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Record of Rare Eelgoby, *Taenioides mordax* (De Vis, 1883) in the Nareri Lagoon, Sindh, Northern Arabian Sea

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Abstract

Over five decades, eastern eelgoby, *Taenioides mordax* (De Vis, 1883) remained native to Cairns to Townville (Queensland) and Sydney to Newcastle (New South Wales) Australia. In this study, two specimens, measuring 19.8 cm in total length and weighing 20.25 grams, were collected from Nareri lagoon, Badin, Sindh. The specimens were collected with an encircled small gillnet installed over the night in shallow water. The body shape of the eelgoby is elongated, scaleless, tiny eyes, mouth upturned with large-sharp canine teeth 12/10 on the upper and lower jaws, respectively. The single continuous dorsal fin, anal fin connected with caudal fin and reaching to opening ventrally, pectoral fin and pelvis are short. The shape of the sagitta is oblong, margin smooth, and prominent rostrum, whereas the anti-rostrum is understated. On the posterior side, a distinct grove can be seen. The sulcus acusticus, ostium and cauda are invisible. Based on these features, the specimens were confirmed eastern eelgoby. To the best of our knowledge, this is the second confirmed record of this species found in the world.

Keywords: Burrowing goby, Nareri lagoons, global record, northern Arabian Sea

Introduction

The marine ecosystem of the northern Arabian Sea, Pakistan (Western Indian Ocean region) is highly productive and serves as a rich source of livelihood, food, transportation and natural beauty. The healthy ecosystem supports biodiversity, which ultimately sustains the economies of many coastal countries[1]. However, sustainable use of marine resources is in a challenging situation owing to overharvest, climate and degradation of habitats causing deterioration of natural resources[2,3].

Historically, left bank outfall drainage (LBOD) which was constructed to channel sewerage into Arabian Sea caused massive change at the lower Indus delta region leading to the transformation of freshwater lakes into the brackish lagoons. Additionally reduced silt deposition due to decreased freshwater flow and rising sea level further contributed to the degradation of the lower delta, turning freshwater lakes into saline lagoons[3].

The catchment area for these lagoons spans over six thousand square kilometers and has very low salinity, ranging from zero to fifty parts per thousand[3]. Despite this, the lagoons support a variety of euryhaline aquatic organisms, contributing to unique biodiversity[2].

Gobies, a group of small fishes that belong to the family Gobiidae are of great variety in body color, pattern, behaviour and adaptations. They are mainly found in lagoons, coastal areas, and estuaries of tropical and subtropical waters globally. These

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fishes boast a vibrant color pattern, smart camouflage and modified sup-like fins to be used to stay on the bottom. Sub-family Amblyopinae of the family Gobiidae comprises of (eel gobies or worm gobies), which are typically inshore and mud-dwelling fishes with elongated bodies of great variety[4].

Eastern eelgoby, *Taenioides mordax* is yet to be limited to Cairns, Townville (Queensland) and Sydney to Newcastle (New South Wales) Australia[5,6]. According to the nomenclature available in the Fishbase, *Leme mordax* is an unaccepted synonym, while *Taenioides mordax* is an accepted name[6]. This study aims to confirm the presence of this species in the small-scale fishery of lagoons. It thoroughly describes the findings, including otolith analysis, and provides important information on the species' taxonomy and distribution.

Materials and Methods

Two specimens, each measuring 19.8 cm in total length, were collected from the Nareri lagoon N 24°19.161, E 068°38.367, situated in the southernmost region of Sindh province, Pakistan. An eight-meter deep and 100-meter-long encircled gillnet of 1.5 cm knot-to-knot mesh size was installed over the night in the lagoons **(Fig 1)**. From the mixed catch, two specimens were opportunistically collected and immediately placed in the icebox and transported to the Centre of Excellence in Marine Biology, University of Karachi, for further analysis. After morphological and taxonomic validation, the length, weight and sex was recorded (Table 1).

Table 1. Morphometric and meristic count of eastern eelgoby collected from Nareri lagoon, Badin, Sindh.

Fish body measurements	Unit
Total length (TLcm)	19.8
Standard length (SLcm)	17.6
Total weight (TWgrams)	20.25
Head length (HLcm)	2.7
Girth cm (circumference)	4.5
Dorsal fin length cm	13
Pectoral fin cm (height)	0.9
Pelvic fin length cm	1.2
Caudal fin length cm	1.8
Anal fin length cm	10.3
Dorsal fin rays	48
Caudal rays	6
Anal rays	44
Pectoral rays	15
Pelvic rays	6
Teeth upper jaw	12
Teeth lower jaw	10

The sagitta otolith was carefully taken out, washed, labeled and photographed as a supporting tool for robust identification.

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Figure 1. A mixed fish catch being landed on-the-spot caught using a fixed-gillnet of 1.5 cm mesh size (knot-to-knot) installed overnight in Nareri lagoon on 26 February 2024.

Results and Discussion

In this study, a confirmed record of the eastern eelgoby, *Taenioides mordax* belongs to the family Oxudercidae and subfamily Amblyopinae, was discovered in the Nareri lagoon **(Table 2)**. The presence of this species in the lagoon validates that *T. mordax* was already present there, as the local biologists in Pakistan could not confirm its presence, given the low likelihood of its distribution through other means such as invasiveness.

Table 2. Traditional classification of the species

Class:	**Actinopterygii**	
Order:	Gobiiformes	
Family:	Oxudercidae	
Subfamily:	Amblyopinae	(Valenciennes, 1837)
Genus:	*Taenioides*	(Lacepede, 1800)
Species:	*mordax*	(De Vis, 1883)

Diagnosis characters

Overall body shape of eelgoby is elongated with single continuous dorsal and anal fin, caudal fin short (**Fig 2**).

Figure 2. Eelgoby, *Taenioides mordax* (A), head and teeth profile (B), and later view of the head and pelvis (C).

The continuous anal fin ends at the opening (anus). The body lacks scales and has tiny eyes and an upturned mouth with 10/12 sharp canine teeth. The pectoral and pelvic fins are short, and the body color ranges from maroon to violet slightly at the caudal peduncle. The swimbladder is short, and there are two whitish glands that presumably help the fish breathe during burrowing (**Fig 3**).

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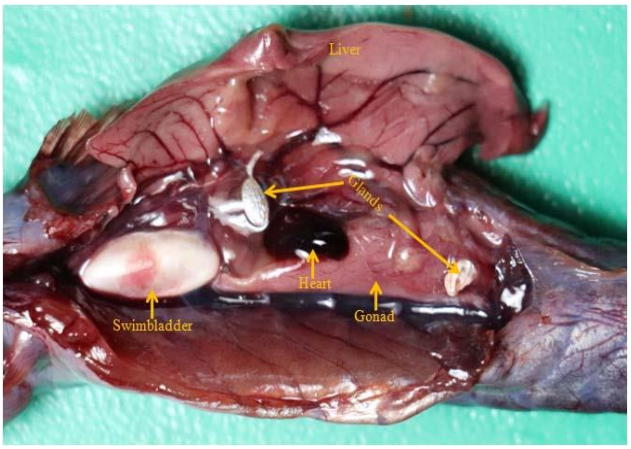

Figure 3. A close-up view of the body cavity showing position of liver, heart, gonads, swimbladder in eelgoby, with an arrow pointing to an unidentified gland.

Otolith shape description

The sagitta has a distinct shape, characterized by a smooth margin and a prominent rostrum, with an indistinguishable anti-rostrum. A noticeable grove is present on the posterior side. The sulcus acusticus, ostium, and cauda are not visible. Because of its species-specific characteristics, the otolith plays a crucial role in fish taxonomic studies for species identification (**Fig 4**).

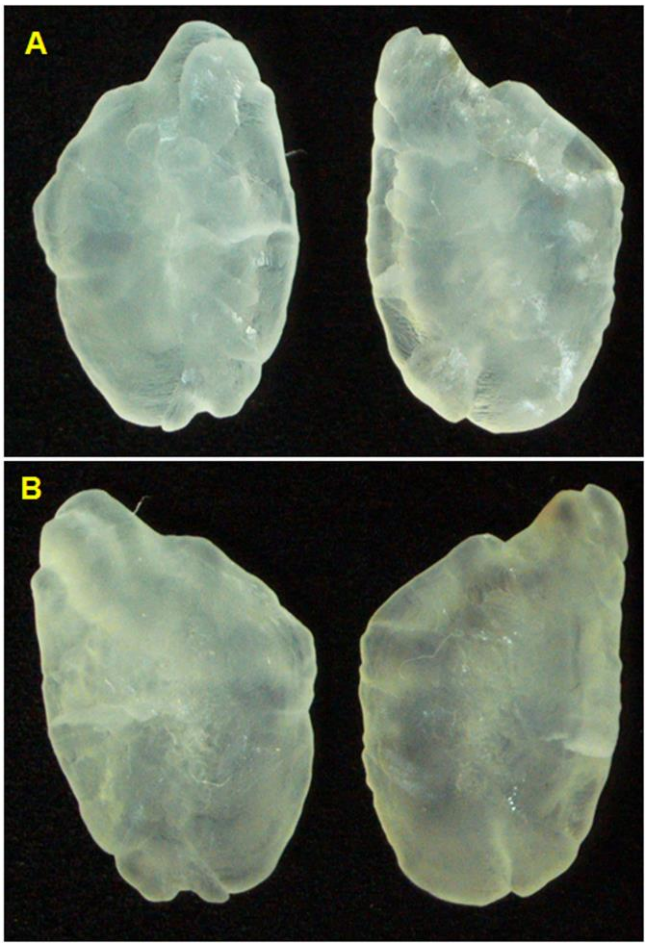

Figure 4. Ventral view (A) and dorsal view (B) of the left and right otoliths (sagitta) extracted from eel goby inhabiting in Nareri lagoon, Badin, Sindh.

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Distribution

This species, previously reported merely from Cairns, Townville (Queensland), and Sydney to Newcastle (New South Wales) Australia [5,6,7] has now been encountered in Pakistan after more than five decades. The identification of this species is based on the earlier studies on eelgoby reported by[5,6].

Habitat

The eastern eelgoby is well-known for burrowing and is found in soft-bottom habitats such as estuaries, muddy coastal areas and lagoons. The biodiversity indicators for the Badin lagoons are low, probably because of sudden salinity fluctuations, which only resilient species can endure[7]. This study provides the new record thorough analysis of the distribution and morphology of the eastern eelgoby, *Taenioides mordax*. The first recorded specimen of *T. mordax* was caught by G Logan in the Clarence River, New South Wales, and subsequently transported to the Northern Region Fisheries Office at Maclean[5,6,7]. An image of the fish was then sent to the Austrian Museum for identification[7]. Considering the current global diversity loss and the need for effective conservation measures, this expended distributional range of the eelgoby provides a valuable opportunity to gain further knowledge about this species. It is thought that eastern eelgoby has specific glands that enhance its respiratory abilities during burrowing, while it uses both gills and skin in the water (Fig. 3). Its short, cylindrical swimbladder plays important role in respiration, and the specialized gland that aid in burrow respiration are not found in other gobies inhabiting coastal ecosystems of Pakistan. Tropical regions, including coastal, creeks, marshes, and lagoons being more diverse, are essential for preserving global aquatic diversity[,8,9,10].

The sagitta otolith has unique characteristics that allows biologists to distinguish between species with close taxonomic similarities, due to its species-specific traits used to differentiate species within the same genus or family[10]. Two specimens of eastern eelgoby were collected in lagoons, the northern Arabian Sea, marking the first recorded presence of this species in this area and its initial global record.

Conclusion

To the best of our knowledge, this is the second confirmed record of eelgoby species in the world, recently discovered in Pakistan**.** After originally being found along the Australian coast, the presence of eelgoby in Pakistan suggests that this species has been remained underreported. This is likely due to its confinement to water bodies such as Nareri lagoon, which limits its potential for invasiveness. The outcomes of this research will enhance understanding of lagoon fish and provide essential information for the developing and implementing Pakistan's aquatic diversity strategy and action plan.

Acknowledgment

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Authors' Declaration

- Conflicts of Interest: None.
- We hereby confirm that all the Figures and Tables in the manuscript are ours. Furthermore, any Figures and images, that are not ours, have been included with the necessary permission for re-publication, which is attached to the manuscript.
- The author has signed an animal welfare statement

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- Ethical Clearance: The project was approved by the local ethical committee at University of Karachi-75270, Sindh, Pakistan.
- Ethical Approval: All applicable international, national and/or institutional guidelines for the care and use of animals have been followed as per Karachi University Ethical Approval Committee (KU-EAC).

Availability of data and material

The data can be provided on the reasonable request to the corresponding author.

Authors' Contribution Statement

NS, SA and NAP participated in sampling, laboratory handling and data recording, SKP supervised research and identified species.

Journal Declaration:

Fourth author P. SK. is an editor for the journal but did not participate in the peer review process other than as an author. The authors declare no other conflict of interest.

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التسجيل الأول لسمكة القوبي الشائكة النادرة، *Taenioides mordax* (De Vis, 1883)، في بحيرة ناريري، شمال بحر العرب

نرمين سليم، سارفاريز امان سيال، نديم احمد بانوار، شيرخان بانوار

مركز التميز في علم الأحياء البحري، جامعة كراتشي، السند، باكستان.

الخلاصة

على مدى أكثر من خمسة عقود، ظلت سمكة القوبي الشائكة الشرقية، *Taenioides mordax* (De Vis, 1883)، متوطنة في المنطقة الممتدة من كيرنز إلى تاونفيل (كوينزلاند) ومن سيدني إلى نيوكاسل (نيو ساوث ويلز) في أستراليا. في هذا التقرير، تم جمع عينتين يبلغ طولهما الكلي 19.8 سم، ووزنهما 20.25 جرامًا، من بحيرة ناريري في بادين، السند. تم جمع العينات باستخدام شبكة صيد صغيرة محيطية تم نصبها طوال الليل في المياه الضحلة. الشكل العام للجسم مستطيل، خالٍ من القشور، مع عيون صغيرة، وفم متجه للأعلى مع أسنان كبيرة وحادة بعدد 10/12 على الفكين العلوي والسفلي على التوالي. الزعنفة الظهرية منفردة ومتصلة، والزعنفة الشرجية متصلة بالزعنفة الذيلية وتصل إلى الفتحة البطنية، والزعنفة الصدرية والحوضية قصيرتان. بشكل عام، شكل حجر الأذن (الساجيتا) مستطيل، والحافة ملساء، مع بروز واضح للمنقار، بينما الجزء المقابل للمنقار غير مميز. على الجانب الخلفي، يمكن رؤية أخدود واضح. الميزاب السمعي والفتحة الأمامية والخلفية غير مرئية. استنادًا إلى هذه الخصائص، تم تأكيد أن العينات هي من نوع سمكة القوبي الشائكة الشرقية. على حد علمنا، هذا هو أول تسجيل مؤكد لهذا النوع في العالم.

الكلمات المفتاحية: القوبي الحفار، بحيرات ناريري، تسجيل عالمي، شمال بحر العرب.