Otolithoides biauritus*	None		Kerala	India	EF534127	NCBI
5	*Otolithoides biauritus*	None		Uttar Pradesh	India	EF536890	NCBI
6	*Otolithoides biauritus*	None		Maharashtra	India	EF536892	NCBI
7	*Otolithoides pama*	UMTF11527	PRK277	Bagan Datuk	Malaysia	PV952757	This study
8	*Otolithoides pama*	UMKL12895	-	Muar	Malaysia	-	This study
9	*Otolithoides pama*	USMFC (48) 00020	OP1	Muar	Malaysia	PV991191	This study
10	*Otolithoides pama*	USMFC (48) 00020	OP2	Muar	Malaysia	PV991190	This study
11	*Otolithoides pama*	USMFC (48) 00020	OP3	Muar	Malaysia	PV991189	This study
12	*Otolithoides pama*	USMFC (48) 00020	OP4	Muar	Malaysia	PV991188	This study
13	*Otolithoides pama*	USMFC (48) 00020	OP5	Muar	Malaysia	PV991187	This study
14	*Otolithoides pama*	None		Kerala	India	PP792681	NCBI
15	*Otolithoides pama*	None		Dhaka	Bangladesh	OQ346271	NCBI
16	*Otolithoides pama*	None		Sundarbans	Bangladesh	MF611579	NCBI
17	*Otolithoides pama*	None		Kolkata	India	MG787254	NCBI
18	*Boesemania microlepis*	None		Sumatra	Indonesia	LC064301	NCBI
19	*Boesemania microlepis*	None		-	Thailand	KP722706	NCBI
20	*Panna microdon*	None		Penang	Malaysia	KP722755	NCBI
21	*Panna microdon*	None		Selangor	Malaysia	KX778046	NCBI
22	*Panna microdon*	None		-	Thailand	KX778047	NCBI

Results

Genus *Bola* Hamilton, 1822 as a junior synonym of *Otolithoides* Fowler, 1933. According to Fricke *et al.* (2025) and the comprehensive reference by Talwar (1995), the genera *Sciaenoides* Blyth, 1860, and *Bola* Hamilton, 1822, are considered junior synonyms, both sharing the same type species, *Pama pama* Hamilton, 1822. These conclusions were drawn from a thorough analysis of Hamilton's (1822) monograph and a review of relevant literature. *Pama pama* shares diagnostic characteristics with the type species of the genus *Otolithoides*, *Bola pama* Hamilton, 1822, particularly the carrot-shaped swim bladder with a single pair of appendages arising from the posterior end of the bladder and extending forward into the head, where they branch beneath the skull, as described by Trewavas (1977) and later confirmed by Talwar (1995).

Literature record of nominal species of *Otolithoides pama* (Hamilton, 1822). Several taxonomic names of *Otolithoides* species commonly used in the literature have been identified. Table 3, Fig. 3, and Fig. 4 present the

Otolithoides species reported from Malaysian sources, along with their current taxonomic status, based on their photo evidence. The references in Table 3 were compiled and revised from a literature review on Malaysian waters (Mohsin *et al.*, 1996; Chin *et al.*, 1998; Sasaki, 2000; Mohamad Faisal, 2009; Lim, 2009; Ambak *et al.*, 2010; Matsunuma *et al.*, 2011; Kimura *et al.*, 2015; Ng *et al.*, 2015; Atan *et al.*, 2010; Shah, 2017; Lim *et al.*, 2018; Seah *et al.*, 2021). Figure 5 illustrates the spatial distribution of *Otolithoides pama* in the Strait of Malacca. Descriptions and identification keys from previous works were also used to cross-check all species identifications (Trewavas, 1977; Mohan, 1972, 1981; Sasaki, 1996, 2001; Fricke *et al.*, 2025).

Molecular verification. This study reconstructed phylogenetic relationships using COI genetic markers for *Otolithoides* species, incorporating GenBank sequences to clarify the taxonomic status of *O. pama* relative to its congeners (Lo *et al.*, 2017), as shown in Fig. 6. The phylogenetic tree indicated that *O. pama* forms a sister clade with *O. biauritus* and is closely related to *B. macrolepis*. Meanwhile, *Panna microdon* formed the basal clade, with high bootstrap support confirming the branching pattern and species validation. Pairwise K2P genetic distances (Table 4) revealed that *O. pama* is 20% divergent from *O. biauritus*, 25% from *B. macrolepis*, and 26% from the outgroup *P. microdon*. In conclusion, the *Otolithoides* species analyzed in this study formed a monophyletic clade, with morphological and genetic evidence jointly supporting the distinct taxonomic status of *O. pama*.

TABLE 3. *Otolithoides* species listed in several references from Malaysian waters and their status.

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Remarks
Otolithoides biauritus	+	V	-	V	V	-	V	-	-	-	V	V	V	-	Valid
Otolithoides pama	+	-	-	-	-	-	-	-	-	-	-	-	-	-	Valid

Reference name: (1) This study; (2) Mohsin *et al.*, 1996; (3) Chin *et al.* 1998; (4) Sasaki (2000); (5) Sasaki, 2001; (6) Mohamad Faisal, 2009; (7) Lim, 2009; (8) Ambak *et al.* 2010; (9) Matsunuma *et al.* 2011; (10) Kimura *et al.* 2015; (11) Ng *et al.* 2015; (12) Atan *et al.* 2010; (13) Lim *et al.* 2018; (14) Seah *et al.* 2021.

v Correct record; - No record; + This study

TABLE 4. Genetic distances for the COI gene among congener species with *Otolithoides pama* species and *Sparus aurata* as an outgroup.

	O. biauritus	***O. pama***	***B. microlepis***	***P. microdon***	***Sparus aurata***
O. biauritus					
O. pama	0.0205				
B. microlepis	0.0212	0.0253			
P. microdon	0.0240	0.0264	0.0211		
Sparus aurata	0.0372	0.0353	0.0405	0.0332	

Systematics

Genus *Otolithoides* Fowler, 1933

Otolithoides Fowler, 1933, *Bull. U. S. Nat. Mus.*, **100, 12**: 364; Type species: *Otolithus biauritus* Cantor, 1850, type locality: Sea of Penang, Malaya; Weber and de Beaufort, *Fish. Indo-Aust. Archipel.,* 7:499–500, 1936; Chu, Lo & Wu, *Monogr. fish. China*: 36–37, 1963; Yazdani, *J. Zool. Soc. India,* **15: 65,** 1963 (1966); Dutt and Thankam, *J. Bombay Nat. Hist. Soc.*, **65 (2)**: 343, 1968.

Sciaenoides Blyth, 1860, J. Asiat. Soc. Beng. **29 (2)**:139; Type species: *Otolithus biauritus* Cantor 1850, type locality: Sitang River, Day, *Fish. India*: 193, 1878.

Pama Fowler, 1933, *Bull. U. S. Nat. Mus*. **100, 12**; Type species: *Bola pama* Hamilton 1822; type locality: Calcutta. Weber and de Beaufort, *Fish. Indo-Aust. Archipel*., **7**: 475, 1936. Yazdani, *J. Zool. Soc. India*, **15**: 65, 1963 (1966).

Diagnosis genera. The genus *Otolithoides* is distinguished from other Sciaenidae genera by the following combination of features: (1) swimbladder with one diverticulum on each side, attached near the posterior end; (2)

vertebrae 12+13, with the third bearing a pair of ventral apophyses that do not meet below; (3) interorbital width 26–33% of head length; (4) lateral line scales cycloid, usually covered with small subsidiary scales; (5) second anal spine weak; (6) sagitta with a large pouched "head" and a "tail" only slightly curved and ending in a disc; and (7) absence of predorsal bones (Trewavas, 1977).

Remarks on genus: The genus *Pama* (Fowler, 1933) is not recognized, as the generic diagnostic characters such as the swimbladder and sagitta type which of its type species, *Otolithoides pama*, are the same as those of *Otolithoides biauritus*. Examination of the syntypes and lectotypes of *O. brunneus* (Day) and *O. biauritus* (Cantor) confirmed that the former is a synonym of the latter (Talwar, 1995).

Key to the species of *Otolithoides* in the West Coast of Peninsular Malaysia waters

1a. Swimbladder with diverticula of each side arise from anterior end and immediately dividing into a cephalic and an abdominal branch . . . . . *Panna* Mohan 1969
1b. Swimbladder with one diverticulum on each side, attached near posterior end 2
2a. Body depth 12% SL; eye diameter 13% of HL; soft dorsal fin rays 27 to 29 . . . . . ***Otolithoides biauritus*** (Cantor, 1849)
2b. Body depth 21–25% SL; eye diameter 10–11% of HL; soft dorsal fin rays 40 to 45 . . . . . ***Otolithoides pama*** (Hamilton 1822)

Otolithoides pama (Hamilton, 1822)

(Common name: Pama Croaker; standard Malay name: Selampai Payau)
(Fig. 3–4, Table 5–6)

Bola pama: Hamilton, 1822, *Fishes of Ganges*: **79**, 368, pl. 32, fig.26 (type locality: Ganges estuaries); Day, 1869, *Proc. Zool. Soc. London.*: 516.
Siaena pama: Cuvier, 1830, *Hist. Nat. Poiss*., **5**: pls 101, 138 and 140.
Collichithys pama: Gunther, 1860, *Cat. Fishes Br. Mus.*, **2**: 316; Volz, 1903, *Zool. Jb*, (syst), **19**: 358; Duncker, 1904, *Mitt. Naturh. Mus. Hamb.*, **21**: 155; Fowler, 1932, *Proc. Acad., nat. Sci. Philad.*, **83**: 446.
Otolithus pama: Mason, 1860, *Burmah Nat. Resources*: 695.
Sciaenoides hardwickii: Blyth, 1861, J. Asiat. Soc. Beng., **29 (2)**; 139 (type locality: Mouth of Gangetic rivers. ?ZSI 884).
Sciaenoides pama: Blyth, 1861, *J. Asiat. Soc. Beng.*, **29 (2)**; 139; Day, 1876, *Fishes of India*: 193; Day, 1889, *Fauna Br. India*, **2**: 124; Vinciguerra, 1885, *Annali Mus. Civ. Stor. Nat. Giacoma Doria*, **(2) 2**: 88; Vinciguerra, 1889, *Annali Mus. Civ. Stor. Nat. Giacoma Doria*, **(2) 9**: 169; Steindachner, 1896, *Annali Naturh. Mus. Wien*., **11**: 227; Lloyd, 1907, *Rec. Indian Mus*., **1**: 226; Hardenberg, 1931, *Treubic*, **13**: 133.
Pama pama: Fowler, 1933, *Bull. U. S. Nat. Mus.*, **100, 12**: 360; Hardenberg, 1934, *Treubic*, **14**: 309; Weber and de Beaufort, 1936, *Fish. Indo-Aust. Archipel.,* **7**: 496; Misra, 1962, *Rec. India. Mus*., **57**: 272; Munro, 1967, *Fishes of New Guinea*: 344; Ahmad, 1971, *Rec. Zool. Surv. Pakistan*, **2**: 134, fig. 6; Talwar, 1976, *J. Inland Fish. Soc. India*, **7**: 37; Jayaram, 1981, *Handbook Zool. Surv. India*, **(2)**: 329.
Otolithoides pama Mohan, 1972*, Indian J. Fish.*, **16**: 90; Fischer and Whitehead, 1974, *FAO species identification sheets for fishery purposes*, **3**: SCIAEN Otold 2; Trewavas, 1977, *Trans. Zool. Soc. Lond*., **33**: 302, fig. 52; Mohan, 1981, *Indian J. Fish.*, **28**: 3, fig.4.
Otolithoides pama (Hamilton, 1822): Atan *et al.*, 2010: 195.

Material examined. Non-types: UMKL (3, 257.33 to 267.25 mm SL), Parit Tiram Muar River, Muar, Johor, Malaysia, 26 June 2019; UMTF 11527 (150.86 mm SL), Bagan Datuk, Perak, Malaysia, 19 January 2024; UMTF 11528 (214.84 mm SL), Muar Fish Market, Muar, Malaysia, 11 April 2025; UMTF 11529 (265.78 mm SL), Muar Fish Market, Muar, Malaysia, 11 April 2025; UMTF 11530 (313.34 mm SL), Muar Fish Market, Muar, Malaysia, 11 April 2025; USM (48) 00020 (5, 209.10 to 245.3 mm SL), Muar River, near Muar Bridge, Muar, Malaysia, 11 April 2025;.

Diagnosis. A species of genus *Otolithoides* with the following combination of characters: a large species with a conical snout and large terminal mouth; eye diameter size small (9 to 11% of HL); upper jaw reaching back beyond eye. Teeth well-differentiate enlarged in both jaws, with 1 or 2 pairs of canines in upper jaw. Lower gill rakers 10, long at join of arch, shorter in front. Dorsal fin with 10 spines, second part of the fin with 1 spine and 40 to 42 soft rays; the second anal spine short and weak; caudal fin pointed. Scales cycloid on head, elsewhere ctenoid; lateral line scales reaching to tip of caudal fin. Swimbladder carrot-shaped, with a single pair of appendages, arising from posterior end of bladder and running forward beside it enter head beneath the skull.

FIGURE 3. Photographs of the comparative materials. *Otolithoides pama,* UMTF 11527, 150.86 mm SL, Bagan Datuk, Perak, Malaysia, 19 June 2024.

FIGURE 4. Photographs of the comparative materials. *Otolithoides pama,* USMFC (48) 00020, 106 mm SL, Muar River, Johor, Malaysia, 14 April 2025.

Description. Counts and measurements of the type specimens are shown in Table 5. The following data is provided for the Talwar (1995) measurement first as comparison, followed by the size range and mean for the following specimen vouchers.

A large species with a fairly slender body with a conical snout; large terminal mouth, upper jaw reaching well beyond eye; eyes very small (9.4–11.4% of HL); Interorbital (23.3–28.7% of HL) region broad and conical; operculum with two flat weak spines; preopercle margin serrated, the serrations at its angle. No rostral pores; marginal pores 5, very small, at or under edge without notching it. Mental pores two pairs, minute, anterior pair on

front of chin. Teeth well-differentiate enlarged in both jaws, with 1 or 2 pairs of canines in upper jaw and a tip of lower jaw. Lower gill rakers 10, long at joint of arch, shorter in front. Dorsal fin with 10 spines, followed by a low notch, second part of the fin with 1 spine and 40 to 42 soft fin rays; pectoral fin as long as or longer than head; anal fin with 2 spines and 7 soft rays, the 2nd spine short and weak (11.8–16.1% of HL); caudal fin pointed (very long and tapering in juveniles). Scales small and cycloid (smooth on head), elsewhere ctenoid (rough to touch), very small above anterior part of lateral line; lateral line scales reaching to tip of caudal fin, scale rows 12 above lateral line, while scale rows 14 below the lateral line. Swimbladder carrot-shaped with a single pair of appendages, arising from posterior end of bladder and running forward beside it to enter the head where they branch under the skull.

Swimbladder (Fig. 7a) carrot-shaped with a pair tubule originating near its posterior end and extending forwards into head, where they give off several branches. Otolith (sagitta) (Fig. 7b) with a tadpole-shaped impression on its inner side, of which the 'head' is heavily pouched and the 'tail' is attached on its dorsal side and nearer the anterior end that the posterior, the 'tail' is moderately deep and nearly straight.

Color in fresh. light browning along the back and silvery-white on belly, with on distinctive markings, head shot with golden and purple. Fins yellowish, the purple half of dorsal fin gray.

Geographical distribution. India: Ganga River and Brahmaputra River and its estuaries; Burma: Sittang River; Sumatra; Guinea (Talwar, 1995); Peninsular Malaysia: Perak River and Muar River (this study). Inhabits coastal waters and enters estuaries and rivers to the upper tidal limit and beyond.

Remarks. Based on Sasaki (1996), *Otolithoides pama* is distributed from Pakistan (Karachi; Ahmad, 1971) to Burma. Fowler (1932) reported the species from Singapore, although the specimen has not been located. Mohan *et al.* (1972) and Mohan (1983) noted that *O. pama* occurs only in the Bay of Bengal and adjacent waters. In Malaysian waters, the species has often been misidentified or synonymized under the names *Panna microdon* or *Otolithoides biauritus* (Sasaki, 2001; Table 6). The present study (Fig. 5) provides new specimen-based records from the west coast of Peninsular Malaysia, specifically from Bagan Datuk, Perak, and Muar, Johor. Sasaki (2022) previously documented collections from the western Indian Ocean, particularly the Bay of Bengal. The extended distributional evidence presented here therefore suggests that populations of *O. pama* may now be established in Malaysian waters.

FIGURE 5. The maps shown the distribution of *Otolithoides pama* in Bay of Bay Bengal and adjacent countries (green shaded layout). Two red star marks shown the extension records of site of collection samples of *O. pama* in Bagan Datuk and Muar, West Coast of Peninsular Malaysia, Strait of Malacca respectively.

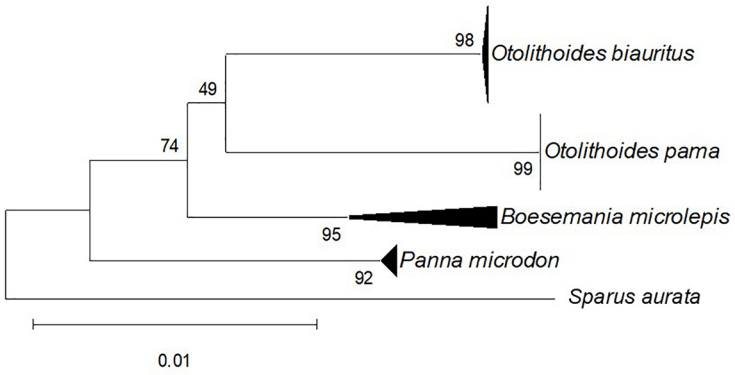

FIGURE 6. Neighbor-joining phylogenetic tree of *Otolithoides* based on COI sequences with *Sparus aurata* as the outgroup. Bootstrap values (neighbor-joining [NJ]/maximum likelihood [ML]) are shown on the nodes.

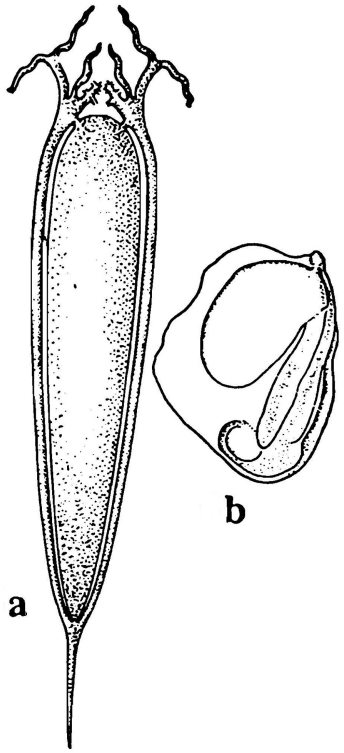

FIGURE 7. The figure shown *Otolithoides pama* (Hamilton, 1822); a. Systematics view of swimbladder; b. Inner surface of sagitta (derived from Mohan, 1984).

Based on Trewavas (1977), juveniles and early stages of *Otolithoides pama* have been reported year-round in the coastal waters off Orissa, and in all months except during the flood season (July–September) at Barrackpore, approximately 125 miles inland. Further upstream in the Hooghly River, the species occurs in progressively smaller numbers, extending as far as the tidal influence reaches. Pantulu and Jones (1951) observed that the species becomes very rare about 170 miles from the sea and is nearly absent at the highest tidal limits of the Hooghly, such as Mokema Ghat, Dighwara, and Buxar on the Ganges, as well as Khaghari on the Burhi Gandak. These findings, particularly during the monsoon months, suggest that *O. pama* is capable of breeding in both freshwater and marine environments.

TABLE 5. Morphometric measurements (expressed as %HL, %SL and %ED) and meristic counts of *Otolithoides pama.*

	Talwar (1995)	voucher specimen, N=4 (UMTF11527-11530)			
		min	max	mean	SD
Standard Length (mm)		150.9	313.3	236.2	
Head Length (mm)		27.7	29.9	28.8	
Eye Diameter (mm)		9.4	11.4	10.6	
MERISTICS					
1st dorsal-fin spine	IX–X	X	X		
2nd dorsal-fin spine	I	I	I		
2nd dorsal-fin soft rays	41–43	40	42		
Anal-fin spine	II	II	II		
Anal-fin soft rays	7	7	7		
Pectoral-fin rays		19	19	19	
Outer gill rakers of 1st arch		14	14	14	
upper limb	4–6	5	5	5	
lower limb	11–15	10	10	10	
Inner gill rakers of 1st arch		11	11	11	
upper limb		3	3	3	
lower limb		8	8	8	
Pored lateral line scales	44–48	49	49	49	
Circumpeduncular scales		25	25	25	
Scales above lateral line	10–11	12	12	12	
Scales below lateral line		14	14	14	
-scale on the body		ctenoid			
-scale on the head		cycloid			
Measurements as %SL					
Head length	27.8–34.0	27.7	29.9	28.8	0.9
Pectoral-fin length		22.7	24.4	23.6	0.8
Pelvic-fin length	26.0–27.2	16.4	18.0	16.9	0.8
Body depth (D1-P2)	21.4–24.5	23.5	25.5	24.4	0.9
Body width (P1-P1)		10.9	13.1	12.2	1.0
1st dorsal-fin base length		14.1	15.2	14.8	0.6
longest spine length		8.8	10.8	9.7	0.9
2nd dorsal-fin base length		50.2	54.3	51.8	1.9
longest ray length		7.9	8.6	8.2	0.3
Anal-fin base length		6.5	6.6	6.5	0.1
2nd anal spine length	3.0–4.5	3.3	4.7	4.0	0.6
1st anal fin ray length		10.3	11.2	10.6	0.4
Snout to anal-fin origin		71.1	73.6	71.8	1.2
Snout to 1st dorsal-fin origin		29.0	29.7	29.3	0.3
Snout to 2nd dorsal-fin origin		42.9	44.0	43.4	0.4
Snout to pectoral-fin insertion		27.9	29.8	29.1	0.9
Snout to pelvic-fin insertion		30.2	32.6	31.4	1.0
Caudal-peduncle depth		6.8	7.6	7.1	0.3
Measurements as %HL					

.....continued on the next page

TABLE 5. (Continued)

	Talwar (1995)	voucher specimen, N=4 (UMTF11527-11530)			
		min	max	mean	SD
Snout length	24.0–26.8	23.8	25.5	24.5	0.8
Maxillary length		47.5	49.4	48.7	0.9
Upper jaw length	47.8–50.0	39.1	42.1	40.6	1.5
Lower jaw length	51.4–54.2	34.6	39.3	36.4	2.1
Eye diameter	10.2–11.7	9.4	11.4	10.6	0.9
Interorbital width	29.0–32.4	23.3	28.7	26.7	2.5
2nd anal spine length	12.0–14.4	11.8	16.1	13.9	1.8
1st anal fin ray length		35.8	37.4	36.9	0.7
Longest gill raker on 1st arch		6.0	10.5	7.9	2.0
Longest gill filament on 1st arch		6.5	13.7	10.8	3.0

TABLE 6. Selected measurement of comparative morphology of *Otolithoides pama* and *O. biauritus.*

Characteristic	***O. pama***	***O. biauritus***
Head region	Conical snout and large terminal mouth	Fairly acute snout and large terminal mouth
Teeth formation	Enlarged in both jaws, with 1 or 2 pairs of canines in upper jaw	Strong and spaced in both jaws, no canine teeth
Dorsal fin rays	40–45	27–32
Caudal fin types	Tapering Pointed	Acutely Pointed
Lower gill rakers	11 to 14, long slender	10 to 11, shorter
Color	Yellowish at fins	Dark brown at fins
Pectoral fin length	Long, as long as /longer than head	Moderate, about ¾ of head length

Discussion

Emerging presence and distribution. The recent documentation of *Otolithoides pama* in Perak and Johor constitutes the first confirmed specimen-based records of this species in Malaysian waters, indicating either a range expansion or a re-establishment in the region. This finding is significant, as *O. pama* has historically been reported from the coastal and estuarine environments of the Bay of Bengal (Mohan, 1983; Sasaki, 1996; 2022), but its presence in Malaysia had not been previously verified. The confirmed specimens from Bagan Datuk (Perak) and Muar (Johor) likely reflect natural dispersal processes, possibly facilitated by regional oceanographic dynamics.

Role of ocean currents in dispersal. The distributional expansion of *Otolithoides pama* is most plausibly associated with seasonal and large-scale ocean currents. In particular, the East India Coastal Current (EICC) promotes southward larval dispersal during the northeast monsoon, facilitating drift from the Bay of Bengal into the Andaman Sea (Schott & McCreary, 2001). Connectivity between the Andaman Sea and the Strait of Malacca which is a semi-enclosed waterway shaped by monsoon- and tide-driven circulation where provides additional pathways for westward dispersal (Shchepetkin & McWilliams, 2005; Mohan, 1991). These passive transport mechanisms align with biogeographic shifts documented in other coastal fishes (Lim *et al.*, 2021; Shen *et al.*, 2011), supporting the hypothesis that *O. pama* has naturally expanded its range into Malaysian waters.

Fisheries relevance. At present, *Otolithoides pama* does not contribute significantly to Malaysian fisheries. Its occurrence appears to be limited to incidental catches from artisanal gears such as trawl nets and bottom-set gillnets. The absence of species-specific monitoring, coupled with its low relative abundance, likely explains why it remains unreported in official fisheries statistics and local markets. Nevertheless, given its large body size and desirable flesh quality documented in other parts of South and Southeast Asia (Mohan, 1984), the species holds potential commercial value should local populations become established. However, any fisheries development should be pursued cautiously in light of current knowledge gaps.

Management implication and research needs. The emergence of *Otolithoides pama* in Malaysian waters has important implications for biodiversity monitoring and marine resource management. Given its current IUCN Red List status as Data Deficient (DD) (Hasan *et al.*, 2020), there is an urgent need for dedicated research to evaluate its population structure, reproductive biology, distribution patterns, and ecological interactions within Malaysian ecosystems. Particular attention should be directed toward its potential niche overlap with other sympatric sciaenids, as this may influence both ecosystem dynamics and fisheries productivity.

The inclusion of *Otolithoides pama* in national biodiversity inventories and fisheries databases is essential for effective early-stage monitoring. Proactive measures such as species-specific landing records, larval dispersal modeling, and molecular stock assessments are necessary to evaluate its potential sustainability as a fisheries resource while also anticipating the possible ecological impacts of its establishment in Malaysian coastal waters.

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