

Research Article

First report of *Cistopus platinoidus* Sreeja, Norman & Biju Kumar, 2015 (Cephalopoda, Octopoda, Octopodidae) from the tropical Hooghly-Matlah estuary, West Bengal, India

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Cistopus platinoidus Sreeja, Norman & Biju Kumar, 2015 is a tropical benthic cephalopod in the Octopodidae family with eight tiny mucous pouches that are present between the bases of each arm. The current findings revealed the presence of the 'pouched octopus', *C. platinoidus*, from the Hooghly-Matlah estuary, West Bengal, India. The mean salinity of the collection sites was measured at 27.80 ± 2.55 ppt, and the location is approx. 75 km from the river mouth and is bordered by mangrove forest. The present study confirms the range extension of *C. platinoidus* from the west coast (Kerala and Gujarat) to the east coast (West Bengal).

[**Keywords:** *Cistopus platinoidus*, First report, Hooghly-Matlah estuary, Octopodidae, Range extension]

Introduction

The genus *Cistopus* Grey, 1849, is often known for the 'pouched octopus' and was thought to be monotypic until the mid-1980s, represented by *Cistopus indicus* (Rapp, 1835), having a distributional range from India to the Philippines¹. *Cistopus* is a little-known cephalopod genus. The term "platinoidus" refers to the distinctive inner surfaces of the species' suckers, which have a sheen resembling platinum. It shares several characteristics with other members of the genus *Cistopus*, such as the development of many arm glands that exude mucus to encapsulate their eggs and protect their offspring. Eight mucus pouches with a mouth between the arm bases distinguish members of this genus, which primarily inhabits soft sediment substrates². The pouches are known as water pouches/water pores, and their role is to create mucus, which may also aid in the formation of subsurface burrows in soft sediments³⁻⁵. *Cistopus indicus* (Rapp, 1835), *C. taiwanicus* Liao and Lu, 2009^(ref. 6), *C. chinensis* Zheng, Lin, Lu and Ma, 2012^(ref. 7), and *C. platinoidus* Sreeja, Norman & Biju Kumar, 2015^(refs. 2,8) are all currently recognised through distinct morphological features. These include eight oviducal glands, a silvery-white dorsal mantle surface, a short arm length (arm length to mantle length ratio < 4:1), biserial suckers, a small ligula, and a unique internal

ink sac with multiple discrete ink sacs, characteristic of the genus *Cistopus*². Sreeja *et al.*² classified *C. platinoidus* as a new species based on specimens collected from the commercial trawl catches in the Kerala fishing harbours of Beypore, Puthiyappa, and Sakthikulangara.

The Hooghly-Matlah estuary along the West Bengal coast, covering approximately 295 km from the sea, is one of the country's largest and most productive estuaries⁹ and is located between latitude 21°31' to 23°30' N and longitude 87°45' to 88°45' E. The Hooghly-Matlah estuary is known for changes in the estuary's biodiversity, including fish diversity at its different zones, with more than 90 % of fish catch coming from the lower estuarine zone¹⁰⁻¹².

Numerous fish and shellfish species, including specific octopus varieties, utilise estuarine habitats as critical environments for their recruitment and protection of early life stages¹³. Studies indicate that juveniles of various coastal fish, shellfish, and mollusc species use estuarine waters during their early life stages^{14,15}. The increased water temperature, abundant prey, and scarcity of predators in estuarine environments enhance the survival and growth rates of juvenile fish and shellfish¹⁶. The proximity of the current study area to mangrove habitats, which provide abundant prey and favourable conditions, may support octopus nursery grounds. Local

fishermen usually discard the smaller octopuses from their haul, while they sell the larger ones as food fish in West Bengal's local market. Although octopus is not yet a targeted species in the West Bengal's Hooghly-Matlah estuarine system, local market demand suggests that this group could soon become one.

Research on cephalopods shows that it's common for them to move to shallow or nearby estuary waters to reproduce, even though there aren't many specific reports of *C. platinoidus* doing this for spawning. In the East China Sea, elevated water temperatures significantly influence gonadal maturation and reproductive activities. Various cephalopod species, including certain octopods, migrate from deeper offshore waters to shallow coastal areas for breeding¹⁷. Estuarine habitats such as the Hooghly-Matlah may serve as optimal spawning grounds for *C. platinoidus*, influenced by temperature-dependent reproductive migration, particularly when environmental factors like water temperature and salinity gradients promote gonadal development.

Future-focused research in these estuaries would be advantageous to verify whether this species exhibits comparable migratory spawning behaviour. The present study reports the first confirmed record of *C. platinoidus* from the Hooghly-Matlah estuary, West Bengal, India.

Materials and Methods

Specimens for the present study were collected from a bag net operated at Jatirampore fishing sites (near Gosaba) in the Hooghly-Matlah estuarine system during June 2022 (Fig. 1). The collected specimens were transported to the institute laboratory (ICAR-CIFRI) and stored in an insulated icebox for future examination and identification. The specimens were identified following Sreeja *et al.*², Nateewathana¹⁸, Norman & Sweeney¹⁹, and Norman *et al.*²⁰. In the laboratory, octopus specimens were photographed using a Nikon D7200 camera with an Olympus stereo zoom microscope (SZ-40). All the morphometric measurements were recorded with a digital Vernier calliper to the nearest 0.01 mm, and

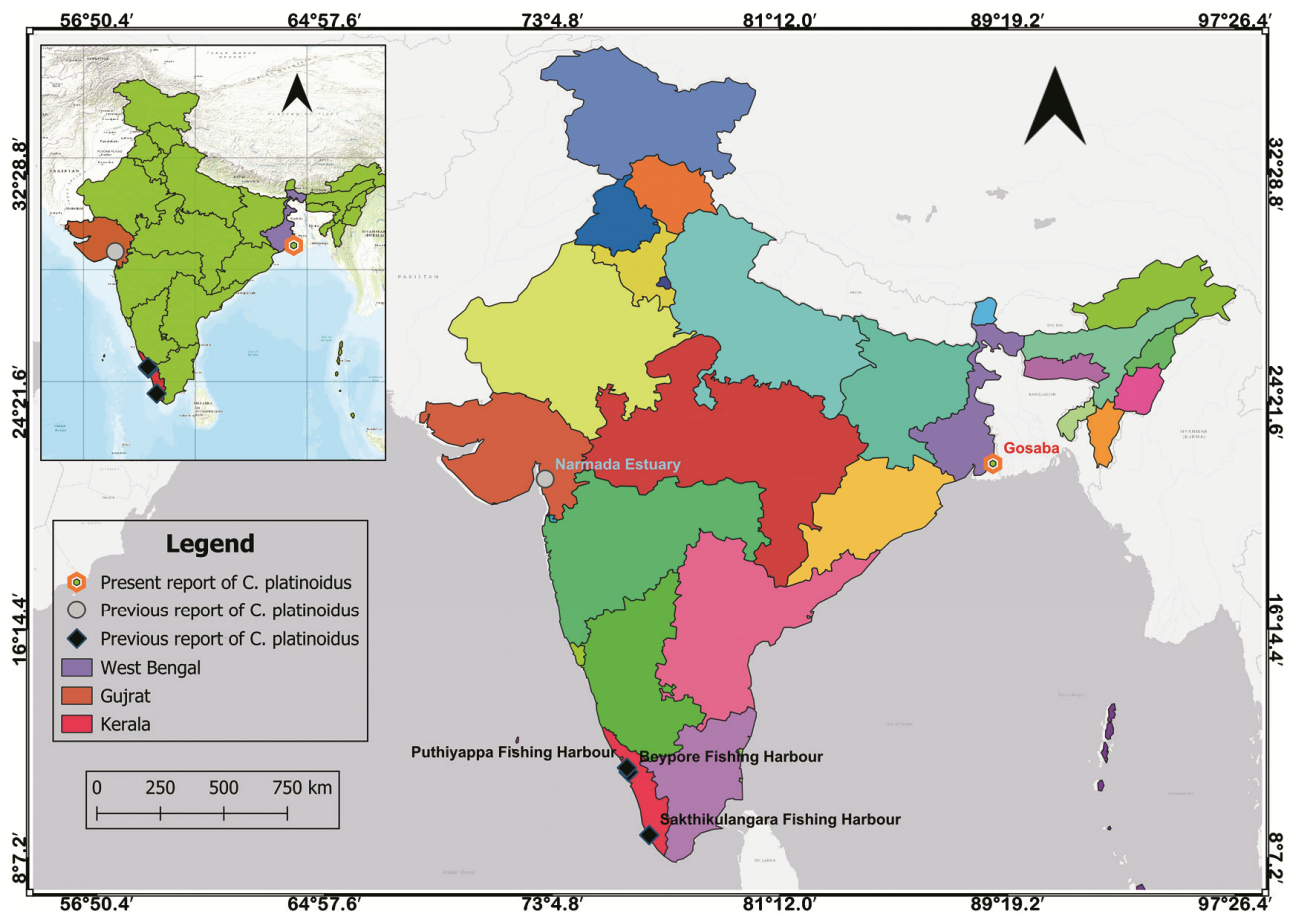


Fig. 1 — Map showing the present and previous collection sites of *C. platinoidus*

meristic counts were performed visually. The water sample was obtained from the bagnet operation site and analysed in triplicate according to standard procedures for temperature, water depth, flow, salinity, pH, DO, total alkalinity, turbidity, transparency, and specific conductivity, following standard methods²¹. The voucher specimens are deposited in the institute museum (CIFRI/Cep/01/2023), and their morphological characteristics are listed in Table 1.

Results

Taxonomic hierarchy

Kingdom: Animalia Linnaeus, 1758

Phylum: Mollusca Linnaeus, 1758

Class: Cephalopoda Cuvier, 1797

Order: Octopoda Leach, 1818

Family: Octopodidae d'Orbigny, 1839

Genus: *Cistopus* Gray, 1849

Cistopus platinoidus Sreeja, Norman & Biju Kumar, 2015

Material examined

Five specimens of *C. platinoidus*, with total length ranging from 96.3 to 150.3 mm, weight from 1.8 to 9.7 g, dorsal mantle length from 28.2 to 32.1 mm, and dorsal arm sucker count from 124 to 134, were collected from the tropical Hooghly–Matlah estuary, West Bengal, India (coordinates: 22°8'5.28" N, 88°49'58.548" E) on 22nd June 2022 by the first author, Dibakar Bhakta. Maturity stage: immature based on gonadal examination. Collection depth:

Table 1 — Morphological features of *C. platinoidus* collected from the Hooghly-Matlah estuarine system (n = 5) with comparison to Sreeja *et al.*² and Vaishak *et al.*⁸

Morphological characters	Present study (2022)	Sreeja <i>et al.</i> ²	Vaishak <i>et al.</i> ⁸
Total length (mm)	96.3–150.3	512.0–887.0	199.0–326.0
Weight (g)	1.8–9.7	–	10.5–52.5
Dorsal mantle length (mm)	28.2–32.1	105.0–180.0	34.2–59.3
Ventral mantle length (mm)	15.4–21.9	75.0–120.	22.2–40.2
Mantle width (mm)	11.3–13.7	50.0–100.0	15.0–35.3
Head length (mm)	6.2–8.1		
Head width (mm)	10.5–13.5	28.5–48.0	11.0–18.7
Dorsal arm length (mm)	76.6–107.5	386.0–677.0	147.0–256.0
Dorso-lateral arm length (mm)	70.3–87.2	338.0–590.0	84.0–219.0
Arm width (mm)	17.8–24.1		
Ventro-lateral arm length (mm)	68.8–81.2	362.0–505.0	84.0–184.0
Ventral arm length (mm)	50.9–64.2	230.0–508.0	73.0–179.0
Web depth (mm)	9.2–14.8	68.0–125.0	15.0–36.0
Funnel length (mm)	9.1–12.2	44.0–80.0	12.0–21.0
Free funnel length (mm)	4.5–5.5	20.0–45.0	12.0–21.0
Dorsal arm sucker count (nos.)	124–134	150–172	131–147
Dorso-lateral arm sucker count (nos.)	92–98	110–194	118–132
Ventro-lateral arm sucker count (nos.)	60–68	60–162	60–112
Ventral arm sucker count (nos.)	72–82	102–174	104–112
Eye diameter	3.2–5.6	-	-
Lens diameter	2.6–3.3	-	-
Mantle width index (% DML)	40.1–43.5	47.0–70.4	43.9–60.5
Head width index (% DML)	37.2–42.1	19.4–42.1	26.2–39.8
Mantle arm index (% DML)	58.9–66.4	21.2–24.6	21.4–29.0
Dorsal arm length index (% DML)	271.6–334.9	337.9–466.7	402.3–471.4
Dorso-lateral arm length index (% DML)	249.3–271.7	275.3–438.6	246.0–369.3
Ventro-lateral arm length index (% DML)	241.8–253.0	253.0–431.6	180.4–427.5
Ventral arm length index (% DML)	180.50–200.6	190.0–421.1	173.8–374.8
Funnel length index (% DML)	32.3–38.0	41.7–53.3	28.2–41.0
Free funnel length index (% DML)	16.0–17.1	13.3–35.1	17.9–26.4
Web depth index (% DML)	12.0–13.8	15.8–20.3	13.1–15.9

Note: DML- Mantle width index

7.0±3.0 m at the bagnet fishing ground during the high tide.

Species description

The collected specimens were confirmed as *C. platinoidus* and described with the following characteristics based on the morphological information provided by Sreeja *et al.*², Natewathana¹⁸, and Norman & Sweeney¹⁹. The existence of eight tiny mucous pouches (specific to the genus *Cistopus*) encircled by the oral faces of the webs between the bases of each arm. The arms are generally long, with the dorsal arms being longer than the ventral arms, with the arm formula 1 > 2 > 3 > 4 (dorsal arm > dorsolateral arm > ventrolateral arm > ventral arm). The dorsal web is deeper than the ventral web and has a moderate depth. The deepest web is approximately 16 – 20 % of the length of the longest arm. The third right arm is hectocotylus. The ligula is very small (0.6 – 1.8 % of arm length), with a modest but noticeable calamus (about 25 % of ligula length). There is no lateral mantle ridge. Mantle is

oval to round (in the present study, oval) and longer than wide (Mental Width, MW is 44 – 66 % of Mental Length, ML). Each demibranch is with 10 – 11 lamellae. The funnel is comparatively broad and massive. Sucker counts in normal arms range from 72 to 134, whereas those for hectocotylus arms range from 60 to 64. Figure 2 provides dorsal and ventral views of fresh and preserved specimens, respectively, as well as the position of the funnel, mouth part with water pores, and mucous pouches. Figure 3 depicts the ventral view of the upper beak, lower beak, and funnel. The lower beak has a narrow hood and moderate wings, while the upper beak has a narrow hood and a blunt rostrum. The live specimen has no iridescent spots or lines on its body, small eyes, and soft skin.

Description of habitat

The specimen was collected from a shallow estuarine fishing ground within the tropical Hooghly–Matlah estuarine complex, which is bordered by dense mangrove vegetation primarily consisting of

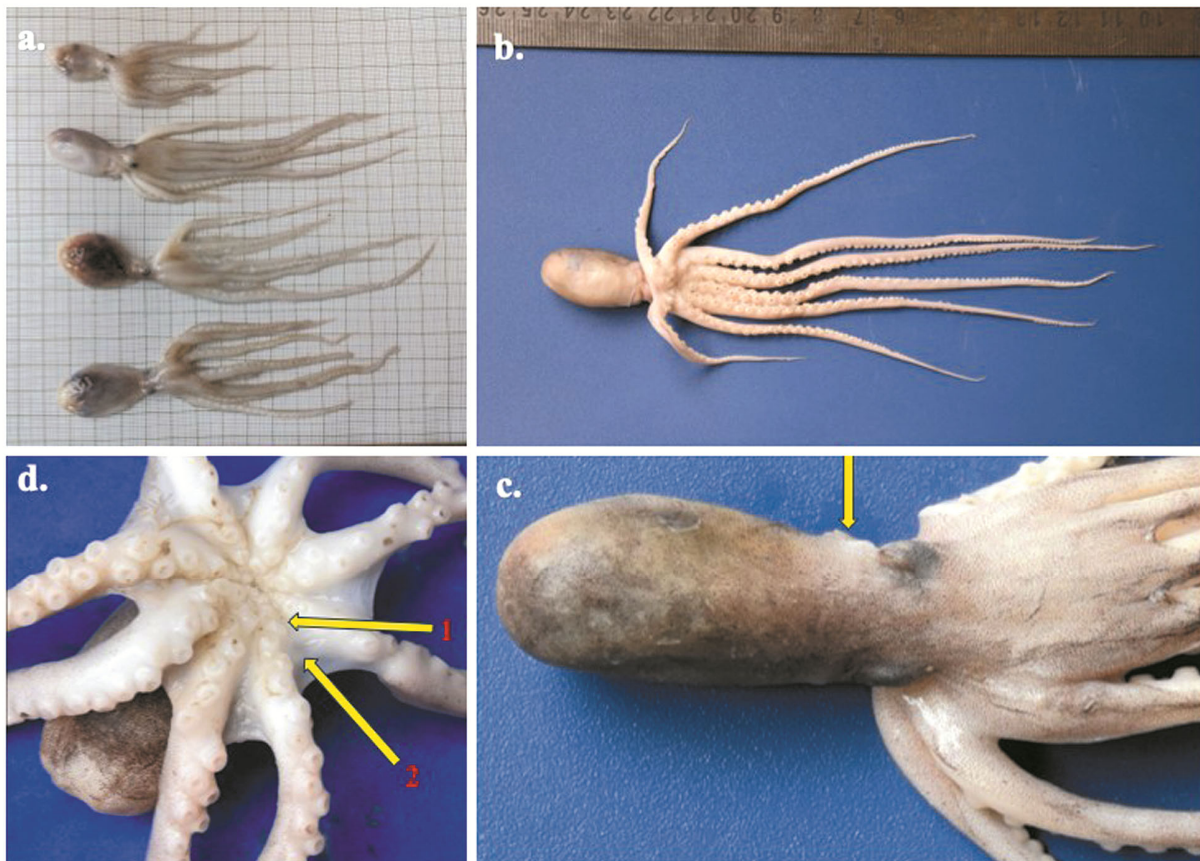


Fig. 2 — *Cistopus platinoidus* – a) Dorsal view of the fresh specimens; b) Ventral view of the alcohol-preserved specimen; c) Dorsal view of the alcohol-preserved specimen showing the funnel position (pointed with yellow marking); and d) Mouth portion showing the water pore and mucous pouch (marked with 1 and 2, respectively)

Avicennia marina, *Rhizophora mucronata*, and *Sonneratia apetala*. The substratum consisted mainly of fine silt and clay mixed with organic detritus from mangrove leaf litter. The region exhibits semidiurnal tidal variations, resulting in moderate turbidity and variable salinity levels. The associated fauna included estuarine crabs (*Scylla olivacea*, *Portunus pelagicus*), shrimps (*Fenneropenaeus indicus*, *Metapenaeus monoceros*), and small benthic fish (*Pseudapocryptes lanceolatus*, *Taenioides anguillaris*, *Odontamblyopus rubicundus*, etc.), which are frequently preferred prey for benthic octopuses.

Water quality parameters of the collection sites during the collection of octopus and other fish samples were analysed using standard methods, and average data of selected parameters are given in Table 2. The water depth was moderate, measuring

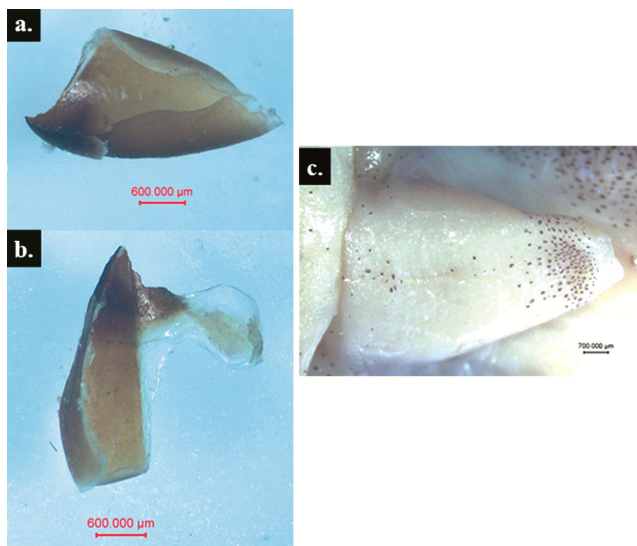


Fig. 3 — *Cistopus platinoidus* – Ventral view of the a) upper beak, b) lower beak, and c) funnel

Table 2 — Water quality parameters of collection site during the collection of *C. platinoidus* from the Hooghly-Matlah estuary systems

Water parameter	Mean (\pm SD)
Temperature ($^{\circ}$ C)	30.03 \pm 0.31
Depth (m)	7.0 \pm 3.0
Water flow (m/sec)	0.36 \pm 0.04
Transparency (cm)	29.67 \pm 2.52
Turbidity (NTU)	75.5 \pm 1.91
Sp. Conductivity (mS/cm)	48.8 \pm 0.26
pH	8.67 \pm 0.07
DO (mg/l)	5.67 \pm 0.31
Total alkalinity (mg/l)	98.0 \pm 2.0
Salinity (ppt)	27.80 \pm 2.55

between 7.0 \pm 3.0 m. Water was less transparent (Secchi depth 29.67 \pm 2.52 cm) and moderately turbid (turbidity 75.5 \pm 1.91 NTU). Monsoon rain-associated dilution caused low conductivity (48.8 \pm 0.26 μ S/cm). Water pH was alkaline (8.67 \pm 0.07), a congenial habitat for fish as well as octopuses. Optimum dissolved oxygen (5.67 \pm 0.31 mg/l) was recorded in the estuarine water. Total alkalinity was comparatively high (98.0 \pm 2.0 mg/l), which may be attributed to satisfactory primary production.

Discussion

Cephalopods are classified as short-lived animals with considerable amounts of suppleness in their life cycles. Environmental parameters and associated changes are particularly important for octopuses in terms of their population size, abundance, and dispersion²². Arms long, up to 6 times the length of the mantle; dorsal pair longer than ventral pair; webs of intermediate depth (15 – 20 % of the longest arm); and dorsal web deeper than ventral web are the characteristics of the genus *Cistopus*. Its distributional range is limited to the tropical Indo-West Pacific region, stretching from Pakistan to Thailand, the Philippines, and China²⁰. The availability and movement of food supplies are two of the key elements influencing the motions of cephalopods²²⁻²⁴. *Cistopus indicus* is a benthic carnivore species, with fish being the primary food item, followed by prawns, cephalopods, crabs, and digested matter²⁵. The dietary preferences of *Octopus membranaceus* along the eastern coast of Visakhapatnam, India, indicate that this species is a benthic carnivore that feeds on fish, prawns, crabs, squilla, and several other organisms²⁶. Authors observed 27 finfish species and many shellfish and molluscs in the study sites, which could be one of the causes of ‘pouched octopus’ migration from the sea to the estuary and establishment in mangrove-associated habitats. *Cistopus platinoidus*, first described from the southwestern coast of Kerala, and now has been recorded in the Hooghly–Matlah estuary, indicating an expansion of its distribution rather than a singular occurrence. Potential reasons encompass passive transmission via estuary inflow, foraging-related ingress, or adaptive tolerance to variable salinity. The abundance of benthic prey in estuarine sediments may also attract individuals. Moreover, limited historical sampling of estuarine cephalopods suggests that its occurrence may have been previously undocumented rather than unprecedented. There might be also a possibility that

Table 3 — *Cistopus platinoidus* morphometric and meristic characteristics in comparison to other reports

Characters	Present study	Sreeja <i>et al.</i> ²	Vaishak <i>et al.</i> ⁸
Normal arm sucker count	72–134	78–194	104–147
Hectocotylised arm sucker count	60–62	60–65	60–62
Web Depth (WD1)	9.2–14.8	15.8–20.3	13.1–15.9
Enlarged suckers in mature males	Could not differentiate as all specimens were juvenile, or sub-adult stages	absent	absent
Ligula Length (LLI)	0.5–1.3	0.6–1.8	0.6
Calamus	present	absent	absent
Iridescent lines and dots on dorsal mantle	absent	absent	absent

Table 4 — Comparative morphometric and meristic characters of *C. platinoidus* with other *Cistopus* spp.

Characters	<i>C. platinoidus</i>	<i>C. indicus</i>	<i>C. taiwanicus</i>	<i>C. chinensis</i>
Data source	Present study	Norman <i>et al.</i> ¹⁷	Liao & Lu ⁵	Zheng <i>et al.</i> ⁶
Normal arm sucker count	72–134	180–200	62–180	81–126
Hectocotylised arm sucker count	60/62	116–123	80–116	57–67
Web Depth (WD1)	9.2–14.8	15.0–20.0	15.0–26.4	2.2–12.9
Enlarged suckers in mature males	absent	absent	2–4 on the arms 1, and 2 at level of 18–21 st proximal suckers	1–2 on the arms 1, 2, and 4 at level of 10–11 th proximal suckers
Ligula Length (LLI)	0.5–1.3	0.5–0.7	0.3–0.6	2.4 % of hectocotylised arm
Calamus	present	absent	absent	present
Iridescent lines and dots on dorsal mantle	absent	absent	absent	present

the species is present in nearby coastal habitats and somehow it is not recorded yet.

Species sucker counts, the presence or absence of calamus, web depths, unusual colour markings, and other characteristics identify *C. platinoidus* from the other three known *Cistopus* species. *Cistopus platinoidus* differs from *C. indicus* morphologically in normal arm sucker count (78 – 194 vs. 185 – 206), hectocotylised arm sucker count (60 – 65 vs. 107 – 127), ligula length (0.6 – 1.8 vs. 0.5 – 0.7), and calamus (present vs. absent in *C. indicus*). *Cistopus platinoidus* differs from *C. taiwanicus* by having a higher hectocotylised normal arm sucker count (60 – 65 vs. 106 – 116), a longer ligula (0.6 – 1.8 vs. 0.3 – 0.6), and a calamus (present vs. lacking in *C. taiwanicus*). *Cistopus platinoidus* differs from *C. chinensis* in web depth (15.8 – 20.3 vs. 2.2 – 12.9), typical arm sucker count (78 – 194 vs. 81 – 126), and iridescent lines and dots on the dorsal mantle (absent vs. present only in *C. chinensis*). Tables 3 and 4 present the comparative morphometric and meristic characteristics, both intra- and inter-specific, of *Cistopus* spp., as reported by various researchers.

Different species exhibit various numbers of suckers, which are specialised disc-shaped structures located on the underside of their arms. Their numerous functions include gripping items, capturing prey, exploring the environment, and acting as sensory organs. Suckers exhibit remarkable strength

and agility, attributed to their muscular and flexible lining. They also exhibit remarkable adaptability and play a crucial role in survival in complex ecosystems, attributed to their strength and keen sensory capabilities.

Most octopus species, including *C. platinoidus*, possess suitable habitats in the shallow coastal waters. The current study identified appropriate water quality parameters that make favourable environments for fish, shellfish, molluscs, and octopuses to inhabit. The salinity value recorded at the collection site was 27.80±2.55 ppt, indicating that the area is a true estuarine zone. In contrast, Vaisakh *et al.*⁸ reported a salinity of 17.63 ppt from the Narmada estuary at the collection sites of *C. platinoidus*.

Conclusion

The present record of *Cistopus platinoidus* from the Hooghly–Matlah estuary in West Bengal extends its known geographical range to northeast coast of India in the Bay of Bengal from the southwest coast of India. Natural range expansion might be aided by Bay of Bengal coastal currents that facilitate the dispersal of paralarvae or juveniles²⁷, foraging-related ingress into the estuarine habitats rich in benthic prey such as crabs, shrimps, and bivalves, possible spawning migration into the shallow sheltered areas with suitable substrata for egg-laying, and post-cyclonic or monsoonal hydrodynamics that promote

movement. Due to inadequate estuarine cephalopod sampling, past surveys may have missed the species. *Cistopus platinoidus* is not yet a major component of cephalopod landings in northeastern India, but octopus demand is rising in domestic and export markets²⁸, and incidental catches in artisanal bagnet and trammel net operations could provide local fishers with additional income if managed sustainably. To ensure the sustainable catch of this highly valued species, further research on its distribution along the east coast of India, as well as its population size and fishing value, is necessary.

Acknowledgements

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Conflict of Interest

There are no competing interests, according to the authors.

Ethical Statement

The study was conducted in conformity with the guidelines established by the institute's ethics committee. All authors have read, understood and agreed to publish the manuscript in IJMS.

Author Contributions

DB: Primary data collection, data entry, analysis, and manuscript writing; RKM: Field data collection and manuscript editing; BKD: Conceptualisation and editing; SMN: Data entry and analysis; and SS: Manuscript editing.

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