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Species diversity and distribution of croakers (Acanthuriformes: Sciaenidae) from Indian waters: Insights from a comprehensive survey

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Original Article

Abstract

The family Sciaenidae, commonly known as croakers or drums, represents a diverse and ecologically significant group of demersal marine and estuarine fishes found primarily in the tropical and subtropical waters worldwide. Taxonomic information on sciaenids in Indian waters remains limited since the comprehensive work of Lal Mohan (1981), who described 30 species from 14 genera. An ichthyofaunal survey conducted from 2020 to 2023 across selected marine and estuarine habitats revealed the presence of 27 sciaenid species in 14 genera (*i.e.*, *Otolithes, Johnius, Daysciaena, Kathala, Nibea, Pennahia, Otolithoides, Protonibea, Pterotolithus, Panna, Atrobucca, Chrysochir, Macrospinosa,* and *Dendrophysa*). Among the sciaenid genera, *Johnius* was the most speciose, indicating a high degree of diversification within this lineage in Indian waters. This survey provides valuable baseline data and contributes to the broader understanding of sciaenid diversity in the region.

Keywords: *Checklist, sciaenids, Arabian Sea, Bay of Bengal*

Introduction

Sciaenids (Family Sciaenidae) or croakers, comprise one of the largest families in the Order Acanthuriformes and represent one of the most ecologically and economically important groups of demersal marine fishes in tropical and temperate waters (Nelson *et al.*, 2016). Globally, they have a wide distribution ranging through the temperate and tropical environments, namely from the Atlantic and Pacific oceans, the Caribbean Sea, Amazon waters, the Mediterranean Sea, and the Indo-Pacific region with high species richness reported from the Indo-west Pacific region (Nelson *et al.*, 2016; Fricke *et al.*, 2024). Croakers exhibit diverse external morphological features, especially in the general body form and mouth position, and this has enabled sciaenids to adapt to a wide range of habitats, from pelagic to benthic. Diverse nature is also noticed in sound production, swimbladder pattern and otolith structure, which is the most distinctive feature of the group.

Taxonomic studies on sciaenids of the Indian seas extend from classical works of Day (1888), Misra (1959), Lal Mohan (1981) to checklists by Talwar and Kacker (1984), Mohanraj *et al.* (2003). Day (1888) reported 27 species in 4 genera; Trewavas (1977) reported 75 species in 25 genera; Lal Mohan (1981) reported 36 species in 17 genera; Talwar (1995) recorded 40 species of sciaenids in 20 genera, while Mohanraj *et al.* (2003) described 30 species in 14 genera, of which 20 were commercially important. On a global pattern, Nelson *et al.* (2016) listed 283 species in 67 genera; Parenti (2020) listed 289 valid species in 69 genera. Most of the taxonomical research work was specifically done in regions of Eastern Atlantic and Indo-West Pacific by Trewavas (1962; 1977); in the Chinese waters by Chu *et al.* (1963); Western Atlantic by Chao (1978) and Japanese waters by Sasaki (1996). Globally, the production of sciaenids from capture increased from 1195939 t in 2019 to 1228260 t in 2020. Taking the pan-India fishery landings of sciaenids in 2021, 101,287 tonnes were landed, accounting for only 3.32% of the total landings.

Higher abundance and availability of sciaenids were noticed off Gujarat, Maharashtra, West Bengal, Tamil Nadu, Odisha, Andhra Pradesh, and Kerala (Bhakta *et al.*, 2021). Worldwide demand for fish maw has intensified in Hong Kong and mainland China (Ben-Hasan *et al.*, 2021), and recent reports of huge landings of *'koth'* across various landing centres have pointed to an increase in targeted fisheries for these species. Despite its commercial importance, studies on the diversity and taxonomy of sciaenids are scanty in India. Misidentification and synonymy have made species level assessments complicated by multiple levels of overlapping in morphometric characters from similar ecological niches (Hebert *et al.*, 2003). Although recent advances in the systematics of the family Sciaenidae, particularly through molecular approaches, have improved the understanding of phylogenetic relationships *(e.g.*, Lim *et al.*, 2021; Han *et al.*, 2022), such studies often lack the detailed morphological validation necessary for practical species identification. In fisheries oriented and field based contexts, species recognition continues to rely predominantly on external morphology, meristic counts, and diagnostic anatomical characters. Therefore, comprehensive morphological reassessments remain indispensable for resolving taxonomic ambiguities, standardising identification keys, and validating species records.

The present study is based entirely on classical taxonomic methods, emphasising detailed morphological characters for species identification. The adopted nomenclature and classification, however, follow recent systematic updates reported in the literature. Such an approach provides a reliable framework for accurate species identification and contributes to strengthening baseline taxonomic data for Sciaenidae in Indian waters.

Material and methods

Surveys were conducted and samples collected from large and small fishing harbours on the west and east coasts of India (Fig. 1), during the period February 2020 to October 2023. A total of 656 fish samples were collected, of which 498 intact specimens were used for morphometric analysis. Croakers were sampled from small and large seines, trawls, set-barrier nets, cast nets, lift nets, traps, hooks and lines, etc. Croakers were predominantly caught in single-day trawls, multiday trawls, motorised gill nets and hooks and lines. Once collected, the fish was photographed in the field using a Canon digital camera, followed by individual tagging. The samples were then placed in crushed ice and transported to the lab in fresh condition. The fishes were then cleaned of dirt, washed to remove debris; morphometrics were done following Lal Mohan (1977) and Kumari *et al.* (2020) with slight modification. All measurements were taken using

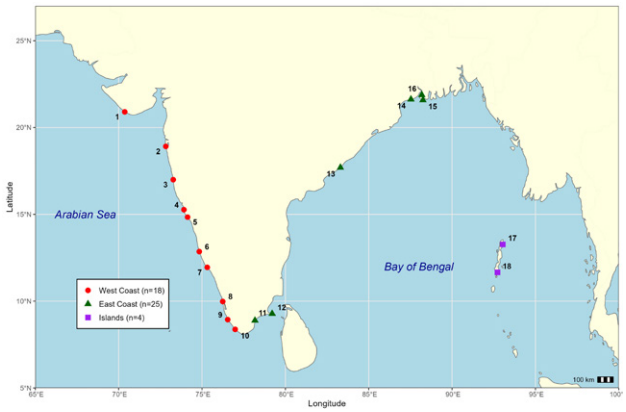

Fig. 1. Sampling locations in India 1. Veraval, 2. Mumbai, 3. Ratnagiri, 4. Benaulim, 5. Karwar, 6. Mangalore, 7. Kannur, 8. Kochi, 9. Kollam, 10. Trivandrum, 11. Tuticorin, 12. Mandapam, 13. Vishakhapatnam, 14. Digha, 15. Frazergunj, 16. Kakdwip, 17. Diglipur, 18. Port Blair

digital callipers (Mitutoyo 500-196-30-aos) in mm to the nearest 0.1 sensitivity and weighed (Saffron 2g: 3kg) to the nearest gram. The fishes were then identified using standard textbooks (Day, 1878; Trewavas, 1977; Munroe, 2000). Since the croakers are difficult to identify using external morphological characters alone, additional internal characters like dentition, arborescent appendages, and otolith were also examined and used in the species identification.

Study Area

The study was conducted across 18 strategically selected coastal locations representing the diverse marine environments of India. These sites span the eastern and western coasts, as well as the Andaman and Nicobar Islands, covering a broad geographical range from Gujarat in the northwest to West Bengal in the northeast, and extending to the islands in the Bay of Bengal. Sampling locations were selected based on ecological relevance, representation of major fishing zones, accessibility, and availability of fish landing centres. Specimens were collected primarily from landing centres and local catches, representing commercially exploited assemblages. Although a consistent methodology was followed, the spatial distribution of sampling was not entirely uniform due to logistical constraints, with relatively more dispersed coverage along the west coast and comparatively clustered sampling along parts of the east coast (Table 1).

On the west coast, sampling was carried out in Veraval (Gujarat), Mumbai and Ratnagiri (Maharashtra), Benaulim (Goa), Karwar and Mangalore (Karnataka), and four locations in Kerala, namely Kannur, Kochi, Kollam, and Trivandrum. These regions form part of the Arabian Sea coastline, characterised by estuarine systems, upwelling zones, and high marine productivity. On the east coast,

Table 1. Details of the study area where the sampling was done for the present study

No.	Collection site	State	Lat. / Long.
1.	Veraval	Gujarat	20°54'07.9"N / 70°21'52.4"E
2.	Mumbai	Maharashtra	18°54'45.5"N / 72°49'32.2"E
3.	Ratnagiri	Maharashtra	16°59'47.8"N / 73°16'26.0"E
4.	Benaulim	Goa	15°15'56.9"N / 73°54'50.4"E
5.	Karwar	Karnataka	14°50'16.2"N / 74°08'01.7"E
6.	Mangalore	Karnataka	12°51'21.5"N / 74°49'58.8"E
7.	Kannur	Kerala	11°56'40.4"N / 75°18'39.1"E
8.	Kochi	Kerala	9°58'55.6"N / 76°14'34.5"E
9.	Kollam	Kerala	8°56'19.6"N / 76°32'27.8"E
10	Trivandrum	Kerala	8°22'40.2"N / 76°59'21.0"E
11.	Tuticorin	Tamilnadu	8°53'18.3"N / 78°10'26.3"E
12.	Mandapam	Tamilnadu	9°16'48.2"N / 79°12'22.9"E
13.	Vizag	Andhra Pradesh	17°41'44.8"N / 83°18'08.8"E
14.	Digha	West Bengal	21°37'33.4"N / 87°31'55.5"E
15.	Frazergunj	West Bengal	21.5793° N / 88.2517° E
16.	Kakdwip	West Bengal	21.8760° N / 88.1853° E
17.	Port Blair	A&N Islands	13°16'08.6"N / 93°02'24.9"E
18.	Diglipur	A&N Islands	11°39'33.0"N / 92°43'31.7"E

the study included Tuticorin and Mandapam (Tamil Nadu), Visakhapatnam (Andhra Pradesh), and three locations in West Bengal, *i.e.*, Digha, Frasergunj, and Kakdwip, situated in the northern Bay of Bengal, known for its deltaic and mangrove ecosystems. Additionally, the Andaman and Nicobar Islands were represented by Diglipur and Port Blair, which support distinct island marine biodiversity.

For analytical purposes, the coastline was divided into four regions: Northwest (Gujarat–Maharashtra), Southwest (Goa–Kerala), Southeast (Tamil Nadu), and Northeast (Andhra Pradesh–West Bengal). This classification is based on geographic continuity and reflects broad differences in oceanographic and ecological characteristics, facilitating comparative analysis of species distribution patterns. The latitude and longitude range (approximately 8°N–21°N and 70°E–93°E) indicates extensive spatial coverage across Indian coastal waters.

Results and discussion

The fishes were identified using morphometric characters, otolith, dentition pattern, arborescent appendages and meristic counts. In the present work, 27 species of sciaenids in 14 genera were collected. The genera recorded were *Otolithes, Johnius, Daysciaena, Kathala, Nibea, Pennahia, Otolithoides, Protonibea, Pterotolithus, Panna, Atrobucca, Chrysochir, Macrospinosa,* and *Dendrophysa*. Of these, 8 species were reported from the northwest coast, 16 species from the southwest and 12 species from the southeast coast. Trewavas (1977) presented the taxonomic revision of the sciaenid fishes of Indo-west-Pacific seas and estuaries, wherein 65 species were placed in 27 genera and 10 tribes. A subsequent revision by Sasaki (1996) reported 47 species in 19 genera. Lal Mohan (1969), working on sciaenids in Indian waters, described 30 species in 14 genera based on the characteristic structure of air bladder, otolith and sensory pores. Lal Mohan (1981) studied 36 sciaenid species collected from Indian waters and clarified taxonomic ambiguities based on the shape of otolith, swim bladder structure and arborescent appendages. Talwar (1995) listed 40 species in 20 genera of 8 tribes from Indian waters. The different species of croakers recorded from Indian waters are described here, genus wise. The distribution pattern across both coasts and their conservation status are provided in Table 2.

Genus Otolithes Oken, 1817

Mouth large, lower jaw projecting; upper pores on snout absent; marginal pores 3–5; mental pores absent. Both jaws have canine teeth. Carrot-shaped airbladder with a series (28 to 36) of arborescent appendages along the sides, two species *Otolithes ruber* and *Otolithes cuvieri* were collected in the present study.

Otolithes ruber (Bloch and Schneider, 1801)

Common name: Tigertooth croaker (Fig. 2a)

Material examined: N=43; TL 139 mm and 210 mm Kochi (Kerala) – 12; Kollam (Kerala) – 4; Ratnagiri (Maharashtra) – 4; Goa – 5; Veraval (Gujarat) – 5; Gulf of Mannar (Tamil Nadu) – 4; Andaman-4 and Visakhapatnam (Andhra Pradesh) – 5.

Meristic characters: D IX–X, I 27-30; A II 7; P I 15; V I 5;LL 50-54; Vert. 24.

Mouth large, terminal, slightly upturned. Teeth in upper and lower jaw in two rows, inner row villiform, outer series enlarged with 1 or 2 pairs of strong canines. Caudal fin rhomboid, pointed in juveniles.

Otolithes cuvieri Trewavas, 1974

Common name: Lesser tigertoothed croaker (Fig. 2b)
Material examined: N=22; TL 152-257 mm Kochi (Kerala)–4; Kollam (Kerala)–3; Ratnagiri (Maharashtra)–3; Goa–2; Karwar (Karnataka)–3; Mangalore (Karnataka)–2; Veraval (Gujarat)–3; Kanyakumari (Tamil Nadu)–2.

Table 2. Checklist and IUCN Red List status of the sciaenids from Indian waters. IUCN Red List categories are: DD: Data Deficient, LC: Least Concern, NT: Near Threatened, VU: Vulnerable, EN: Endangered, CR: Critically Endangered

Genus	Species	West coast/state	East coast/state	IUCN
Otolithes Oken, 1817	*Otolithes ruber* (Bloch and Schneider, 1801)	Kochi (Kerala), Kollam (Kerala), Ratnagiri (Maharashtra), Goa, Veraval (Gujarat),	Gulf of Mannar (Tamil Nadu) Visakhapatnam (Andhra Pradesh)	LC
	Otolithes cuvieri (Trewavas, 1974)	Kochi (Kerala), Kollam (Kerala), Ratnagiri (Maharashtra), Goa, Karwar (Karnataka), Mangalore (Karnataka), Veraval (Gujarat)	Kanyakumari (Tamil Nadu)	LC
Daysciaena Talwar, 1970	*Daysciaena albida* (Cuvier 1830)	Kochi (Kerala)		LC
Kathala Mohan, 1969	*Kathala axillaris* Cuvier, 1830)	Kochi (Kerala), Kollam (Kerala), Mangalore (Karnataka), Go a	Kanyakumari (Tamil Nadu)	LC
Nibea Jordan and Thompson, 1911	*Nibea maculata* (Bloch and Schneider, 1801)	Kochi (Kerala), Kollam (Kerala), Karwar (Karnataka), Mangalore (Karnataka),	Visakhapatnam (Andhra Pradesh), Gulf of Mannar (Tamil Nadu)	LC
	Nibea soldado (Lacepède, 1802)		Kanyakumari (Tamil Nadu)	LC
Pennahia Fowler, 1926	*Pennahia aneus* (Bloch, 1793)	Ratnagiri (Maharashtra), Goa, Gujarat	Visakhapatnam (Andhra Pradesh), Gulf of Mannar (Tamil Nadu)	LC
	Pennahia macrocephala (Tang, 1937)		Visakhapatnam (Andhra Pradesh), Gulf of Mannar (Tamil Nadu)	LC
Otolithoides Fowler, 1933	*Otolithoides biauritus* (Cantor, 1849)	Veraval (Gujarat), Kochi (Kerala)		DD
	Otolithoides pama (Hamilton, 1822)		West Bengal	DD
Protonibea Trewavas, 1971	*Protonibea diacanthus* (Lacepède, 1802)	Mangalore (Karnataka), Goa, Gujarat	Gulf of Mannar (Tamil Nadu)	NT
Johnius Bloch, 1793	*Johnius amblycephalus* (Bleeker, 1855)	Kochi (Kerala), Kollam (Ke rala), Ratnagiri (Maharashtra), Goa, Karwar (Karnataka) Mangalore (Karnataka),	Gulf of Mannar (Tamil Nadu), West Bengal	LC
	Johnius carutta (Bloch, 1793)	Kochi (Kerala), Kollam (Kerala), Mangalore (Karnataka),	Gulf of Mannar (Tamil Nadu)	LC
	Johnius carouna (Cuvier, 1830)	Kochi (Kerala), Kollam (Kerala), Ratnagiri (Maharashtra), Goa, Karwar (Karnataka)	Visakhapatnam (Andhra Pradesh)	LC
	Johnius elongatus Lal Mohan, 1976	-	Gulf of Mannar (Tamil Nadu)	DD
	Johnius belangerii (Cuvier, 1830)	Kochi (Kerala), Kollam (Kerala), Mangalore (Karnatak a),	West Bengal	LC
	Johnius dussumieri (Cuvier, 1830)	Kochi (Kerala), Kollam (Kerala), Goa, Mangalore (Karnataka)	Gulf of Mannar (Tamil Nadu)	LC
	Johnius borneensis (Bleeker, 1851)	Kochi (Kerala), Kollam (Kerala)	Gulf of Mannar (Tamil Nadu), West Bengal	LC
	Johnius macrorhynus (Lal Mohan, 1976)	Kochi (Kerala)	West Bengal	LC
	Johnius macropterus (Bleeker, 1853)	Kochi (Kerala)	Gulf of Mannar (Tamil Nadu)	LC
	Johnius coitor (Hamilton, 1822)	Kochi (Kerala), Kollam (Kerala), Mangalore (Karnataka),	Gulf of Mannar (Tamil Nadu), West Bengal	LC
Dendrophysa Trewavas, 1964	*Dendrophysa russelii* (Cuvier, 1829)	Kochi (Kerala)	Gulf of Mannar (Tamil Nadu), West Bengal	LC
Chrysochir Trewavas and Yazdani, 1966	*Chrysochir aurea* (Richardson, 1846)		West Bengal	LC
Pterotolithus Fowler, 1933	*Pterotolithus maculatus* (Cuvier, 1830)		West Bengal	LC
Panna Lal Mohan, 1969	*Panna heterolepis* Trewavas, 1977		West Bengal	LC
Macrospinosa Lal Mohan, 1969	*Macrospinosa cuja* (Hamilton, 1822)		Gulf of Mannar (Tamil Nadu), West Bengal	DD
Atrobucca Chu, Lo and Wu, 1963	*Atrobucca alcocki* Talwar, 1980		Mumbai	LC

Meristic characters: D IX–X, I 27-30; A II 7; P I 15; V I 5; LL 50-52; Vert. 25.

Mouth large, terminal, lower jaw projecting, more than half of head length. Body silvery with a golden tinge on flanks; maxilla with a bluish spot, soft dorsal fin anal fin edged with grey; pectoral and pelvic fins yellow. Genus *Otolithes* has a wide distribution along both coasts. The species is commercially important and landed by trawlers.

Fig. 2. (a) *Otolithes ruber* (Bloch and Schneider, 1801) (b) *Otolithes cuvieri* Trewavas, 1974 (c) *Johnius dussumieri* (Cuvier, 1830) (d) *Johnius macropterus* (Bleeker, 1853) (e) *Johnius macrorhynus* (Lal Mohan, 1976) (f) *Johnius carouna* (Cuvier, 1830) (g) *Johnius carutta* (Bloch, 1793) and (h) *Johnius amblycephalus* (Bleeker, 1855)

Genus Johnius Bloch, 1793

This genus is represented by ten species distributed along both the east and west coasts. The species has a hammer-shaped swimbladder; but its dorsal appendages are absent; 3 pairs of mental pores. Barbels may be present or absent in some species. In *Johnius amblycephalus*, a small barbel is present on the lower jaw; the otolith has a hollow cone structure. The species recorded

in the present study were in this study *J. belangerii, J. carutta, J. macropterus, J. macrorhynus, J. dussumieri, J. elongatus, J. borneensis, J. carouna, J. coitor* and *J. amblycephalus* from the southwest Bay of Bengal and eastern Arabian Sea

Johnius dussumieri (Cuvier, 1830)

Common name: Sin croaker (Fig. 2c)
Material examined: 10; Kochi (Kerala)=3, Kollam (Kerala)=3, Goa=2, Mangalore (Karnataka)=1, Gulf of Mannar (Tamil Nadu) =1.
Meristic counts: D X-XI + I 26-29; A II, 7; P I, 15-16; V I, 5. LL 49-52; Vert. 25; GR 5+8.

Body oblong to moderately compressed, dorsal profile gently arched; mouth terminal to slightly sub-terminal; fins whitish to faintly yellowish, mostly translucent; caudal fin truncated to slightly rounded. Swimbladder hammer-shaped with 14 or 15 pairs of arborescent tubules.

Johnius macropterus (Bleeker, 1853)

Common name: Large fin croaker (Fig. 2d)
Material examined: 2; TL-175-191 mm; Kochi (Kerala) =1, Gulf of Mannar (Tamil Nadu) = 1.
Meristic counts: D X + I 29-30; A II, 7; P I, 14–16; V I, 5; LL 50: Vert. 25; GR 4-5+10-11.

A small-sized species with a rounded, slightly projecting snout. Mouth narrow, inferior; lower jaw with 5 large pores, one median at base of mental barbel. Swimbladder hammer-shaped with 13 to 16 pairs of lateral appendages.

Johnius macrorhynus (Lal Mohan, 1976)

Common name: Big snout croaker (Fig. 2e)
Material examined: 35; Kochi (Kerala), West Bengal.
Meristic counts: D X-XI + I 27-29; A II, 7; P I, 15-16; V I, 5; Vert. 24; GR 4-5+7-8.

Body medium sized spindle shaped; snout rounded, projecting; eyes large. Mouth narrow, inferior; fins light yellowish to amber in colour with slightly dusky edges. Swimbladder hammer-shaped with 13 or 14 pairs of arborescent appendages.

Johnius carouna (Cuvier, 1830)

Common name: Caroun croaker (Fig. 2f)
Material examined: 22; Kochi (Kerala)=4; Kollam (Kerala)=4; Ratnagiri (Maharashtra)=4; Goa=4; Karwar (Karnataka)=3 and Visakhapatnam (Andhra Pradesh) =3.
Meristic counts: D X-XI + I 27-29; A II, 7; P I, 15-16; V I, 5; LL 48-52; Vert. 24; GR 4-5+11-12.

Body fairly deep, snout swollen and prominent, head relatively large; eyes large, spines darkened rugged; caudal fin rounded to truncate; body dark brownish grey in color. Swimbladder hammer shaped with 14 or 15 pairs of arborescent appendages.

Johnius carutta Bloch, 1793

Common name: Karut croaker (Fig. 2g)
Material examined: 32; Kochi (Kerala)=8, Kollam (Kerala) =8; Mangalore (Karnataka) =7; Gulf of Mannar (Tamil Nadu) =9.
Meristic counts: D IX–X, I 25–30; A II, 7; P I, 16; V I, 5; LL 47-50; Vert. 25; GR 3-5+7-9.

Mouth small; both jaws equipped with villiform teeth. Scales on upper part of body cycloid; caudal fin truncate; black body with a white streak present along lateral line. Swimbladder hammer-shaped, with 15 to 16 pairs of appendages.

Johnius amblycephalus (Bleeker, 1855)

Common name: Bearded croaker (Fig. 2h)
Material examined: 53; TL-78-196mm; Kochi (Kerala)-8; Kollam (Kerala)-6; Ratnagiri (Maharashtra)-7; Goa-6; Karwar (Karnataka)-7; Mangalore (Karnataka)-6; Gulf of Mannar (Tamil Nadu)-7; West Bengal-6.
Meristic counts: D X-XI + I 24-26; A II, 7; P I, 15-16; V I, 5; LL 47-52; Vert. 25; GR 4-5+6-8.

Small to medium in size, with a moderately deep body. Snout steep; bluntly rounded, mouth inferior, firm, blunt barbel present on the chin. The fish appears black with flanks black or dark brown. Swimbladder hammer shaped, with 14 to 15 pairs of appendages.

Johnius coitor (Hamilton, 1822)

Common name: Coitor croaker (Fig. 3a)
Material examined: 20; Kochi (Kerala)-6; Kollam (Kerala)-3; Mangalore (Karnataka)-3; Gulf of Mannar (Tamil Nadu)-5; West Bengal-3.
Meristic counts: D X-XI + I 26-28; A II, 7; P I, 15-16; V I, 5; LL 48-50; Vert. 25; GR 3-4+8-10.

Small sized species; snout swollen; interorbital region flat, area above the eyes with a slightly concave profile. Airbladder hammer shaped with 11 to 13 pairs of lateral appendages.

Fig. 3. (a) *Johnius coitor* (Hamilton, 1822) (b) *Johnius borneensis* (Bleeker, 1851) (c) *Johnius belangerii* (Cuvier, 1830) (d) *Johnius elongatus* Lal Mohan, 1976 (e) *Daysciaena albida* (Cuvier, 1830) (f) *Kathala axillaris* (Cuvier, 1830) (g) *Nibea maculata* (Bloch and Schneider, 1801) and (h) *Nibea soldado* (Lacepède, 1802)

Johnius borneensis (Bleeker, 1851)

Common name: Sharpnose hammer croaker (Fig. 3b)
Material examined: 12; Kochi (Kerala)-5; Kollam (Kerala)-4; Gulf of Mannar (Tamil Nadu)-2; West Bengal-1.
Meristic counts: D X-XI + I 27-30; A II 7; P I 16; V I 5; LL 46-49; Vert. 25; GR 5-6+11-13.

Body elongate, moderately compressed; dorsal profile more convex than the ventral side; body color silvery-grey colour with yellow tinge on the fins.

Johnius belangerii (Cuvier, 1830)

Common name: Belanger's croaker (Fig. 3c)
Material examined: 25; Kochi (Kerala)-7; Kollam (Kerala)-6; Mangalore (Karnataka)-6; West Bengal-6.

Meristic counts: D X-IX, I 27-31; A II, 7-8; P I, 15-16; V I, 5; Vert. 25; GR 4-5+8-11.

Mouth terminal to slightly sub terminal; snout rounded. Body silvery grey in colour, with the back appearing darker

and gradually fading to a lighter underside. Head is slightly more pigmented, especially around the eyes. Swimbladder hammer-shaped with 11 to 14 pairs of arborescent appendages.

Johnius elongatus Lal Mohan, 1976

Common name: Spindle croaker (Fig. 3d)
Material examined: 30; Gulf of Mannar (Tamil Nadu).
Meristic counts: D X-XI + I 24-29; A II, 7; P 17; V I, 5; LL 49-51; Vert. 25; GR 4-5+7-10.

Body moderately elongate, laterally compressed; head large; snout blunt; preopercular edge appears slightly serrated; dorsal fin long, continuous; caudal fin rounded to truncate.

Genus *Daysciaena* Talwar 1970

The genus is represented by one species *Daysciaena albida,* which was collected from the west coast (Kerala). Mouth terminal. Snout with 3 upper and 5 marginal pores; mental pores 5, of which the median is the opening of a pair lying close together behind the symphysis; a pair of minute barbels present between the median and anterior lateral pores, second anal spine strong. Swimbladder carrot-shaped, extending behind the vent to the anal spines.

Daysciaena albida (Cuvier, 1830)

Common name: Two-bearded croaker (Fig. 3e)
Material examined: N= 44; TL 210-566 mm from Kalamukku.
Meristic counts: DIX-X + 123-26; A II, 7; P I, 17; V I, 5; LL 45-58; Vert. 24; GR 11-12/20-22.

Body oblong; snout rounded, projecting only slightly beyond tip of upper jaw; mouth terminal. Teeth differentiated in size in both jaws, outer row of upper and inner posterior teeth of lower jaw enlarged, spaced; canines absent. Swimbladder carrot shaped, extending behind the vent to the anal spines, with 17 to 19 pairs of arborescent appendages. Body greyish on back silvery on belly; pectoral, pelvic and caudal fins yellowish; a black blotch present at axil of pectoral fin. The fish was collected from Vembanad Lake west coast (Kerala) and is commercially important species.

Genus Kathala Lal Mohan, 1969

Mouth terminal, jaws about equal; snout with small pores; 3 mental pores; swimbladder carrot shaped with unbranched cornua entering the head. Caudal fin rhomboid. The genus is monotypic, species easily identified by a small black spot at and above the pectoral fin base region. *Kathala axillaris* was collected during the study from both east and west coasts of India.

Kathala axillaris (Cuvier, 1830)

Common name: Kathala croaker (Fig. 3f)
Material examined: N=15; TL 120-154 mm Kochi (Kerala)-5; Kollam (Kerala)-3; Mangalore (Karnataka)-3; Goa-2; Kanyakumari (Tamil Nadu)-2.
Meristic counts: D X I, 27-29; P 18; V I, 5; A II, 7; LL 45-50; Vert. 25; GR (9-12) + (19-23).

Medium sized with a fairly deep body. Snout rounded, but not projecting. Mouth terminal and oblique; jaws nearly equal. Caudal fin rhomboid. Body colour is silvery grey to bluish-grey on the back, fading to silvery white on the belly; body with a black notch on the base of pectoral fin. *Kathala axillaris* is a commercially important fish in the fishery.

Genus Nibea Jordan and Thompson, 1911

Species in this genus are distinguished by a slightly projecting snout; five mental pores surrounded by thick skin; mouth terminal; teeth differentiated in size in both jaws, inner row of lower jaw and outer row of upper jaw with enlarged teeth; barbels absent; swimbladder carrot-shaped. Worldwide, ten species are reported, and in the present study two species were recorded, namely *Nibea maculata* and *Nibea soldado*. In fresh condition, *Nibea maculata* is easily distinguished by having five dark blotches, which may be broken or entire, extending from the dorsum to the lower part of the flanks. In the case of *Nibea soldado*, a well-arched back with deep body. Both *Nibea maculata* and *Nibea soldado* are commercially important fish.

Nibea maculata (Bloch and Schneider, 1801)

Common name: Blotched croaker (Fig. 3g)
Material examined: 37; TL-128-215 mm; Kochi (Kerala)-7; Kollam (Kerala)-6; Karwar (Karnataka)-6; Mangalore (Karnataka)-6; Visakhapatnam (Andhra Pradesh)-6; Gulf of Mannar (Tamil Nadu)-6.
Meristic counts: D X + I 24-26; A II, 7; P I, 17; V I, 5; LL 45-47; Vert. 45; GR 5-6+7-8.

Mouth inferior; lips thick; upper jaw overshooting lower and extending to below middle of eye; mental pores 5, surrounded by thick skin. Swimbladder carrot-shaped, with 18 to 21 pairs of arborescent appendages. The fish has a wide distribution on both east and west coast.

Nibea soldado (Lacepède, 1802)

Common name: Soldier croaker (Fig. 3h)
Material examined: 3; TL-175-191 mm; Tamil Nadu.

Meristic counts: D X + I 28-29; A II, 7; P I, 16; V I, 5; LL 47-49; Vert. 45; GR 4-5+7-8.

Mouth terminal; snout blunt, not projecting beyond upper jaw, jaws meeting equally in front; five mental pores; median composed of two united by a crescentric groove just behind symphysis. Swimbladder carrot-shaped with 20 to 22 pairs of lateral appendages.

Genus Pennahia Fowler, 1926

Mouth large, terminal; lower jaw half as long as head or more. Teeth well differentiated in size in both jaws, canine teeth present; Swimbladder carrot-shaped with 17 to 27 pairs of arborescent appendages along sides of bladder. Two species *Pennahia aneus* and *Pennahia macrocephala,* were collected in the present study. *Pennahia aneus* is a commercially important fish on the east coast of India.

Pennahia aneus (Bloch, 1793)

Common name: Bigeye croaker (Fig. 4a)
Material examined: N=21; TL 111-175mm Ratnagiri (Maharashtra)-5; Goa-3; Gujarat-4; Visakhapatnam (Andhra Pradesh)-2; Gulf of Mannar (Tamil Nadu)-4 and Andaman-3.
Meristic counts: D IX-X + I, 21-26; A II, 7-8; P 16-17; V I, 5; LL 52–54; Vert. 26; GR 5–6 + 9–11.

Deep bodied species with large, terminal, oblique mouth; upper jaw reaching below the hind part of the eye; lower jaw projecting when the mouth is open. Two pairs of small mental pores present, with the anterior pair located at the front of the prominent chin.

Pennahia macrocephalus (Tang, 1937)

Common name: Big-head pennah croaker (Fig. 4b)
Material examined: N=7; TL 132-205mm Visakhapatnam (Andhra Pradesh)-2; Gulf of Mannar (Tamil Nadu)-5.
Meristic counts: D X + I 24-26; A II, 7; P 17; V I, 5; LL 45-49; Vert. 26; GR 4-6/10-12.

A medium sized species, with an acute prominent snout which slightly projects beyond upper jaw. Mouth inferior; lips rather thick. Mental pores 5; surrounded by thick skin. Swimbladder carrot shaped, with 18 to 21 pairs of arborescent appendages.

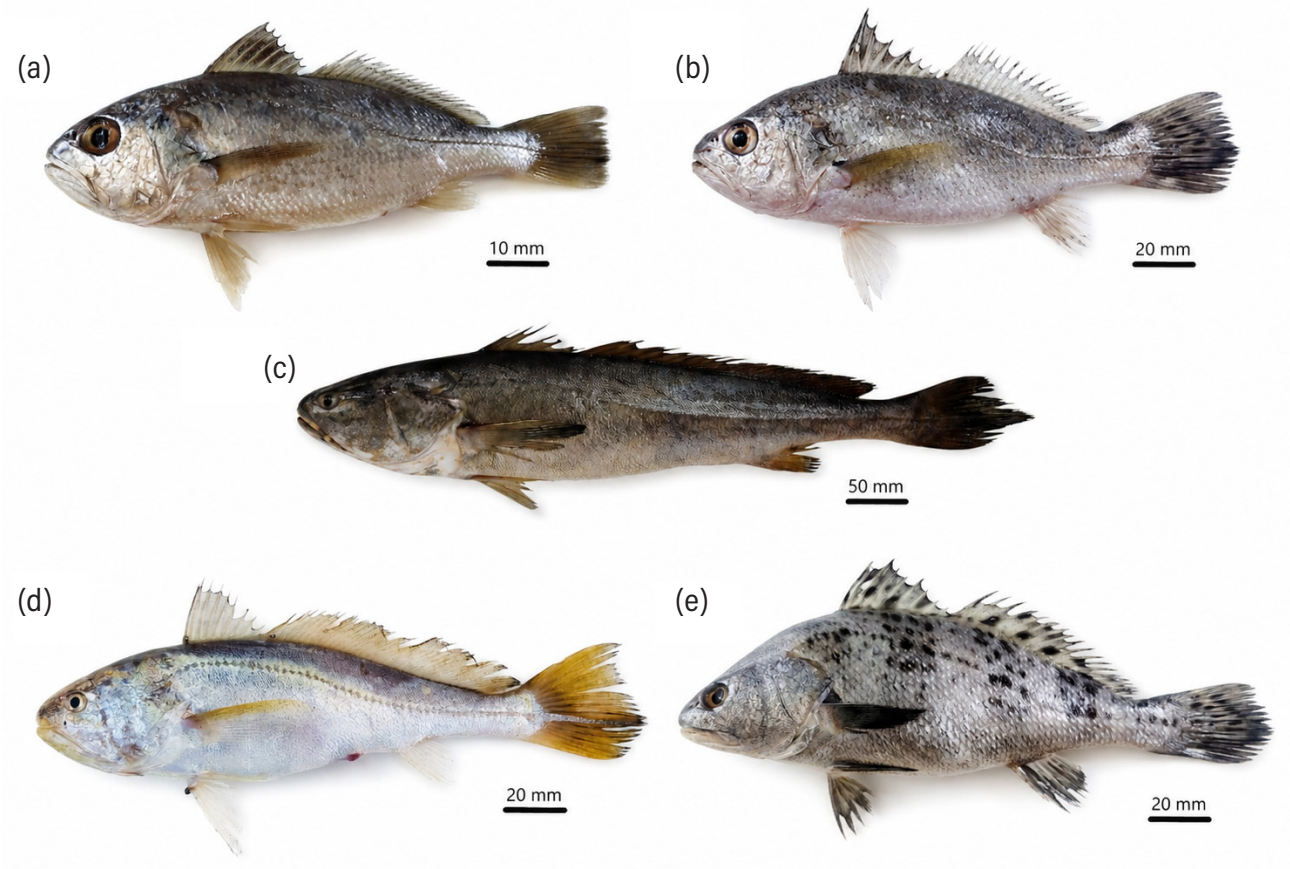

Fig. 4. (a) *Pennahia anea* (Bloch, 1793) (b) *Pennahia macrocephalus* (Tang, 1937) (c) *Otolithoides biauritus* (Cantor, 1849) (d) *Otolithoides pama* (Hamilton, 1822) and (e) *Protonibea diacanthus* (Lacepède, 1802)

Genus Otolithoides Fowler, 1933

Mouth large terminal; teeth well differentiated in size in both jaws, upper outer row and lower inner row caniniform, spaced. Swimbladder carrot shaped with a pair of long tubular appendages originating near its posterior end. The second anal spine weak. Lateral line scales cycloid, covered with small subsidiary scales; scales of upper anterior part of body very small. In the present study two species *Otolithoides biauritus* and *Otolithoides pama* were collected.

Otolithoides biauritus (Cantor, 1849)

Common name: Bronze croaker (Fig. 4c)
Material examined: 8; TL-120-292 mm, Veraval (Gujarat) = 7, Kochi (Kerala) = 1.
Meristic counts: D IX + I, 28-29; A II, 8; P I, 17; V I, 5; LL 57-58; Vert. 82; GR 7-11.

A large species with a slender body and acute snout. Mouth terminal; upper jaw reaching back well beyond eye. Scales small. Caudal fin acutely pointed. Swimbladder carrot shaped, with a single pair of long tubular appendages arising from posterior end of bladder. *O. biauritus*, known for its large size and firm flesh, is especially valued in local markets and is landed as a high-value species. The swim bladders of large fishes are harvested for export, adding to their commercial value.

Otolithoides pama (Hamilton, 1822)

Common name: Bronze croaker (Fig. 4d)
Material examined: 15; TL 145-223 mm from West Bengal.
Meristic counts: D X + I 42-43; A II, 7; P I, 16; V I, 5; LL 56-58, Vert. 25; GR 5+12.

Body slender; snout acute; mouth large and terminal; eyes very small; interorbital region broad, conical. Fins yellowish, the upper half of dorsal fin grey. Swimbladder carrot-shaped with a pair of tubule originating near its posterior end and extending forwards into head, with several branches. *O. pama*, though small in size, also contributes significantly to artisanal and small scale fisheries. Both *Otolithoides biauritus* (Cantor, 1849) and *Otolithoides pama* (Hamilton, 1822) are of high commercial importance, particularly in the coastal fisheries of the eastern coast, including West Bengal, Odisha, Andhra Pradesh, and Tamil Nadu.

Genus Protonibea Trewavas, 1971

Head large; snout acute shaped; mouth large, terminal; three pairs of mental pores; swimbladder carrot shaped; caudal fin rhomboid; teeth well differentiated in both jaws. The species is characterised by small black spots on the upper part of the body, including the dorsal and caudal fins. The genus is represented by a single species *Protonibea diacanthus*, which is highly valued in export. Large sized fishes are worth lakhs, and their air bladder fetches a prime value in export.

Protonibea diacanthus (Lacepède, 1802)

Common name: Spotted croaker (Fig. 4e)
Material examined: N=5 from Karnataka = 1; Goa = 1; Gujarat = 1; Mandapam Harbour = 1; Kochi = 1.
Meristic counts: D IX-X + I 22-25; A II, 7; P I, 17-18; V I, 5, LL 49-53, Vert. 25; GR 4-5+ 6-8.

Large, slender bodied; mouth large, body dark grey; five dark blotches along back, many smaller black spots (about size of pupil) on top of head, upper half of body, dorsal and caudal fins; pectoral, pelvic, anal and lower parts of caudal fins black. Swimbladder carrot-shaped bearing 16 to 20 pairs of appendages. It is one of the largest sciaenid species found in Indian coastal and estuarine waters, and is highly valued for both its meat and swim bladder. The flesh is considered nutritious and is widely consumed, especially in eastern coastal states like Andhra Pradesh, Odisha, and West Bengal, where it supports local livelihoods through small-scale and commercial fisheries. The species is typically caught using trawl nets, gill nets, and hook-and-line. Fishery for this species is present along Gujarat coast.

Genus Dendrophysa Trewavas, 1964

Head small; mouth inferior; snout prominent lower jaw shorter than upper. A median mental barbel present; five mental pores, the median of which is the aperture of a pair that are situated closely below the symphysis. Teeth in upper jaw villiform band, outer row slightly enlarged; teeth of lower jaw small uniform. Monotypic genus.

Dendrophysa russelii (Cuvier, 1829)

Common name: Goatee croaker (Fig. 5a)
Material examined: 17; TL 115-178 mm, Kochi (Kerala) -4, Gulf of Mannar (Tamil Nadu)- 5, West Bengal- 3, Andaman-3, Gujarat -2.
Meristic counts: D X + I 25-32; A II, 7; P 16; V I, 5; LL 46-49; Vert. 24; GR 4-5+7-8.

Small-sized body oblong; head small, inferior mouth. Snout rounded; projecting slightly before upper jaw. Mental pores 5, one median, two lateral pairs; one pointed and tapering barbel behind the median mental pore. Swimbladder carrot-shaped with 14 to 17 pairs of arborescent diverticula. The fish has moderate commercial importance in India, particularly

along the east coast, including the coastal waters of Andhra Pradesh, Odisha, and Tamil Nadu.

Genus *Chrysochir* Trewavas and Yazdani, 1966

Mouth terminal, or slightly inferior; upper jaw slightly protruded than lower jaw; snout with 3 upper and 5 marginal pores; mental pores 5; second anal spine strong; carrot-shaped swimbladder extending behind the vent to the anal spines. A single species *Chrysochir aurea* (Richardson, 1846) was collected in the present study.

Chrysochir aurea (Richardson, 1846)

Common name: Reeve's croaker (Fig. 5b)
Material examined: N = 8; TL 152-245 mm from West Bengal.
Meristic counts: D X + I 26-28; A II, 6-7; P I, 17; V I, 5; LL 49-52; Vert. 26; GR 5-9.

Body slender, with an acute, prominent snout. Mouth large; caudal fin rhomboid with pointed tip. Swimbladder carrot-shaped, bearing 24 to 28 pairs of arborescent appendages along sides. The fish has high commercial importance in parts of its range, including Indian coastal waters, particularly in the Bay of Bengal region. In India, it is landed primarily found along the east coast, including Andhra Pradesh, West Bengal, and Odisha.

Genus Pterotolithus Fowler, 1933

Body elongate, compressed; mouth large; strongly oblique. A pair of canine teeth in each jaw. No upper pores on snout; body with a distinctive pattern of three to four rows of black blotches on the upper part of the body. A single species *Pterotolithus maculatus* (Cuvier, 1830) was collected in the present study.

Pterotolithus maculatus (Cuvier, 1830)

Common name: Blotched tiger-toothed croaker (Fig. 5c)
Material examined: N=3; 148-170 mm from West Bengal.
Meristic counts: D IX + I 30-34; A II, 10; P I, 17; V I, 5; LL 48-49; Vert. 25; GR 7+8.

Body large, slender; with the head profile low and horizontal. Mouth large, oblique, superior, with a distinctive pattern of three or four rows of black blotches on the upper part of the body. Swimbladder broad, oval, with a narrow point posteriorly, having 37 to 42 pairs of arborescent appendages. The fish is not commercially important in the Indo-West Pacific region, including the east coast of India. It is commonly found in coastal and estuarine waters, where it contributes to the artisanal and small-scale fisheries, particularly in states like West Bengal and Odisha.

Genus Panna Lal Mohan, 1969

Fishes of this genus have a carrot shaped swimbladder with an anterior tubule on each side, which bifurcates into a long, simple abdominal appendage and a simple or branched cephalic appendage. Mouth large, terminal; teeth well differentiated in size in both jaws; moderately spaced, and a narrow band of small inner teeth; 3 pairs of mental pores. In the present study, *Panna heterolepis* Trewavas, 1977 was obtained. The species was collected from West Bengal.

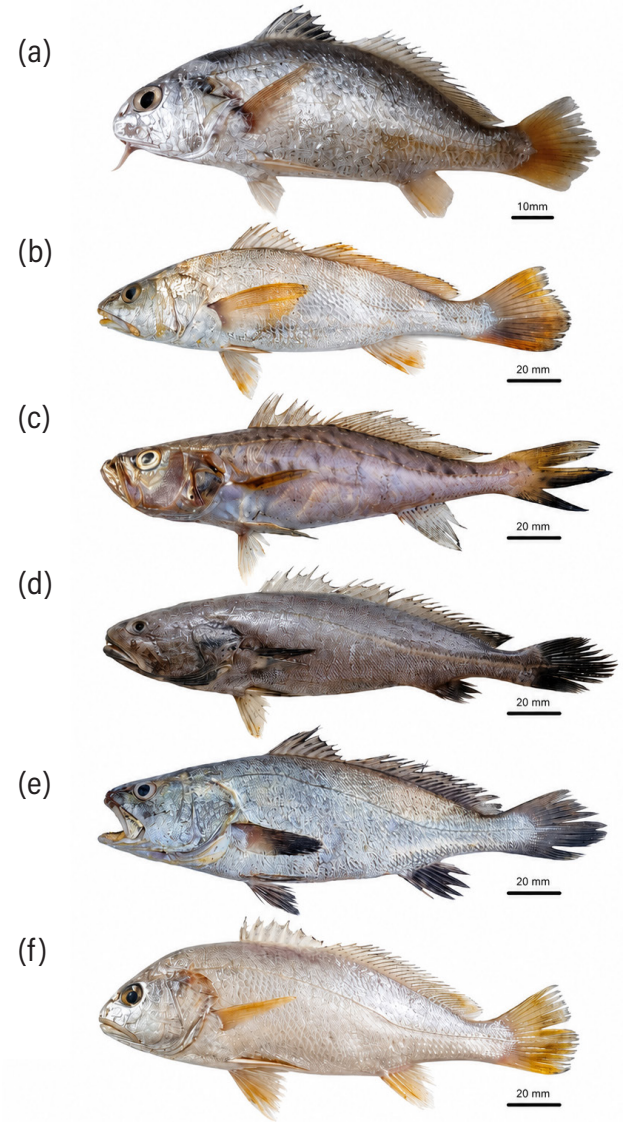

Fig. 5. (a) *Dendrophysa russelii* (Cuvier, 1829) (b) *Chrysochir aurea* (Richardson, 1846) (c) *Pterotolithus maculatus* (Cuvier, 1830) (d) *Panna heterolepis* Trewavas, 1977 (e) *Atrobucca alcocki* Talwar, 1980 and (f) *Macrospinosa cuja* (Hamilton, 1822)

Panna heterolepis Trewavas, 1977

Common name: Hooghly croaker (Fig. 5d)
Material examined: 1 TL=160 mm from West Bengal.
Meristic counts: D IX, I 34; A II, 7; P I, 16-17; V I, 5; LL 54; Vert. 24; GR 6+12.

Body medium, slender. Head compressed with an acute snout. Mental pores three pairs, anterior very small, on front of chin, second and third pair of pores open ovals. No pores on snout. Body brownish, becomes lighter on flanks and belly. Swimbladder carrot shaped, with a diverticulum on each side arising from the anterior end and immediately dividing into a short abdominal and a narrower, unbranched cephalic tube.

Genus Atrobucca Chu, Lo and Wu, 1963

Mouth terminal; teeth sharp, needle-like, well differentiated in size in both jaws, outer series in upper jaw and inner series in lower jaw enlarged and spaced, canines absent; carrot shaped swimbladder with 20 to 30 pairs of lateral arborescent appendages; three pairs of mental pores on lower jaw; anterior pair minute and on front of chin, separated by symphysis. In the present study, *Atrobucca alcocki* Talwar, 1980 was collected from Mumbai.

Atrobucca alcocki Talwar, 1980

Common name: Bombay blackmouth croaker (Fig. 5e)
Material examined: N = 4; TL 150 – 204 mm from Mumbai.
Meristic counts: D X, I 2-26; A II, 7, P I, 16-17; V I, 5; LL 49-50; Vert. 25; GR 5-8.

Mouth terminal; teeth well differentiated in both jaws; outer upper row enlarged, moderately spaced, with a narrow band of small inner teeth. The mouth is black in colour. This species is not as well known or abundant in shallow coastal fisheries as some other sciaenids, and is occasionally encountered in deep-sea trawl fisheries.

Genus Macrospinosa Lal Mohan, 1969

Mouth terminal, lower jaw slightly inferior; teeth differentiated in size in both jaws, but without specialised caniniform teeth. Snout with three indistinct pores, five well developed pores at the edge of the rostral flap; mental pores three pairs, those of the anterior pair immediately behind the symphysis. Second anal fin spine long, robust. In the present study, *Macrospinosa cuja* (Hamilton, 1822) was collected from West Bengal.

Macrospinosa cuja (Hamilton, 1822)

Common name: Cuja bola (Fig. 5f)
Material examined: 1 TL=218 mm from West Bengal.
Meristic counts: D X, I 27-29; A II, 7; P 17; V I, 5;LL 50;Vert. 26; GR 5 + 7.

A fairly large species with a blunt snout; dorsal profile above the orbit is convex. Dorsal fin deeply notched. Mental pores three pairs, the anterior pair immediately behind the symphysis close together or in a pit opening by a single pore. Swimbladder carrot-shaped. Though not a high value species, it is frequently caught as part of the multispecies demersal fishery, especially in Odisha and West Bengal.

The west coast exhibits the highest species diversity and supports a rich diversity of sciaenid species. Genus *Johnius* exhibits the highest species richness, with six species (e.g., *J. amblycephalus, J. carutta, J. carouna, J. belangerii, J. dussumieri*) distributed widely along the west coast. The east coast supports fewer species in terms of overall richness but includes significant representatives from multiple genera, such as *Otolithes ruber, Nibea maculata, Pennahia macrocephala, Protonibea diacanthus,* and *Dendrophysa russelii*. Notably, the Gulf of Mannar (Tamil Nadu) and West Bengal emerge as prominent localities with a high occurrence of croaker species. Several genera like *Pterotolithus, Panna, Macrospinosa*, and *Atrobucca* are restricted to only the east coast (Orissa and West Bengal) region, indicating a more localised distribution.

Multivariate statistical analysis of sciaenids

The dendrogram constructed using the Bray–Curtis similarity index reveals distinct patterns in the distribution of sciaenid (croaker) species across the coastal regions of India (Fig. 6a). The northwest coast forms an isolated cluster, diverging at the highest hierarchical level, indicating a comparatively low similarity in species composition with the other regions. This distinctiveness may be attributed to region specific ecological conditions or the presence of locally restricted species. The northeast coast exhibits an intermediate level of similarity, forming a separate cluster that is moderately related to the southern regions, yet still distinct in its species composition. In contrast, the southeast and southwest coasts cluster closely together at the lowest height, signifying a high degree of similarity in sciaenid species assemblages. This close association likely reflects shared ecological and environmental conditions, as well as potential continuity in habitat types across these southern maritime states. Overall, the hierarchical clustering analysis highlights clear biogeographic structuring in the distribution of sciaenids along the Indian coastline, underscoring the relative faunal distinctiveness of the northern regions and the species homogeneity of the southern coastal zones.

The Bray-Curtis dissimilarity heatmap provides a quantitative assessment of the variation in sciaenid (croaker) species composition across four major coastal regions of India–northwest, northeast, southeast, and southwest (Fig. 6b). The observed dissimilarity values range from 0.32 to 0.54, where higher values indicate greater dissimilarity in species assemblages. Notably, the Northwest coast exhibits the highest levels of dissimilarity with the other regions, particularly with the Southwest (0.54) and Northeast (0.53), suggesting that it harbours a distinct croaker community structure, likely influenced by unique environmental or oceanographic conditions. In contrast, the southeast and southwest coasts display the lowest dissimilarity value (0.32), indicating a high degree of similarity in their species composition. This pattern implies a strong biogeographic affinity between these two southern regions, possibly due to continuous habitat features or similar ecological niches. The northeast coast shows moderate dissimilarity with both the southeast (0.42) and southwest (0.39), reflecting an intermediate faunal relationship.

The associated dendrogram confirms these findings, grouping southeast and southwest as the most similar regions, followed by the northeast, while the northwest forms a separate cluster. Collectively, these results underscore a distinct latitudinal gradient in sciaenid species distribution along the Indian coastline, with southern regions showing higher faunal connectivity and the northwest emerging as a biogeographically isolated zone. Such insights are critical for regional biodiversity assessments, conservation prioritisation, and understanding ecological drivers influencing species turnover among India's coastal ecosystems.

Presently, 270 species in 70 genera are reported throughout the world in the family Sciaenidae (Chao, 1986). Allen and Robertson (1994) estimated 80 genera with about 300 species. Trewavas (1977) grouped 65 species into 27 genera in 10 tribes. Lal Mohan (1981) recorded 36 species from 14 genera, from which we have collected 15 species under 7 genera. Talwar (1995) reported 40 species from 20 genera in 8 tribes, from which we have collected 17 species in 8 genera (Table 2). Most work has been limited to regional studies (*viz*., eastern Atlantic by Trewavas, 1962; Chinese waters by Chu *et al*., 1963; Indian waters by Mohan, 1972; Indo- West Pacific by Trewavas, 1977; western Atlantic by Chao, 1978). In the present study, based on morphometric and hard parts, we could identify 27 species in 14 genera from the Indian coasts. Weber and Beaufort (1936) recorded 34 species from 6 genera from the Indo-Australian Archipelago. Allen and Robertson (1994) estimated 80 genera with about 300 species. Druzhinin (1971) recorded 45 species from 15 genera, while 48 species in 27 genera were reported by Lal Mohan (1991) from the Indian Ocean.

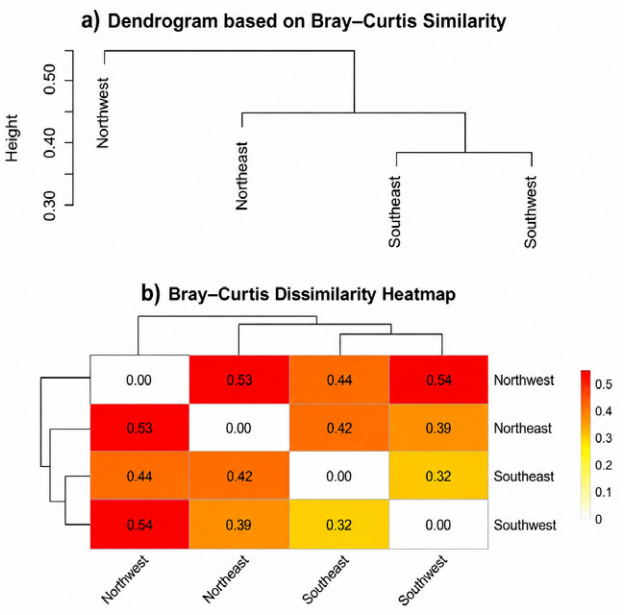

Fig. 6. Distribution of sciaenids from the different coasts of India based on Bray-Curtis Similarity Index: (a) dendrogram representing Bray-Curtis similarity, (b) heatmap ordination representing clustering of coasts

Lal Mohan (1981) in his consolidated work had reported 36 species in 14 genera. The comparative assessment between the species listed by Lal Mohan (1981) and those validated in the present study reveals both taxonomic advancements and shifts in species status and occurrence in Indian waters. Several species originally identified by Lal Mohan have undergone nomenclatural changes or genus level reassignments based on modern taxonomic frameworks. *Umbrina canariensis* described by Lal Mohan (1981), is of doubtful occurrence had included some doubtful species and some species not recorded from Indian waters.

Several species appear consistently across all references and were also confirmed in the present study, indicating their continued prevalence and ecological stability in Indian marine ecosystems. These include commonly encountered species such as *Kathala axillaris*, *Otolithoides biauritus*, *Otolithoides pama*, *Chrysochir aurea*, *Otolithes ruber*, *Otolithes cuvieri*, *Pterotolithus maculatus*, and *Protonibea diacanthus*. Their consistent documentation across nearly a century affirms their status as core sciaenid species in the region. Conversely, some taxa such as *Bahaba chaptis, Macrospinosa cuja, Panna hetrolepis, Atrobucca nibe, Nibea chui, Johnius macropterus*, and *Johnius mannarensis* are categorised as rare or of uncertain status, possibly due to habitat specificity, depth distribution, limited population sizes, or under sampling. Notably, *Argyrosomus hololepidotus*, though previously mentioned in older literature, is clarified in this table as a South African species not found in Indian waters, pointing to earlier misidentifications or range misinterpretations.

Table 3. Observations done by various workers on the species of the family Sciaenidae

Genus	Lal Mohan, 1981	Current valid name	Weber and Beaufort (1936)	Trewavas (1977)	Talwar (1995)	Present study	Comments
Umbrina	*Umbrina sinuata*	*Umbrina canariensis*		✓	✓		Doubtful
Bahaba	*Bahaba chaptis*	*Bahaba chaptis*		✓	✓		Rare occurrence
Macrospinosa	*Macrospinosa cuja*	*Macrospinosa cuja*		✓	✓	✓	Rare occurrence
Kathala	*Kathala axillaris*	*Kathala axillaris*	✓	✓	✓	✓	Common
Otolithoides	*Otolithoides biauritus*	*Otolithoides biauritus*	✓	✓	✓	✓	Common
	Otolithoides pama	*Otolithoides pama*	✓	✓		✓	Common
Panna	*Panna microdon*	*Panna microdon*	✓	✓	✓		Doubtful
		Panna hetrolepis		✓	✓	✓	Rare
Pennahia	*Pennahia macrophthalamus*	*Pennahia aneus*	✓	✓	✓	✓	Common
		Pennahia macrocephala		✓	✓	✓	Rare
Argyrosomus	*Argyrosomus hololepidotus*	*Argyrosomus hololepidotus*		✓	✓		Not found in India. It is a South African species
	Argyrosomus amoyensis	*Argyrosomus amoyensis*		✓	✓		Doubtful
Atrobucca	*Atrobucca nibe*	*Atrobucca nibe*		✓	✓		Rare
	Atrobucca trewavasae	*Atrobucca trewavasae*		✓	✓		Occasional
		Atrobucca alcocki		✓	✓	✓	Occasional
Chrysochir	*Chrysochir aureus*	*Chrysochir aurea*		✓	✓	✓	Common
Otolithes	*Otolithes ruber*	*Otolithes ruber*	✓	✓	✓	✓	Common
	Otolithes cuvieri	*Otolithes cuvieri*		✓	✓	✓	Common
Pterotolithus	*Pterotolithus maculatus*	*Pterotolithus maculatus*	✓	✓	✓	✓	Common
Protonibea	*Protonibea diacanthus*	*Protonibea diacanthus*	✓	✓	✓	✓	Common
Dendrophysa	*Dendrophysa russelii*	*Dendrophysa russelii*	✓	✓	✓	✓	Occasional
Nibea	*Nibea semiluctuosa*	*Paranibea semiluctuosa*		✓			Rare
	Nibea albida	*Daysciaena albida*		✓	✓	✓	Common
	Nibea maculata	*Nibea maculata*	✓	✓	✓	✓	Occasional
	Nibea chui	*Nibea chui*		✓	✓		Rare
	Nibea soldado	*Nibea soldado*	✓	✓	✓	✓	Occasional
Johnius	*Johnius carutta*	*Johnius carutta*	✓	✓	✓	✓	Occasional
	Johnius elongatus	*Johnius elongatus*		✓	✓	✓	Occasional
	Johnius belangerii	*Johnius belangerii*	✓	✓	✓	✓	Common
	Johnius dussumieri	*Johnius dussumieri*	✓		✓	✓	Common
	Johnius mannarensis	*Johnius mannarensis*					Rare
	Johnius coitor	*Johnius coitor*		✓	✓	✓	Occasional
	Johnius glaucus	*Johnius carouna*			✓	✓	Common
	Johnius macropterus	*Johnius macropterus*	✓	✓	✓	✓	Rare
		Johnius amblycephalus		✓	✓	✓	Common
Johnieops	*Johnieops marorhynus*	*Johnius macrorhynus*		✓	✓	✓	Common
	Johnieops aneus	*Pennahia aneus*		✓	✓	✓	Common
	Johnieops dussumieri	*Johnius dussumieri*			✓	✓	Common
	Johnieops sina	*Johnius dussumieri*			✓	✓	Common
	Johnieops vogleri	*Johnius borneensis*	✓		✓	✓	Common

Certain species, such as *Atrobucca alcocki, Dendrophysa russelii, Nibea soldado, Johnius elongatus,* and *Johnius coitor* are marked as "occasional," indicating they may be locally abundant but have patchy or seasonal distributions. The presence of several revalidated or recently confirmed species, like *Johnius amblycephalus*, *Johnius borneensis* (formerly *Johnieops vogleri*), and the synonymised *Johnius dussumieri* (previously listed under *Johnieops*), demonstrates the impact of modern revisions in taxonomy. Lal Mohan (1991) has reported the sciaenid fishery along the four major coastal regions of India, *i.e.*, northwest, southwest, southeast, and northeast, with significant variation in species diversity. The northwest coast

Table 4. Number of species recorded from different Coastal regions of India

No.	Genus	Total no. of Species	Northeast	Northwest	Southeast	Southwest
1	*Otolithes*	2	2	2	2	2
2	*Daysciaena*	1	0	0	0	1
3	*Kathala*	1	1	1	1	1
4	*Nibea*	2	1	1	2	1
5	*Pennahia*	2	1	1	2	0
6	*Otolithoides*	2	2	1	0	0
7	*Protonibea*	1	1	1	1	1
8	*Johnius*	10	8	10	9	9
9	*Dendrophysa*	1	1	1	1	1
10	*Chrysochir*	1	1	0	0	0
11	*Pterotolithus*	1	1	0	0	0
12	*Panna*	1	1	0	0	0
13	*Macrospinosa*	1	1	0	0	0
14	*Atrobucca*	1	0	1	0	0

stands out as one of the richest regions for sciaenid resources, with a high diversity and dominance of species such as *Otolithes cuvieri*, *Johnius glaucus* and *Protonibea diacanthus*. The southwest coast, while supporting a moderately diverse sciaenid assemblage, is primarily characterised by species like *Johnius macrorhynus*, *J. aneus*, and *O. cuvieri*. The southeast coast hosts a broader and more evenly distributed range of species, including *Pennahia macrocephalus*, *Johnius carutta*, *Kathala axillaris*, and *Chrysochir aurea*, contributing to a productive and diverse fishery. The northeast coast reflects a rich sciaenid fauna with notable contributions from *P. macrocephalus*, *C. aureus*, *Johnius coitor*, and *Otolithoides pama*. The present study matches these results that the rich sciaenid ground on the northwest coast of India.

The distribution of Sciaenidae species along the Indian coastline reflects significant regional variation in species richness and composition. The northwest coast hosts the highest diversity, with a dominance of important genera such as *Johnius, Otolithes, Nibea, Protonibea,* and *Otolithoides*, indicating highly favourable conditions for croakers. The southwest coast also supports a rich sciaenid community, with many overlapping genera including *Johnius, Otolithes, Nibea*, and *Atrobucca*, highlighting the ecological productivity of this region. On the southeast coast, sciaenid diversity is moderate, with prominent genera including *Johnius, Pennahia, Chrysochir, Dendrophysa,* and *Kathala*. These species are well adapted to the sandy and muddy bottoms of the continental shelf in this region. The northeast coast, while relatively lower in diversity, features distinct genera such as *Macrospinosa, Otolithoides, Bahaba, Pterotolithus, Johnius* and *Pennahia*, often associated with coastal ecosystems.

Overall, the west coast (northwest and southwest) stands out as the most species rich zone for sciaenids, dominated by key genera like *Johnius, Otolithes*, and *Nibea*. The East Coast (southeast and northeast), though less diverse, supports several region-specific genera contributing to localised fisheries. The taxonomy of Sciaenidae has shifted from classical morphology based identification to a more rigorous, integrative taxonomic approach incorporating molecular phylogenetics. While early taxonomists laid the foundation, recent work has revealed the non monophyly of several genera and the need for comprehensive global revisions. As molecular data continue to grow, further changes in genus boundaries and species identities are expected, especially in species-rich tropical Indo-Pacific regions.

The present study provides an updated account of the diversity and distribution of sciaenids (Family Sciaenidae) in Indian waters based on detailed morphological examination. Although no new species records were observed, the study verifies the occurrence of previously reported taxa and refines species identification, addressing challenges of misidentification and overlapping morphometric characters. The species composition largely agrees with earlier reports (Day, 1888; Trewavas, 1977; Lal Mohan, 1981; Talwar, 1995; Mohanraj *et al*., 2003), with minor variations that may be attributed to differences in sampling, fishing pressure, and environmental conditions. As demersal fishes associated with soft bottom habitats, sciaenids show distribution patterns influenced by substrate type, depth, and estuarine inputs (Chao, 1978; Sasaki, 1996). The observed similarity in species composition along the southern coast of India can be explained by continuity of habitats, comparable environmental conditions, and uniform fishing practices, particularly along Kerala and Tamil Nadu coasts (Qasim, 1977; CMFRI, 2020). From a fisheries perspective, sciaenids are economically important, and increasing demand for fish maw may influence exploitation patterns and species composition (FAO, 2020; Ben-Hasan *et al*., 2021; CMFRI, 2021). Environmental factors such as seasonal variability, freshwater influx, and climate-related changes may also affect distribution and abundance (Pauly and Christensen, 1995; Legg, 2021). Despite advances in molecular systematics, species identification in fisheries contexts continues to rely primarily on morphology (Nelson *et al*., 2016; Parenti, 2020), and thus the present classical taxonomic approach provides essential baseline data for accurate identification, biodiversity assessment, and sustainable fisheries management.

Conclusion

This study provides an updated and comprehensive assessment of the diversity, distribution, and biogeographic patterns of sciaenid fishes along the Indian coastline and associated island ecosystems. Clear regional structuring of sciaenid assemblages was observed, with higher similarity between the southwest and southeast coasts and a distinct faunal composition along the northwest coast, reflecting the influence of oceanographic processes, shelf characteristics, and habitat variability. Island ecosystems, although supporting lower species richness, contribute to regional diversity and highlight the importance of insular habitats in sciaenid distribution. The results further emphasise the growing vulnerability of several sciaenid species under increasing fishery pressure, particularly large-bodied and high-value taxa targeted for fish maw trade. The presence of Data Deficient and Near Threatened species within commercially exploited assemblages underscores significant gaps in biological knowledge and fisheries monitoring. Accurate taxonomic resolution, combined with species-level landing data, targeted biological studies, and periodic stock assessments, is essential for effective fisheries management and conservation planning. Overall, the study highlights the importance of integrating taxonomic, biogeographic, and fisheries perspectives to support sustainable utilisation and long-term conservation of sciaenid resources in Indian waters.

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Author contributions

Conceptualisation: SAT, RJN; Methodology: SAT; Data Collection: SAT, VKM; Data Analysis: SAT Writing Original Draft: SAT; Writing Review and Editing: SAT, RJN; Supervision: RJN

Data availability

Data will be made available on request

Conflicts of interest

The authors declare that they have no conflict of financial or non-financial interests that could have influenced the outcome or interpretation of the results

Ethical statement

No ethical approval is required as the study does not include activities that require ethical approval or involve protected organisms/ human subjects/ collection of samples/ protected environments

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