Brief Communication

An overview of status, trends, and management of the Hilsa shad fishery along the West Bengal Coast

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Hilsa shad, *Tenualosa ilisha* (Hamilton, 1822), is an anadromous, euryhaline, and commercially significant pelagic clupeid widely distributed in the Indo-West Pacific region, with major fisheries in Bangladesh, India, and Myanmar (Dutta *et al*., 2021). As a highly valued food fish in Bangladesh and eastern India, particularly in West Bengal, hilsa fishery provides livelihoods to millions of people in this region. The species is widely distributed across marine, estuarine, and riverine habitats in the Bay of Bengal. Nutritionally, hilsa is considered excellent because of its protein, lipid and omega-3 fatty acid content, essential for human health. Its seasonal availability, particularly during the monsoon spawning migration, drives high consumer demand and premium market prices, reinforcing its socio-economic and cultural importance. West Bengal records the highest hilsa landings among Indian maritime states, highlighting need for fisheries management to ensure ecological sustainability, food security, and the preservation of cultural heritage.

Taxonomic notes on hilsa and hilsa-like fishes

Hilsa and hilsa-like fishes belong to the family Dorosomatidae, within which the genera *Tenualosa* and *Hilsa* include morphologically similar species that are frequently confused/misidentified in fishery landings (Fig. 1). This can lead to inaccuracies in catch statistics and stock assessments, particularly in multi-species fisheries occurring in the Bay of Bengal. *Tenualosa ilisha* (Hamilton, 1822) is the most

economically important species and is characterised by a moderately deep, laterally compressed body with 30–33 well-developed abdominal scutes. The head length constitutes about 28–32% of standard length, and the top of the head lacks longitudinal fronto-parietal striae. A distinct median notch is present in the upper jaw. Gill rakers are fine and numerous, typically numbering 100–250 on the lower limb of the first gill arch. The caudal fin is moderate in length (25–31% of standard length). A conspicuous dark blotch occurs behind the gill opening, followed by a series of small spots along the flank are distinguishing characters. *T. ilisha* closely resembles *T. toli* (Valenciennes, 1847), which differs in having a shorter head (22–27% of standard length), a longer caudal fin (31–34% of standard length), fewer gill rakers (60–100), 28–30 abdominal scutes, and the absence of flank spots. Both species share a notched upper jaw, a feature that distinguishes them from most other clupeids, except *Hilsa kelee* (Cuvier, 1829), which is identifiable by the presence of numerous longitudinal striae on the top of the head (Whitehead, 1985; Psomadakis *et al*., 2029). Ecologically, *T. ilisha* Inhabits in marine, estuarine, and freshwater environments and undertaking long upstream spawning migrations. In contrast, *T. toli* is predominantly marine with limited estuarine occurrence. *H. kelee* is smaller, mainly marine, and occasionally enters estuaries but does not exhibit extensive spawning migrations (Whitehead, 1985; Psomadakis *et al*., 2029). Accurate taxonomic discrimination among these species is essential for dependable fishery statistics, robust stock assessments, and effective conservation-oriented management of hilsa resources.

Hilsa fishery of West Bengal coast

The hilsa fishery along the West Bengal coast shows a clear declining trend in landings over the past 17 years (2007–2024), despite considerable fluctuations in fishing effort. From the graph, hilsa landings peaked in 2010 and 2016, exceeding 15,000 t during these years, but thereafter declined sharply to below 5,000 t after 2018 (Fig. 2). The dashed red trend line indicates a consistent downward trajectory in total landings, reflecting a progressive depletion of the stock. Fishing effort (represented by the purple line) fluctuated widely, with notable peaks around 2008–2010, 2013, and 2017, suggesting increased fishing pressure during these years. However, even with fluctuating or high effort, the corresponding catch levels did not show proportional increases, implying a decline in catch per unit effort (CPUE) and possible signs of overexploitation. The recent years (2019–2024) are characterised by low landings

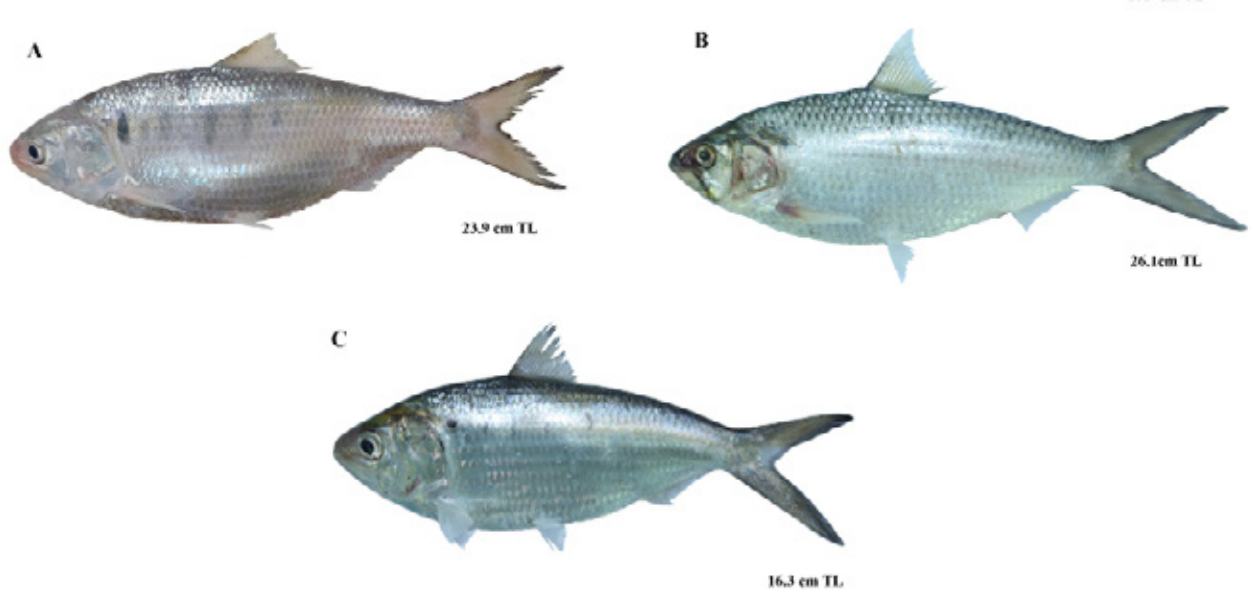

Fig. 1. Lateral view of fresh specimens of (A) *Tenualosa ilisha* (Hamilton, 1822), 23.9 cm TL; (B) *Tenualosa toli* (Valenciennes, 1847), 26.1 cm TL; and (C) *Hilsa kelee* (Cuvier, 1829), 16.3 cm TL

(<3,000 t) and reduced effort, suggesting diminishing returns and potential economic strain on the fishers targeting this resource. The decoupling between effort and yield over time highlights biological and environmental stress on the hilsa stock likely linked to juvenile fishing, spawning ground degradation, altered river flow regimes, and climatic variability affecting migration and recruitment. Overall, the data suggest that the hilsa fishery in West Bengal is in a declining phase, showing symptoms of overfishing and reduced stock productivity. Without effective enforcement of mesh-size regulations, seasonal bans, and habitat protection measures, the long-term sustainability of this fishery and the livelihoods of dependent fishing communities remain at risk.

Fig. 2. Hilsa landing along the West Bengal Coast (2007–2024)

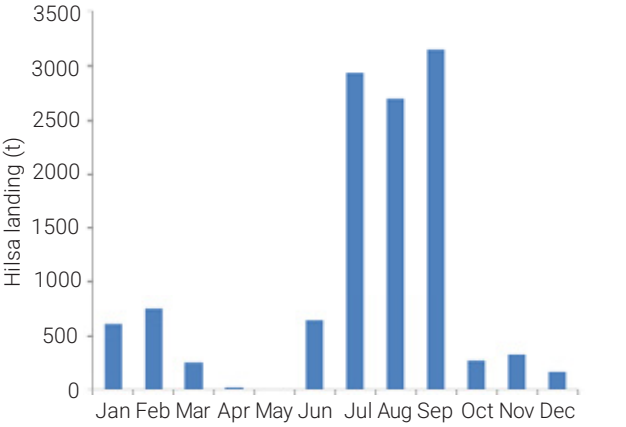

Fig. 3. Monthly landing of hilsa along the West Bengal Coast (2024)

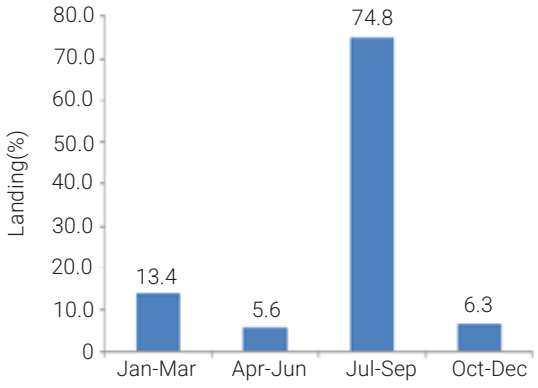

Fig. 4. Quarter-wise landing (%) of hilsa along the West Bengal Coast (2024)

The monthly catch pattern indicates a distinct seasonal trend, with hilsa landings concentrated primarily during the monsoon months (July to September). The highest catch was recorded during the July - September period, together contributing over 74.8% of the annual hilsa landings (Fig. 3). This period coincides with the major upstream spawning migration of *T. ilisha* from the coastal waters into the estuarine and riverine stretches, facilitated by increased freshwater inflow and moderate salinity conditions. In contrast, landings were minimal between April and May, marking a natural lean period likely due to the pre-monsoon fishing ban (15 April–15 June) and the offshore distribution of mature hilsa shoals. Smaller but noticeable catches occurred during January–February (590-736 t) and again in October-December (163-313 t), representing minor migratory pulses and residual post-spawning stocks in the coastal waters (Fig. 4). Overall, the 2024 monthly trend highlights the strong monsoonal dependency of hilsa fishery in West Bengal, emphasising its seasonal and migratory nature. Effective management of this fishery thus requires strict enforcement of seasonal fishing bans, mesh-size regulations, and protection of spawning grounds during peak migration months to ensure sustainable exploitation and stock replenishment.

Sector-wise landings

Sector-wise, the landings indicate the dominance of the mechanised fishing fleet reflecting the increasing modernisation of the fishery along the West Bengal coast (Fig. 5). Mechanised trawlers and gillnetters operating in the coastal regions have become the primary contributors to hilsa catches due to their higher efficiency, wider operational range, and

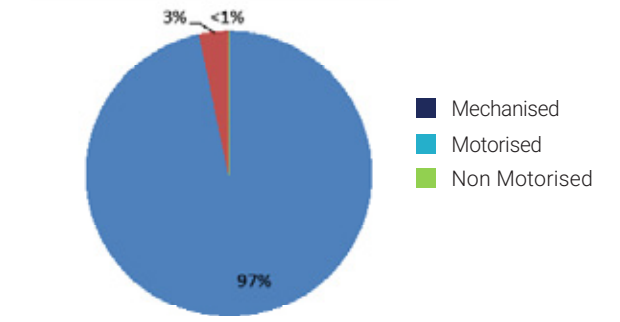

Fig. 5. Sector-wise landings of hilsa along the West Bengal Coast (2024)

advanced gear technology. The motorised artisanal fleet, using smaller boats mostly with inboard engines, contributes marginally (3%), mainly in the nearshore waters, where traditional fishing practices persist. Non-motorised craft, once significant in the past, have nearly disappeared from the hilsa fishery, reflecting a technological shift driven by increased competition and declining catch per unit effort (CPUE). This trend highlights a shift from traditional to commercialised fishing, potentially leading to increased fishing pressure and reduced access for small-scale fishers. While mechanisation enhances productivity, it also intensifies exploitation, especially during peak migratory periods, raising sustainability concerns. The near-total dominance of mechanised landings underscores the need for effort regulation, equitable resource access, and targeted conservation measures to balance economic efficiency with ecological and social sustainability.

The gear-wise landings composition highlights the predominant role of mechanised gillnetters (MGN), contributing highest (69%) to the *T. ilisha* landings along the West Bengal coast. Gillnets are highly effective in targeting adult hilsa during their migratory movements between the estuary and coastal waters, particularly in the monsoon months (July–September). Their widespread use across mechanised and motorised sectors underscores their efficiency but also raises sustainability concerns due to the capture of sub-adult fish and lack of selectivity. The multi-day trawlers or multi-day trawl net (MDTN), though contributing moderately (11%), are mainly operated in nearshore waters and often overlap spatially with gillnet operations, increasing fishing pressure on the stock. The "other mechanised gears" (MOTHS) category, comprising combinations gears (17%)

Fig. 6. Hilsa landings from gillnets at Digha Mohana, West Bengal

(Fig. 7). The negligible contribution from inboard gillnetter (IBGN) and inboard bag netter (IBBN) reflects the declining use of traditional gears, which historically played an important role in estuarine and coastal hilsa catches. Overall, the dominance of gillnets and their extensive deployment during peak migration periods indicates a high level of exploitation intensity. This pattern underscores the urgent need for gear regulation, such as enforcing minimum mesh sizes (>90 mm), restricting fishing during spawning migrations, minimise juvenile bycatch and ensure the long-term sustainability of the hilsa fishery in West Bengal.

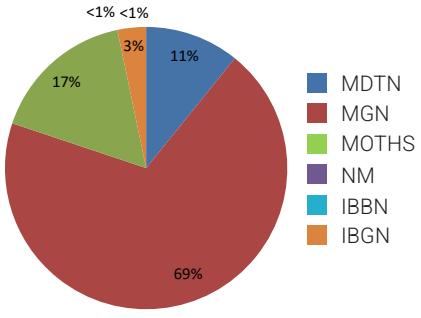

Fig. 7. Gear-wise landings of hilsa along the West Bengal Coast (2024)

The length–frequency distribution of *Tenualosa ilisha* (Hilsa) revealed total length (TL) varying between 13.7 cm and 60.4 cm (mean 31.4 cm) and corresponding total weight (TW) ranging from 26.1 g to 2473 g (mean 425.7 g) (Fig. 8). The size distribution was unimodal with majority of individuals distributed between 25 cm and 40 cm TL, indicating the dominance of sub-adult and

adult fishes in the sampled population mostly due to the coverage of its coastal and marine habitats and its riverine habitat not sampled. Smaller size groups (<20 cm) were sparsely represented, suggesting limited juvenile occurrence in the sampled populations. The presence of larger individuals (>50 cm) in moderate numbers reflects the occurrence of mature brooders during their migratory phase. Overall, the distribution indicates an active recruitment and a healthy representation of multiple age classes, though the predominance of mid-sized groups highlights the need for continued monitoring to prevent growth overfishing and to ensure the sustainability of hilsa stocks along the West Bengal coast.

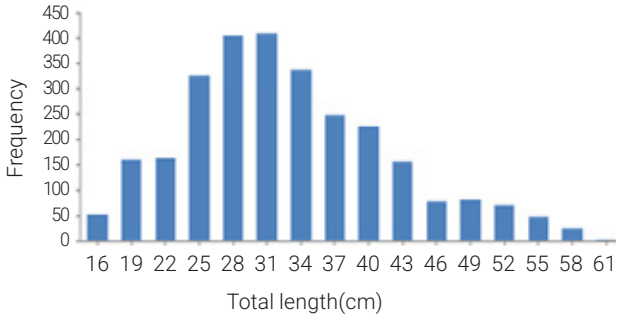

Fig. 8. Length–frequency distribution of *T. ilisha* along the West Bengal Coast

Some of the key fishery management measures already in place and those proposed based on the study reported here, are as follows.

The Government of West Bengal, Fisheries Department, through Notification No. 718 Fish/ C-I/9R-3/2012 (Part-I) dated April 4, 2013 and published in the Kolkata Gazette (Extraordinary) on April 9, 2013, issued a series of regulations to conserve and manage hilsa (*T. ilisha*) stocks in the state's marine and estuarine waters under the West Bengal Marine Fisheries Regulation Act, 1993 (West Ben. Act IX of 1993). The order introduces five major restrictions aimed at protecting hilsa landings and their critical habitats:

- Mesh size regulation: The use of monofilament gill nets with mesh size below 90 mm is strictly prohibited for hilsa fishing in the state's territorial waters to prevent the capture of juveniles and undersized fish.
- Ban on juvenile catching (Jatka/Khoka Hilsa): The use of bag nets, scoop nets, lift nets, and small-meshed gill nets (below 1 inch) to catch juvenile hilsa (below 23 cm in length) in estuarine and bay-mouth areas is banned from February to April every year, protecting young fish during their seaward migration.
- Minimum legal size (MLS) enforcement: Catching, transporting, marketing, or possessing hilsa smaller than 23 cm is prohibited throughout the state to ensure sufficient recruitment into the spawning stock.
- Ban on bottom trawling: To safeguard shallow marine habitats essential for hilsa growth and survival, bottom trawling within the 12 nautical mile zone of the continental shelf is completely banned.
- Seasonal fishing ban during breeding: To promote natural spawning, catching hilsa of any size is banned for five days before and after the full moon period between 15 September and 24 October each year, the peak breeding season in the Bay of Bengal region.

Collectively, these measures aim to ensure sustainable management and long-term conservation of hilsa resources, which hold high ecological, economic, and cultural importance for West Bengal. The notification represents a critical policy step toward ecosystem-based fisheries management and the protection of marine biodiversity along the northern Bay of Bengal coast. The observations in this study indicate that the fishery is under stress, while not collapsed. The indicators (declines in catch, smaller average size, and juvenile over-exploitation) suggest that without strong fishery management rules, the resource and the fisher-livelihoods are at risk. Some recommended actions are

- Strengthen enforcement of existing regulations: mesh size, closed seasons, minimum legal size (MLS).
- Implement effort control: limit number of boats/ nets targeting hilsa specifically.
- Monitor and protect critical habitats (spawning

grounds, migration routes, and estuarine nurseries).

- Socio-economic support to hilsa fishers during the ban period: diversification, value-addition, gear improvements, cooperative management.
- Research & monitoring: better data on stock, migration, spawning, recruitment to inform adaptive management.
- Continuous monitoring and periodic stock assessment.
- Establishment of an Indian Ocean Hilsa Commission (IOHC) to enable coordinated, science-based management of the transboundary hilsa (*T. ilisha*) fishery across the Indian Ocean region.

Acknowledgements

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