

Prospect of Hilsa (*Tenulosailisha*) fishery in fresh water

Arup Kar¹, Suman Nayek², Gourhari Kala³

¹Department of Fisheries Science, Ramnagar College, PurbaMedinipur, West Bengal, India

²Marine Biology and Oceanography, Annamalai University, Cuddalore ,Tamilnadu

³Department of Zoology and Applied Aquaculture, Barkatullah University, Bhopal, Madhya Pradesh

¹arupramnagar2008@gmail.com;

²sumannayek1999183@gmail.com;³kala.gourhari1999@gmail.com

Abstract

Hilsa, Tenulosailisha is an exceptionally renowned fish for regarded delectable taste, high market interest and cost. It frames a significant fishery of pipe molded 72 km long Narmada Estuary. Fast decrease in Hilsa get has-been kept in the Narmada Estuary over most recent couple of many years. Hilsa get was kept 5180 ton in 2006 to 2007 that diminished to just 419 ton in 2014 to 2015. Pre-impoundment of dam showed that Tenulosailisha added to the tune of 977.1 to 3727 ton from 1974 to 1975 to 1982 to 1983 and the most noteworthy catch of Hilsa was 15319 ton during 1993 to 1994. Sardar Sarovar Dam began useful in the year 1994 which has affected regular water stream of the stream furthermore, brought about a decrease of freshwater accessibility in the estuary; the improvement of shoals at the mouth of the estuary likewise decreased the flowing entrance into the framework; low profundity, loss of reproducing, nursery and taking care of grounds, over fishing might be the main variables influencing Hilsa fishery in Narmada estuary. Getting of adolescent Hilsa during winter by 'Golava' net (little coincided sack net) likewise prompted a fast decrease in Hilsa get.

Hilsa is a rising fish species found in the North Indian Ocean, mainly in the Bay of Bengal (BoB). Hilsa is a public fish in Bangladesh, representing 10% of complete fish creation and having a market worth of \$1.74 billion. Hilsa is additionally very significant in the economies of West Bengal, India, representing 12.5 percent of the catch, and it drives the marine catch in Myanmar. Hilsa yield from inland waters has been consistent during the most recent twenty years, yet marine yields in the BoB have expanded fundamentally.

Keywords: *Hilsa (Tenulosailisha), Fresh Water, Inland Water*

1. Introduction

Due to the fast development in fishing pressure and erratic double-dealing, which might have hindering repercussions for environments and society, the maintainability of marine fisheries has turned into a worldwide concern. This situation is exacerbated in non-industrial nations, where compelling administration devices and political will are missing, and unlawful fishing of adolescent and brood fishes is predominant. This most dire outcome imaginable for the stocks gives catalyst for creating proficient administration methodologies that underscore the participation of all intrigued partners with regards to request to advance environment preservation and accomplish ideal respects support occupations and food supplies. Once more, a fruitful administration plan incorporates an assortment of the board instruments, for example, exertion control, net cross section size norms, and greatest allowed get limits. Prior to executing those administration measures, stock status, especially the ongoing degree of double-dealing and stock bringing forth biomass state, should be tended to.

An individual of the Clupeid, *Tenulosailisha* (Hamilton, 1822), occurs from the northern part of the Bay of Bengal to the Arabian Sea and certain coastal areas of Southeast Asia.. During the bringing forth seasons, Hilsa spends most of their grown-up life adrift and moves to freshwaters, practically in each open waterway and feeder along the coast. This species has high market interest, especially in South and Southeast Asia, and worldwide yearly creation surpasses 0.60 million tons. However Hilsa has a more extensive dissemination, the northern Bay of Bengal districts (India, Myanmar, and Bangladesh) basically support this fishery, representing around the vast majority of worldwide creation in 2018, with Bangladesh representing almost 83% of recorded worldwide Hilsa catches. This fishery is known as Bangladesh's biggest single-species fishery, representing around 14% of in general fish creation and 47 percent of all out marine catch. Subsequently, this fishery turned into a "social and financial dynamo," straightforwardly and in a roundabout way giving food and occupations to very nearly 3,000,000 individuals. Bangladesh's yearly Hilsa creation midpoints over 0.45 million tons, representing over 1% of the nation's all out GDP.

2. Review of Literature

SudhaChandran 2019: Aquatic System Annual report Volume 16; the aquatic system chosen for the present study was a station of River Cauvery at Upper Anicut, Tiruchirappalli District, and Tamil Nadu. River Cauvery which is one of the sacred rivers of southern India is the source of water for an extensive irrigation system and hydroelectric power. It has supported irrigated agriculture for centuries and served as the life blood of the ancient kingdoms and modern cities in the states of Karnataka and Tamil Nadu. This river is the very life-guard of Central Tamil Nadu's agriculture. The five districts (Karur, Namakkal, Tiruchirappalli, Thanjavur and Nagapattinam) which depend on the river for irrigation produce over 40 per cent of the food crops of Tamil Nadu.

(Vijay Kumar and Kar, 2020 ;)Updated Biodiversity is also essential for stabilization of ecosystems, protection of overall environmental quality, for understanding intrinsic worth of all species on the earth¹ (Ehrlich and Wilson, 1991). In India, there are 2,500 species of freshwater fishes that have been recognized in the Indian subcontinent out of which 930 are categorized as freshwater species.

Ramanjaneya and Ganesh, 2018; With Recent Updates of last five years before 2018 the balance in food chain may be affected due to pollution in aquatic system. In addition, there are many threats to fish diversity such as construction of dam, which block the spawning migrations and introduction of exotic species and over fishing. Therefore, knowing the status of fish fauna is indispensable to prevent the loss of particular species.

Sabuj Kumar Chaudhuri 2010; Thirumala et al., 2011;Number of endemic species in warm water is about 544. Freshwater fishes are a poorly studied group since information regarding distribution, population dynamics and threats is incomplete, and most of the information available is from a few well-studied locations only (Zooreach organization 2010; Vorosmarty et al., 2000). Fresh water biodiversity has declined faster than either terrestrial or marine biodiversity over the past 30 years (Jenkins, 2003). In parts of earth, declining river flow rates have been a major cause for species loss (Plafkin et al., 1989)

and are likely to be further reduced by warming temperatures, reduced precipitation and increased withdrawal for agricultural and other human uses

3. About Hilsa

Tenulosailisha, an individual of the subfamily ClupeidAlosinae, is considered one of the most important business fish in the Indo-Pacific. The carriage is wide and can be seen in coastal, estuary and river environments. Fish can be found in the Persian Gulf, Red Sea, Arabian Sea, Bay of Bengal, Vietnam Sea and China Sea. East India including Sachiru Arab, Iran and Iraq's Tigris and Euphrates, Pakistan's Indus, Ganges, Begirt, Hooghly,Rupunarayan, Brahmaputra, Godavari, Narmada, Tapti and other beachfront waterways And rivers in western India, Irawaji and Pakistan in Myanmar, Yamuna , Megna, Karnafur (Fig. 1). Bangladesh, India and Myanmar dominate most of Hilsa (about 90%).

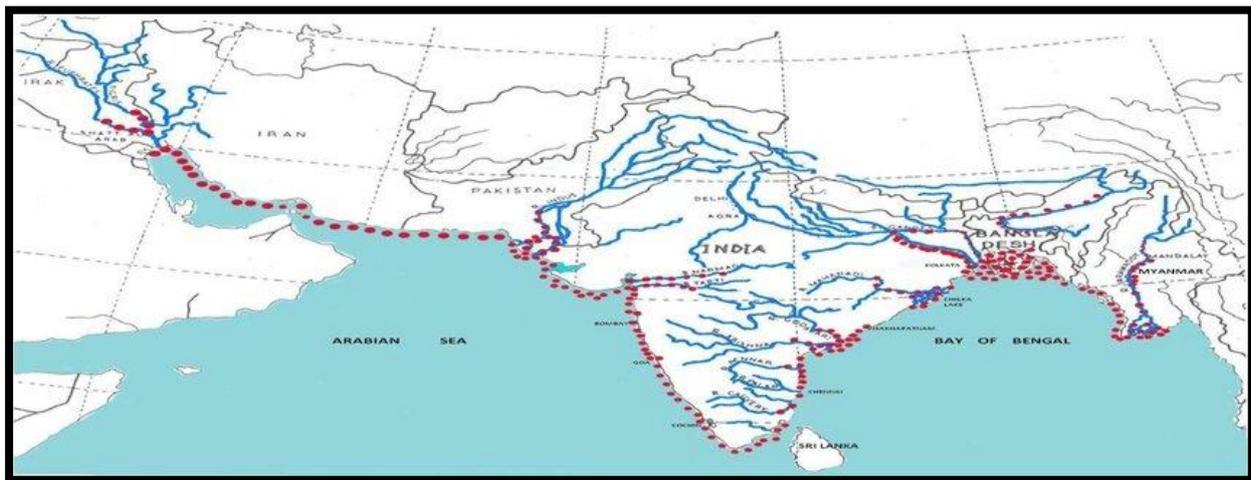


Figure: 1The Indo-Pacific distribution of Hilsa

Tenulosailisha (Hamilton), *Tenulosatoli* (Valenciennes), and *Hilsakelee* (Clouder) are taken from India's estuaries and waterfront streams. The standard territory, transitory propensity, most extreme age, and development rate shift from species to species. Since these species are essential for the esteemed Hilsa fishery, they are presented areas of strength for to pressure, and dishonest double-dealing prompts a reduction in get. *Tenulosailisha* is the sole species with a business fishery, while *Tenulosatoli* and *Hilsakelee* are scant in Indian oceans.



Figure: 2Hilsa shad comes in three varieties

Truth be told, the Hilsa fishery in India and Bangladesh is totally founded on a solitary animal types, *Tenulosailisha*, which lives in the Indo-Gangetic and Brahmaputra stream bowls (Fig.3).

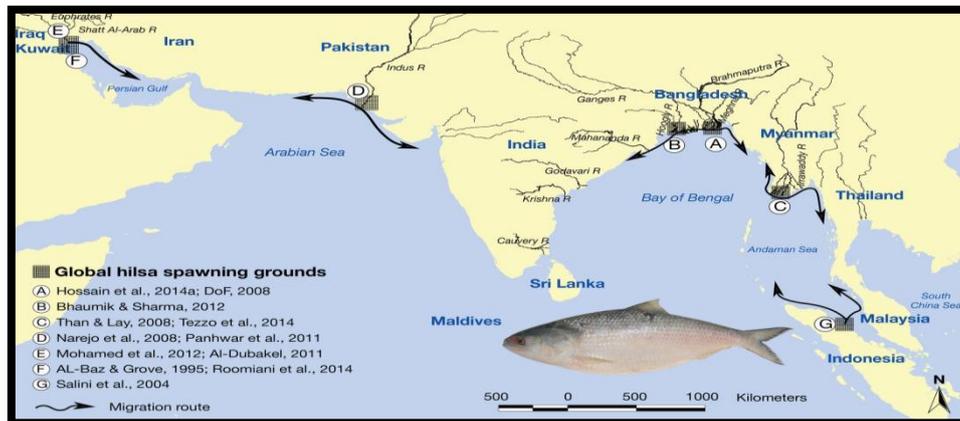


Figure: 3. Hilsa Freshwater Habitats in the Indo-Gangetic and Brahmaputra Rivers

Tenulosailisha, the most far reaching and all around concentrated on species, has been the subject of extensive exploration across the Indian subcontinent. Russell portrayed the fish in 1803 and Hamilton described its most memorable ordered position in 1822.

4. Socio-Religious significance

Hora has examined the socio-strict significance of customary legends on hilsa as confirmed through maxims and conventional colloquialisms (1954). He has expressed that there could be no other fish in Bengal that is as generally cherished and esteemed as the Hilsa. He referred to hilsa's remedial properties as being demulcent (alleviating), stomachic (expanding utilitarian action of the stomach), phlegmatic (set apart by an overabundance of phlegm), and carminative (easing fart). Hora (1954) likewise expressed that it assumes a significant part in different social events as well as strict celebrations like Dusserahand Panchami in Bengal.

5. Age and growth

The age and improvement of Hilsa differs depending upon the stream. Prashad et al., (1940); Jones and Menon (1951); Raj (1937), Chacko and Dixitulu, 1951 analyzed the age and advancement of Hilsa at various stages. Chacko et al. 1948 and Chako and Kulkarni 1950 decided the age of the hilsa by counting the scale radii. Regardless, the scales utilized thus couldn't be used to choose the age of the species. They found a quick association between the amount of scale radii and fish length.

According to Dewan and Raj (1950), improvement rings in hilsa are such an enormous number of and genuinely described to check age, yet get over radii in the first piece of the scale, which are customary and obvious, were found to give verification mature enough. Pillay (1958) confirmed that the amount of radii on the scales is superfluous to the time of Hilsa subsequently may not be significant in distinctive the species' age and improvement.

Different analysts, including Pillay and Rao (1960 and 1962), Rajyalakshmi (1973 and 1979), and De and Dutta (1990a and b), utilized the length-recurrence technique to decide age, which was not viewed as solid on the grounds that the recurrence dissemination oftentimes covered because of safeguarded generating period and size specific testing. Sujansingani (1957), De (1957), and others have given an account of the development of adolescent Hilsa acquired from the Hooghly estuary (1986 and 2001). Bhaumik and Sharma (2012) determined the period of Hilsa utilizing otholiths. Hence, the Hilsa of the Hooghly waterway developed 21.5 cm, 41 cm, and 44.8 cm, comparing to the ages of 1 year, 3 years, and more than 3 years, separately.

6. Food and Feeding habits

Numerous specialists have analyzed the food and taking care of propensities for Hilsa at different periods of its life cycle in different water frameworks. Hilsa for the most part profits by small fish. South well and Prashad (1918) derived that adult hilsa don't deal with while climbing streams since the stomachs of endless fishes were viewed as empty. Chacko and Ganapati (1949) and Chacko and Krishnamurthy (1950) found that Hilsa stops dealing with during the delivering season. Pillay et al., (1962) invalidated the articulations, expressing that there has all the earmarks of being next to zero end of eating during Hilsa producing. Halder (1968) saw as no confirmation of stoppage or even a huge diminishing in food maintenance during upstream creating movement. According to Hora (1938 and 1940), Hilsa fry (20-40 mm) generally feed on diatoms, copepods, Daphnia, and ostracism, but more young Hilsa (up to 100 mm) feed on more unassuming scavengers, bugs, and polyzoa. He similarly got from his investigation that hilsa feed towards the base. As shown by Nair (1939), burn basically ate copepods, diatoms, and ostracods. Jones and Sujansingani (1951) avowed that Hilsa are little fish feeders, however they don't deal with explicitly. As per Pillay (1958), there is no way to see an adjustment of taking care of force all through the generating stage. Chacko and Ganapati (1949) and Malhotra (1955) approved past outcomes that grown-up Hilsa benefits from tiny fish. Swarup (1959) researched the morphology, histology, and digestive items in adolescent and grown-up Hilsa taken from the Ganga waterway close to Allahabad.

7. Production of hilsa

Hilsa catch records are only consistent in a few sites and over a few years. The catches from various places have shown significant variability (Figures 4-10). According to Pillay and Rosa (1963), catches in the former East Pakistan (Bangladesh) varied from 13,608 to 18,144 tones. They estimate that the entire Hilsa catch in India is around 16,000 tones. They have also provided production data for some of the locations where sampling surveys were conducted between 1958 and 1961. As indicated by these numbers, the Padma arrived at the midpoint of 766 tons, the Hooghly 303 tons, and the Ganga 110 tons. Gosh (1967) expressed that Hilsa represented around 14,000 tons of the normal arrival of 4, 60, 00 tons of fish from India's inside waters. The waterways Hooghly, Jamuna, Ganga, and Brahmaputra, as well as their feeders, may represent roughly 70% of all outHilsa creation in India. CIFRI get insights

for the Hooghly-Matlah estuary framework show that from an exceptionally low catch of 100 to 200 tons before to 1960, the normal figure expanded to 1,085 tons during the 1960s and 2,670 tons during the 1970s. There were two major harvests, in 1971 to 1972 and 1981 to 1982, when in excess of 6,000 tons of Hilsa were landed. From 1955 to 1962, the normal catch at Allahabad was 72 tons from the Jamuna and just about 120 tons from the Ganga. It is tracked down that the normal catch from 1957 to 1965 was 142 tons, but starting around 1970, the normal catch has improved fairly to 165 tons. As per Jhingran and Natarajan (1966 and 1969), the northern piece of Chilika Lake supplies around 78% of the whole catch. Rajyalakshmi (1973) revealed Godavari Hilsa creation going from 14.3 tons to 46.2 tons during 1963 and 1967. Chacko and Dixitulu (1951) saw that when the water level in the Godavari River was low because of flood disappointment and silting during the season in 1950, the fish migrated along the shoreline, coming about in a monstrous Hilsa catch on the Coconada coast. The business fishery in the Sunder bans is upheld by the medium-sized 30-38 cm bunch (Sarkar, 1957). The organized assertion of Gosh (1967) showing the appropriation of prevailing size bunches in the waterway Jamuna shows that little cum-medium estimated fish in the size scope of 23-38 cm were more habitually addressed than the other size gatherings, while the progress of the fishery relies upon extra commitments from bigger fish in the 38-50 cm bunch. Little and medium-sized fish in the size scope of 24-40 cm support the fisheries in Chilka Lake (Ramakrishnaiah, 1972). Bhaumik (2012), while assembling the country's Hilsa get information, expressed that the Hilsa fisheries have been profoundly factor in Indian waterways and are reliant upon various organic, climatologically, and hydrological components of normal and anthropogenic beginning. As per time scale evaluations of yearly creation numbers, each waterway framework, with exception of Hooghly-Bhagirathi distributor of Ganga stream framework, has a descending propensity in Hilsa fisheries.

Year	Production (t)
1971-1980	158
1980-1990	75
2001-2010	351

Table: 1Chilika'shilsa production has a decadal pattern.

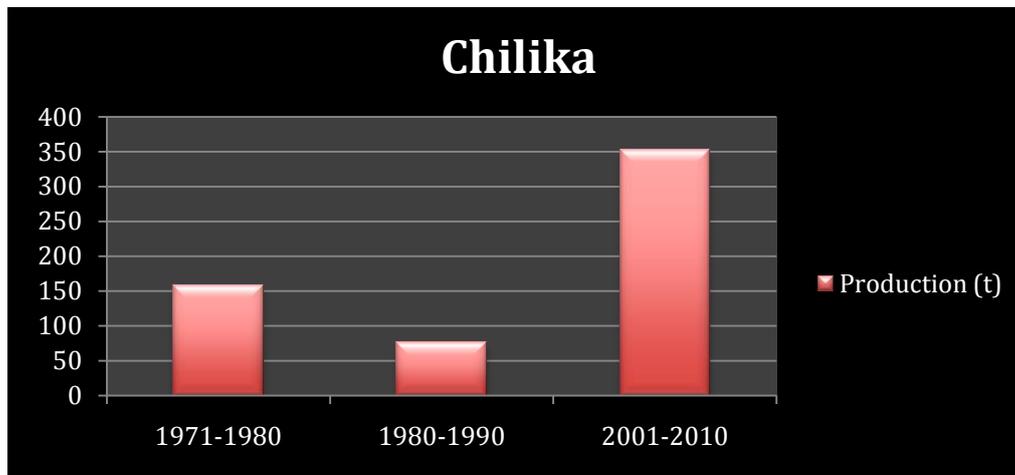


Figure: 4 Chilika's shilisa production has a decadal pattern.

8. Race or Stock profile of hilsa

Numerous specialists communicated their confidence in the presence of various Hilsa races. As per certain examination, Hilsa populaces from various waterways are different and can be separated by morph metric, serological, and meristic qualities. The possibility of various Hilsa races in the Gangetic arrangement of waterways was envisioned at a beginning phase of examination. Day (1873) recognized two gatherings that climb the streams: the people who are short of what one year old and don't seem to raise, or on the other hand assuming they do, it is close to the furthest limit of the year or the start of the following; and the individuals who breed in the rainstorm climate. Jenkins (1938) addressed assuming there are at least two races or kinds of Hilsa, with 394 unmistakable producing destinations and propensities. As per these numbers, the Padma found the middle value of 766 tons, the Hooghly 303 tons, and the Ganga 110 tons. Ghosh (1967) expressed that Hilsa represented around 14,000 tons of the normal arrival of 4,60,00 tons of fish from India's inside waters. The streams Hooghly, Jamuna, Ganga, and Brahmaputra, as well as their feeders, may represent around 70% of all out hilsa creation in India. CIFRI get insights for the Hooghly-Mata estuary framework show that from an exceptionally low catch of 100 to 200 tons before to 1960, the normal figure expanded to 1,085 tons during the 1960s and 2,670 tons during the 1970s. There were two major harvests, in 1971-72 and 1981-82, when in excess of 6,000 tons of Hilsa were landed. From 1955 to 1962, the normal catch at Allahabad was 72 tons from the Jamuna and just

about 120 tons from the Ganga. It is tracked down that the normal catch from 1957 to 1965 was 142 tons, but starting around 1970, the normal catch has improved fairly to 165 tons. As per Jhingran and Natarajan (1966 and 1969), the northern piece of Chilika Lake supplies around 78% of the whole catch.

Rajyalakshmi (1973) detailed Godavari hilsa creation going from 14.3 tons to 46.2 tons during 1963 and 1967. Chacko and Dixitulu (1951) saw that when the water level in the Godavari River was low because of flood disappointment and silting during the season in 1950, the fish moved along the shoreline, coming about in an enormous Hilsa catch on the Coronado coast. The business fishery in the Sunderbans is upheld by the medium-sized 30-38 cm bunch (Sarkar, 1957). The organized assertion of Gosh (1967) showing the dissemination of predominant size bunches in the waterway Jamuna shows that little cum-medium measured fish in the size scope of 23-38 cm were more habitually addressed than the other size gatherings, though the progress of the fishery relies upon extra commitments from bigger fish in the 38-50 cm bunch. Little and medium-sized fish in the size scope of 24-40 cm support the fisheries in Chilka Lake (Ramakrishnaiah, 1972). Bhaumik (2012), while ordering the country's Hilsa get information, expressed that the hilsa fisheries have been exceptionally factor in Indian waterways and are subject to various organic, climatologically, and hydrological components of normal and anthropogenic beginning. As per time scale evaluations of yearly creation numbers, each stream framework, with the exception of the Hooghly-Bhagirathi distributor of the Ganga waterway framework, has a descending propensity in Hilsa fisheries.

9. Conclusion

The dam seriously confines water stream, especially during the post-storm, winter, and summer seasons. The arrangement of shoals at the estuary's mouth additionally restricts fish movement to the estuary. Immediately, serious fishing in all waterways should be controlled. It shouldn't surpass the MSY level to foster a feasible fishing in the country's waterway frameworks. Unlawful killing of adolescents and catch of Hilsa brooders ought to be totally banned. Mindfulness missions ought to be coordinated in waterfront regions to urge anglers to save Hilsa as a component of their broaden obligation. Accordingly, serious protection

endeavors are expected to improve Hilsa fisheries in the country's waterway estuarine frameworks.

10. References

1. Liben Fisheries Annual Report, Vol. 3 2017, page 312, Notebook Prescription
2. Vim and Vim Water Fisheries Annual Report 2018, Jacob Martin Subseries, 212, volume 18.
3. Sarthi and P. Gayathri 2020, 32, 12 Global Mapping Analysis; Study of Fisheries and Water Purification and Supply system.
4. MawhoobNomanAlkadasi, E. T. Puttaiah and A. Shahnawaz. Fish fauna of Lakkavalli Lake, Karnataka with respect to environmental variables. Current Biotica 2020, 4(1):103-110.
9. Rajaram, R., M. Srinivasan, S. Ajmal Khan and L. Kannam, :Ichthyofaunal diversity of Great Nicobar Islands, Bay of Bengal. J. Ind. Fish. Ass. 2018, Vol. 31: 13-26.
- 10.
5. Ramanjaneya and Ganesh C. B. Fish faunal diversity in Tungabhadra Reservoir, Hosapete, Ballari District, Karnataka. International Journal of Research in Fisheries and Aquaculture 2016, 6(2): 21-25. 11.
6. Sabuj Kumar Chaudhuri. Fresh water fish diversity information system as a basis for sustainable fishery. Department of Library and Information Science, Jadavpur University, Kolkata-32.2020.
7. Shivashankar. P and G. V. Venkataramana. : Ichthyodiversity status with relation to water quality of Bhadra River, Western Ghats, Shimoga District, Karnataka. Annals of Biological Research, 2012, 3 (10):4893-4903. 2012.
8. Anon, 1957 to 2012, Annual Reports, Central Inland Fisheries Research Institute, Barrack pore,
9. Anon, 2000-2012, Reports of Department of Fisheries, Government of West Bengal.
10. Anon, 2000-2012, Reports of Department of Fisheries, Government of Gujarat.
11. Behera, Bijoy Kumar, Bangra, Rama and Alam, SamsulMd, 2012, In. Hilsa: Status of fishery & potential for aquaculture, Eds; What, Phillips & Rahaman, World Fish Centre, Bangladesh; 156-169

12. Brandt, K.K. and De, D.K. 1984. Observations on culture of Hilsailisha in freshwater pond Abstract, Proceedings 71st Indian Science Congress held at Ranchi.
13. Bhanot, K.K., 1973. Observations on the spawning of Hilsailisha (Hamilton) in the Hooghly estuary. J. Inland Fish. Soc., India, 5: 50-54.
14. Bhaumik Utpal and Manna R.K, 2010a, Present status of the fishery of Indian Shad, *Tenualosailisha*, in the Hooghly river system., In. Suresh, Manna, Bhaumik and Mitra eds. Souvenir and Abstract, Seminar on Caring Wetlands and Riverine fisheries–its conservation, Kolkata, October 2 ,2010, 59-67 p.
15. Bhaumik, Utpal. 2010b. Status of fishery of Indian Shad, (*Tenualosailisha*) with reference to the Hooghly river system, Souvenir, 21st All India Congress of Zoology and National Seminar on Biodiversity Conservation with reference to fisheries management for food, livelihood and environment security held at CIFRI, Barrack pore, December 21-23, 2010: 66-81. 401
16. Bhaumik, Utpal and Sharma, A.P., 2011, the fishery of Indian Shad (*Tenualosailisha*) in the Bhagirathi-Hooghly river system, Fishing chimes, 31 (8): 21-27.
17. Bhaumik, Utpal, Mukhopadhyay, M.K, Shrivastava,N.P and Sharma, A.P.,2012, The largest recorded Hilsa (*Tenualosailisha*) in India from Tapti estuary, Gujarat, Fishing Chimes, 31 (12): 57-58.
18. Rahman, M.J.; Wahab, M.A.; Amin, S.M.N.; Nahiduzzaman, M.; Romano, N. Catch Trend and Stock Assessment of Hilsa *Tenualosailisha* Using Digital Image Measured Length-Frequency Data. Mar. Coast. Fish. 2018, 10, 386–401.
19. Hossain, M.S.; Sharifuzzaman, S.M.; Rouf, M.A.; Pomeroy, R.S.; Hossain, M.D.; Chowdhury, S.R.; Uddin, S.A. Tropical Hilsa shad (*Tenualosailisha*): Biology, fishery and management. Fish Fish. 2018, 20, 1–22.
20. Pillay, S.R.; Rosa, H. Synopsis of Biological Data on Hilsa, *Hilsailisha* (Ham.1822). In Fisheries Synopsis 25; FAO (Food and Agriculture Organization of the United Nations): Rome, Italy, 1963.
21. Ahsan, D.A.; Naser, M.N.; Bhaumik, U.; Hazra, S.; Bhattacharya, S.B. Migration, Spawning Patterns and Conservation of Hilsa Shad (*Tenualosailisha*) in Bangladesh and

India. Ecosystems for Life: A Bangladesh-India Initiative; Academic Foundation: New Delhi, India, 2014.

22. Hassan, M.S.; Sarker, S.; Sharifuzzaman, S.M.; Chowdhury, S.R. Discovering spawning ground of Hilsa Shad (*Tenulosailisha*) in the coastal waters of Bangladesh. Ecol. Model. 2014, 282, 59–68.