

Historical aspects and traditional knowledge of Hilsa (Indian shad) in Odisha, east coast of India

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*Great personalities of the Indian subcontinent are associated with our legends, folklore, traditions, rituals and regional songs. Similarly, mountains, trees, cows, fishes, etc. are also linked with the above aspects. Among fishes, these aspects are associated with hilsa or ilisha (*Tenualosa ilisha*; family Clupeidae). Because hilsa is associated with traditions, scholars have studied this in detail. Hilsa is generally found during the monsoon season between Rivers Ganges and Godavari in India and in Bangladesh. Past several years hilsa has drawn attention because of low production and escalating costs. Therefore, fishermen along the Odisha coast in eastern India require information on hilsa with regard to fishing season and techniques. The catch statistics indicated an increase in the hilsa landings for the past few years. This note discusses information collected from fishing communities of Odisha and compared it with the published literature. It is important to formulate specific guidelines for non-destructive fishing methods for its sustainable management, along with proper scientific assessments to manage the stock by the concerned agencies, which can help in preserving this fish for future generations.*

Fishing has been practised since the Mesolithic period in India, if not earlier. This is evident from archaeological explorations and excavations, including rock art¹. Archaeological excavations of Golbai, Suabari and Bharati Huda, the coastal sites of Odisha, India, have revealed faunal remains of various fishes and shark teeth²⁻⁴. In Hindu mythology, fish has been considered an incarnation of God. It is widely referred to in Indian literature from the *Rig Veda* period onwards and profusely depicted in Indian art and architecture. The rulers of the Chola, Pandya and Alupa dynasties of South India had issued fish-motif coins (Figure 1)⁵⁻⁷. Furthermore, the fish was the royal insignia and main symbol on the royal flag of the Pandya dynasty. Varieties of edible fish are known; however, hilsa or ilisha (*Tenualosa ilisha* belonging to the family Clupeidae) is the only fish which is widely referred to in several texts, highly praised, and associated with legends and folklores. Hilsa is considered one of the tastiest fishes due to its unique texture and flavour.

The earliest reference to hilsa comes from the text *Matsyavinoda* in *Manasollasa* (1131 CE) by King Somesvara-III of the Chalukya dynasty (1126–1138 CE), which mentions various types of fishes and the art of angling^{8,9}. The text also refers to kaurattha and pallaka, and the description of these two fishes resembles hilsa. Kaurattha is an inhabitant of both the estuaries and the sea⁸. Further, *Manasollasa* describes that Kaurattha is an estuarine fish with a scaly body found in the Ganges and Mahanadi rivers, and this fish can traverse up to 100 km upstream. Pallaka is a medium-sized, fleshy

fish full of tiny bones. Sadhale and Nene¹⁰ suggested that Pallaka could be another name for hilsa. Hamilton¹¹ has mentioned hilsa as Palasah, found in the Indian waters, belonging to the family Clupeidae. Besides *Manasollasa*, most of the information on hilsa is provided in the Bengali literature *Bharat Chandra Rachanabali* of Bharat Chandra (post 14th century CE)¹². This is the only fish associated with religious festivals and social activities in India¹³.

Hilsa is generally found in brackish, marine, freshwater and estuarine regions of

India, Pakistan, Bangladesh and Burma¹⁴. This fish grows up to 60–70 cm in length and can attain a maximum weight of up to 3 kg. Hilsa is an omnivore; it feeds on phytoplankton and zooplankton by filter-feeding and grubbing on the muddy bottom. The colour of the fish is silver shot with gold and purple. Hilsa migrates upstream in the rivers to spawn during the southwest (summer) monsoon (June to September) and the northeast (winter) monsoon (November to February) and later migrates to the sea. This fish is found in the seas and major



Figure 1. Fish-motif coins issued by the Chola, Pandya and Alupa dynasties of South India. **a**, Uttama Chola, Chola Dynasty, 10th century AD, copper coin. **b**, Jatavarman Sundara Pandyan I, Pandyan dynasty, 13th century AD, copper coin. **c**, Royal insignia of Jatavarman Veera Pandyan I, Pandyan dynasty, found at Koneswaram Temple, Trincomalee, Sri Lanka, 11th century AD. **d**, Pandya Dhananjaya, Alupa dynasty of coastal Karnataka, 14th century AD, gold coin.

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rivers of the east and west coasts of India, and the entire South Asia extending up to the Persian Gulf¹⁵.

Hilsa is a highly preferred staple food in India, especially in the states of West Bengal, Odisha, Andhra Pradesh, Assam and Tripura, as well as Bangladesh, where it is the national fish. Hilsa has different common names in the local languages of the Indian subcontinent¹⁶. The inherited knowledge on hilsa gained by the fishermen and information on traditions of the fish associated with society were collected from the fishermen of Odisha living alongside the Bhauda, Rushikulya and Kushabhadra rivers, Chilika Lake, Dhamra and Paradeep (Figure 2). The information obtained was compared with the available literature.

Previous studies on hilsa along the Odisha coast

Pati and Pati¹⁷ examined the role of rainfall on hilsa fishery in Odisha by collecting rainfall data for 10 years between 1967–68 and 1976–77 off the Balasore coast and hilsa catch data from the Chandipur fish landing centre near Balasore. They specified that during heavy precipitation, the catch of hilsa was high. Similarly, the fish and fisheries of Chilika Lake have been studied, and various types of fishes, including hilsa have been recorded^{18,19}. The Chilika Lake was considered a suitable breeding ground for hilsa because River Daya and other deltaic branches of River Mahanadi discharge into this lake. The spawning period of hilsa starts in July–August and peaks during September, but not beyond October. A disparity has been observed in the maturation and breeding of hilsa in Chilika Lake and River Hooghly²⁰.

Interestingly, hilsa was found throughout the year in Chilika Lake. However, the monthly variation in catch was maximum during the summer monsoon (southwest monsoon), with a drop during the winter monsoon (northeast monsoon). Fishermen of the region use a specialized net to catch hilsa. The movement and migration of hilsa are considered to be influenced by the volume of water discharged by River Daya and other deltaic branches of River Mahanadi into Chilika Lake. The changes in water flow lead to a decline in the catch of hilsa in the lake. The catch of hilsa is low in the southern sector of Chilika Lake, which can be attributed to high salinity in this region. It is also suggested that if the river discharge is low, hilsa will be less, indicating that

they do not move into the lake; instead, they are reported in the nearby rivers. Such observations have also been recorded in River Godavari as hilsa migrated to Kakinada²¹.

Association of hilsa with Odia culture

In Odia culture, hilsa has been designated as a high-status fish because of its high cost, taste and flavour. Besides, in many Odia songs, it has been equated with gold and other precious metals.

Interactions with the fishermen of Odisha on hilsa fishing

Field visits were undertaken along the Bhauda, Rushikulya and Kushabhadra rivers, Chilika Lake, Dhamra and Paradeep to collect information from fishermen involved in hilsa fishing, both in the estuary and sea. Such knowledge is passed from one generation to another among fisher folk. During the discussion, information was gathered on the type of nets being used for hilsa fishing; the season of fishing, identification of fishes/fish shoals, and the stories associated with hilsa and experiences of the fishing community. At present, all varieties of nets such as gill, Ragoon, doobi, phasi, disco, jhika and bhida are being used for hilsa fishing; some of these nets have 2–3 layers. Generally, 10–15 fishermen are engaged with 2–4 mechanized or manually operated traditional fishing boats, which

take 2–4 h for a single operation, and such operations are repeated time and again. Generally, fishermen engaged in hilsa fishing start their work in the morning and return home in the evening. Those who start fishing in the evening return the next morning. According to the information provided by the fishermen, usually hilsa fishing is carried out for 12 h duration. Previously, hilsa was reported up to 25 km upstream in the estuaries and about 15 km off the coast. However, the trend has now changed in the estuaries. This can be attributed to human intervention and the construction of dams, barrages and reservoirs. Fishes such as talakeli, nalakaroti, dala, khaira and olati are caught in both estuaries and coastal regions. Hilsa can be distinguished from these fishes based on the colour of its eyes, body shape and size.

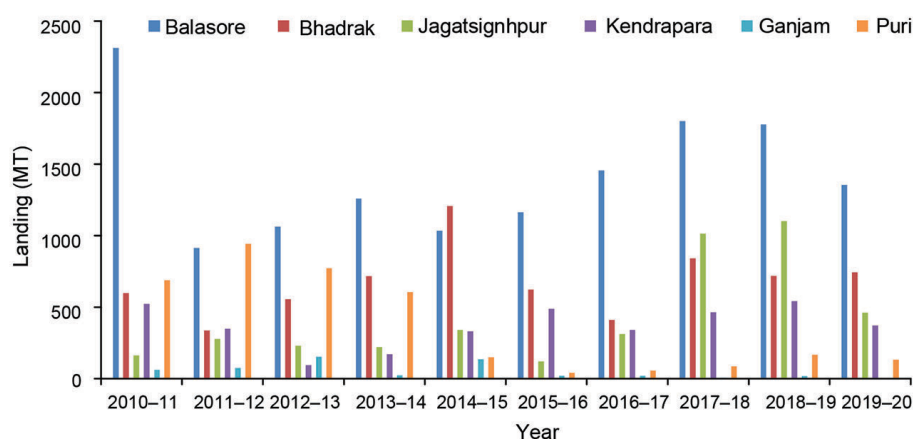
According to local fishermen, hilsa is a seasonal, migratory and fast-moving fish that can migrate long distances. Breeding areas are in the estuaries. So hilsa migrates to the estuaries and Chilika Lake for spawning during monsoon (July and August), and this continues until February. Then it migrates back to the sea. It swims from saline to freshwater, and this is a part of its life cycle. During the spawning season, fishermen catch hilsa in the estuaries between July and August, as well as in October and December. Hilsa, always found in shoals, prefers shallow, low-saline water during dawn and dusk. It has been observed that the catch of hilsa is comparatively high during monsoon season. At a high tide



Figure 2. Rivers and sites for obtaining data on hilsa fish.

Table 1. Hilsa fish landing (metric tonnes) in the marine sector of Odisha coast, India during 2010–11 to 2019–20

Year	Balasore	Bhadrak	Jagatsinghpur	Kendrapara	Ganjam	Puri	Total
2010–11	2,313	597	163	523	61	688	4,345
2011–12	914	336	277	348	74	943	2,892
2012–13	1,064	555	230	93	153	772	2,866
2013–14	1,258	717	219	170	22	606	2,993
2014–15	1,035	1,208	342	331	135	149	3,199
2015–16	1,163	622	121	488	19	40	2,453
2016–17	1,457	410	313	341	19	56	2,595
2017–18	1,801	842	1,014	463	5	86	4,211
2018–19	1,779	718	1,103	542	16	167	4,325
2019–20	1,355	744	463	371	0	133	3,066
Total	14,138	6,749	4,243	3,670	505	3,640	32,945

**Figure 3.** Hilsa fish landing (metric tonnes, mt) in different marine sectors of Odisha, India during 2010–11 to 2019–20.

during the full moon and new moon, higher amounts of sediment or suspended particulate matter with high organic material are flushed from the rivers into the sea, and the estuaries are rich with food for the hilsa. This fish is found throughout the year in Chilika Lake¹⁹, but not in the estuaries and sea. During our interactions with the fishermen of Kalupadaghat on Chilika Lake and Dhamra, we noticed hilsa *Tenualosa ilisha* (family Clupeidae). It has been observed that soon after cyclones and storms, the catch of hilsa increases by two-to-threefold. The fishermen mentioned that after the *Hud Hud* cyclone in October 2014, the catch of hilsa increased in Odisha and West Bengal. During that time, the fishing trawlers were almost full of hilsa. Hilsa from the sea is smaller, skinny and less tasty; however, its taste and size increase after migrating to freshwater. Similarly, the fat content of hilsa is higher in the sea, and it reduces in brackish water and becomes even lesser in the rivers. Hilsa prefers to live in the regions of strong current, high turbidity, low salinity and high abundance of planktonic food.

According to fishermen, it is challenging to identify juvenile hilsa. Their male : female sex ratio is 1 : 10. Generally, hilsa grows up to 60 cm (2 ft) from head to tail, and gains maximum weight up to 2.5–3 kg. Its growth varies with various water bodies. Female hilsa grows faster compared to males; they are tastier. Male and female hilsa move together. The body of the female hilsa is flat and silver in colour, covered with small scales. The information obtained from the fishermen indicated that if a single hilsa is caught in the net, almost the entire school comes into the net. Similarly, if one escapes from the net while fishing, the entire shoal will try to escape; the reason behind such behaviour is yet to be understood. Hilsa is beyond the ordinary person's reach because of its high cost, and the riverine and estuarine fishes are more expensive than those caught in the sea. However, the cost of this fish reduces when the catch is high, mainly during cyclones or storms. Regarding the decrease in hilsa catch along the Odisha coast, fishermen pointed towards using all types of nets for fishing and catching all sizes of fishes, including juve-

niles. The increasing number of fishing trawlers and deep-sea fishing, and the discharge of pollutants in the coastal areas are also the causes of the reduction of hilsa in the state.

Statistical data

Hilsa is reported from all coastal districts of Odisha. The statistical data from 2010–11 to 2019–20 collected from the Department of Fisheries, Government of Odisha, Cuttack, suggest that the maximum catch is in Balasore, followed by other coastal districts and the lowest in Ganjam district (Table 1 and Figures 3 and 4 a). Similarly, the landing of hilsa shad in the marine sector from 2010–11 to 2019–20 shows that the 2015–16 and 2016–17 were comparatively less than during the other years (Figure 4 b). When the rise and fall of hilsa catch in the coastal districts was compared, the catch in Balasore was more in 2010–11 and 2011–12, followed by a fall and a further rise in 2017–18 and 2018–19, and again a fall. However, in the other coastal

districts, the disparity in the rise and fall of hilsa catch was not uniform (Figure 5). The statistical data between 2008–09 and 2017–18 validate that the marine catch is higher than that in brackish water and fresh-water. However, there is no change in the catch of Chilika Lake during the above periods (Figure 6). Further, one-year data from April 2011 to March 2012 showed that during winter monsoon between November and December, the catch was maximum, followed by summer monsoon between

May and September. There was a significant fall in the catch during the offseason, i.e. from January to April (Figure 7).

Evaluation with the published data from Odisha

Jones and Sujansingani^{18,19}, and Pati and Pati¹⁷ have provided information on hilsa of Chilika Lake and Balasore district of Odisha respectively. We also carried out

studies in these regions. The descriptions of hilsa mentioned in the literature correspond with the information collected from the fishermen on their movement, time and season of mating, breeding, spawning, the role of the monsoon, and the availability of food. Examples suggest that hilsa has been reported from 10 fathoms (18 m) of water depth²², and it prefers to live on the surface seawater²³. This is in agreement with the information provided by the fishermen of Odisha. However, no scientific studies on hilsa have been carried out along the rivers Rushikulya, Vamsadhara, Kushabhadra and Bahuda. Fishermen informed that hilsa catch is abundant in the sea because fishes move in shoals, whereas the catch is comparatively less in the estuaries. Hilsa prefers larger rivers, namely the Mahanadi, Ganges and Godavari, because of more discharge of freshwater, abundant food, better breeding facilities, etc. If the discharge is less or there are other obstructions to its movements, hilsa moves to smaller rivers such as the Rushikulya, Vamsadhara and Bahuda. Such occurrences have been noticed in the Godavari, as hilsa was found in Kakinada¹⁸. With regard to hilsa fishery, the local Government has not formulated any rules, nor do fishermen get proper advice from any organizations, which is essential.

Why is hilsa preferred?

The question arises as to why hilsa is preferred over other fishes. Also, why is it so expensive? Hilsa is easy to digest, delicious, and a rich source of protein with a high biological value²⁴. It is an oil-rich fish and rich in essential fatty acids. A portion of hilsa provides one-third to half of one's daily protein requirements, which indicates how it helps acquire nutritional food security, especially in preventing protein-calorie malnutrition.

Probable causes of reduction in hilsa catch

The primary cause for the reduction in hilsa catch is the reduction in their breeding grounds, which have been hindered by the construction of dams, anicuts and barrages that control the flow of the rivers and intrusion of saline water. The indiscriminate fishing during the ban period, as well as smaller mesh-size nets and over-catch of hilsa fingerlings and juveniles, have also led to the depletion of their stock. The World

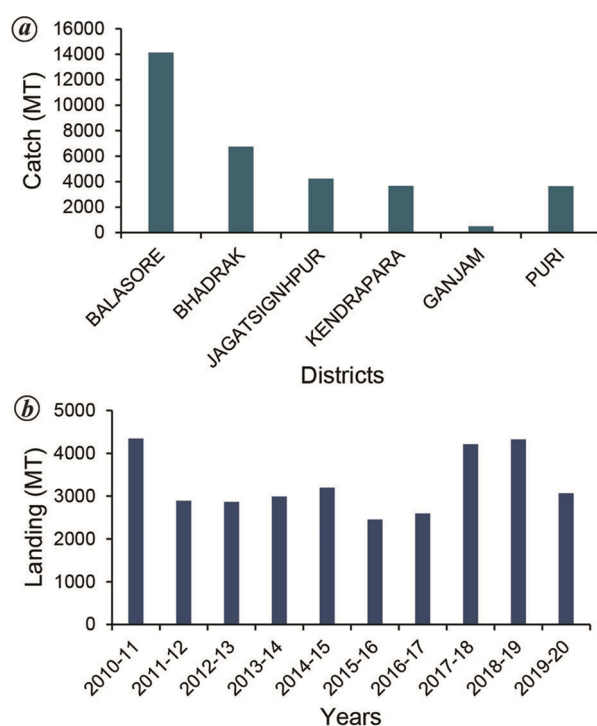


Figure 4. Total hilsa fish landing (mt) in the coastal districts of Odisha (a) and marine sector of Odisha (b) during 2010–11 to 2019–20.

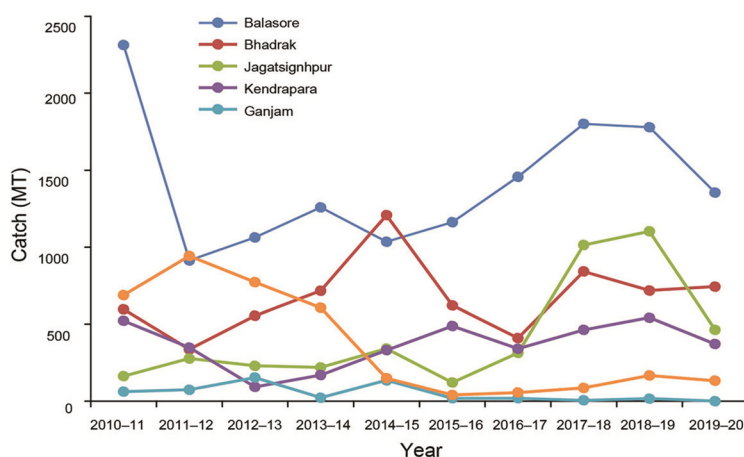


Figure 5. Variation in hilsa landing (mt) in major districts in the marine sector of Odisha during 2010–11 to 2019–20.

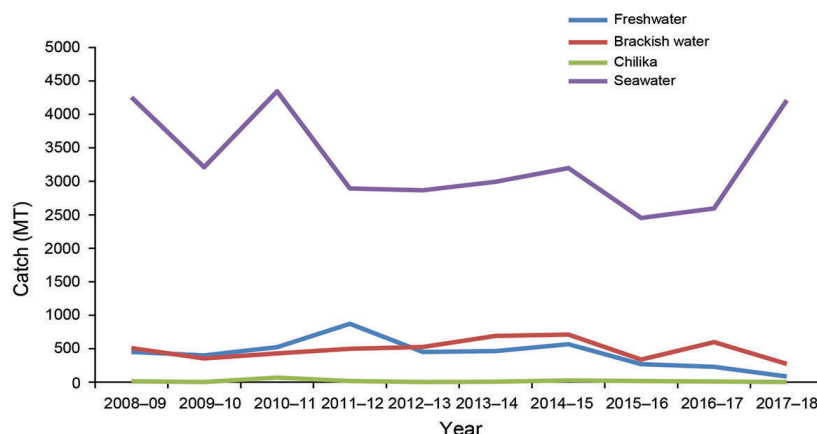


Figure 6. Annual variations in hilsa catch (mt) in different regions of Odisha from 2008–09 to 2017–18.

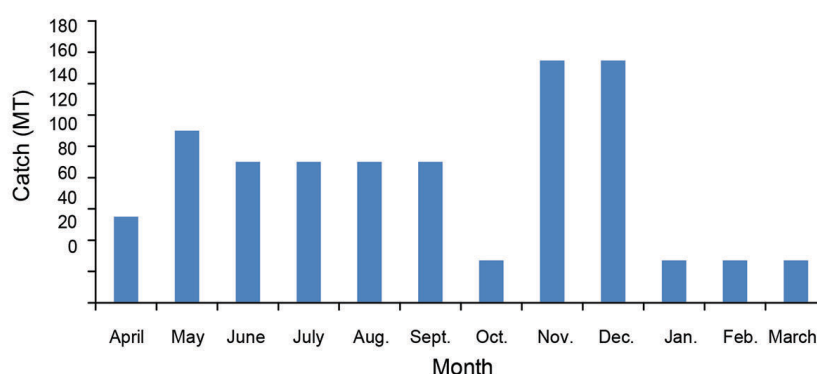


Figure 7. Monthly variation in hilsa catch (mt) from April 2011 to March 2012.

Wide Fund for nature, India has reported that large-scale trawling in marine waters is also one of the causes of reducing hilsa stock. The other possible reasons could be a discharge of effluents and pollutants into the estuaries, and the lack of stringent rules and regulations in this regard. The formation of sandbars could be another reason for the reduction of hilsa catch. The indirect impacts could be deforestation and changing climate. Earlier, hilsa generated employment and income for millions of people in India, Bangladesh and Myanmar; however, this is not the case at present. Despite this, hilsa remains a subsistence food for many coastal communities.

Conclusion

To our knowledge, no previous studies have been carried out on hilsa along the southern coast of Odisha. Earlier studies were confined only to Chilika Lake and Balasore district in the state. During field surveys, information on hilsa catch was obtained

from Kalupadaghat on Chilika Lake. Hilsa is found throughout the year in this Lake; hence, it could be presumed that it breeds in Chilika Lake, and its migratory movements are restricted during the cold/winter season. This requires further research into the biology of hilsa in the region.

During discussions with the fishermen, we found that hilsa catch is related to the monsoon pattern and riverine discharge of water into the sea. However, the construction of dams and other structures and the deposit of sediments in the estuarine region, resulting in the formation of sandbars, affected the hilsa catch and its reduction along the coast. Hilsa provides both food and employment opportunities for the coastal people. The reduction in hilsa catch due to an unsupportive and destructive environment has had a severe and undesired impact on the economy and society. Nevertheless, excessive fishing may face the danger of extinction of hilsa for future generations. From the perspective of hilsa fishing, specific guidelines and non-destructive fishing methods should be evolved

and adopted, and measures should be in place for proper follow-up of these guidelines. For continuous production of this particular species, proper scientific assessment is required, which can help in preserving it for future generations. Measures to manage the stock of hilsa by the concerned agencies are also necessary.

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