e-ISSN: 2527-5186 p-ISSN: 2615-5958 *Jurnal Enggano, April 2025,* **10(1):1-7**
DOI: : https://doi.org/10.31186/jenggano.10.1.1-7
Available online at https://ejournal.unib.ac.id/index.php/jurnalenggano

Pupulation Density of (*Tenualosa ilisha*) During The Peak Spawning Season in The Down Stream Barumun River

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Received: 2024-9-29. Revised: 2024-10-05. Accepted: 2025-03-30

ABSTRAK

Tujuan penelitian ini adalah untuk mengeksplorasi kepadatan populasi *Tenualosa. ilisha* selama musim puncak pemijahannya. Pemahaman ini sangat penting untuk pengelolaan dan konservasi spesies yang efektif, yang sangat penting untuk perikanan dan ekosistem local. Penelitian dilakukan dari Januari hingga April 2023. Periode ini dipilih untuk menangkap data selama musim puncak pemijahan ikan Hilsa, yang sangat penting untuk memahami dinamika populasinya. Penelitian dilakukan di daerah hilir Sungai Barumun. Lokasi penelitian dibagi menjadi tiga titik pengambilan sampel, yang ditentukan berdasarkan informasi yang diberikan oleh nelayan setempat. Pemilihan titik pengambilan sampel yang strategis ini sangat penting untuk menilai secara akurat kepadatan populasi (*T. ilisha*) di lingkungan sungai.Analisis data dalam penelitian ini menggunakan perangkat lunak SPSS, analisis korelasi Pearson, dan berfokus pada parameter kualitas air utama untuk menilai dampaknya terhadap kepadatan populasi *T. ilisha*. Kepadatan populasi (*T. ilisha)* diamati berkisar dari 0,11 hingga 0,14 ikan per 100 m² di stasiun. Hasil analisis korelasi menunjukkan adanya korelasi yang kuat antara salinitas dengan populasi (0,723). Hal ini menunjukkan salinitas yang paling berpengaruh terhadap kepadatan poplasi. Berdasarkan hal tersebut dapat disimpulkan bahwa kepadatan poplasi ikan (*T.ilisha)* di daerah hilir sungai Barumun di pengaruhi oleh salinitas.

Kata kunci : Ikan Terubuk, Sungai barumun, *Tenualosa ilisha*

ABSTRACT

The aim of this study was to explore the population density of (*Tenualosa. Ilisha)* during its peak spawning season. This understanding is crucial for effective management and conservation of the species, which is critical to fisheries and local ecosystems. The study was conducted from January to April 2023. This period was chosen to capture data during the peak spawning season of Hilsa fish, which is critical for understanding its population dynamics. The study was conducted in the lower reaches of the Barumun River. The study site was divided into three sampling points, which were determined based on information provided by local fishermen. This strategic selection of sampling points was critical to accurately assess the population density of (*T. Ilisha)* in the river environment. Data analysis in this study utilised SPSS software, Pearson correlation analysis, and focused on key water quality parameters to assess their impact on *(T. Ilisha)* population density. The population density of (*T. Ilisha)* was observed to range from 0.11 to 0.14 fish per 100 m² at the station. Correlation analysis showed a strong correlation between salinity and population (0.723). This shows that salinity has the most influence on population density. Based on this it can be

concluded that the density of (*T.ilisha)* fish populations in the lower reaches of the Barumun River is influenced by salinity.

Keywords: Terubuk Fish, Barumun River, *Tenualosa ilisha*

INTRODUCTION

Anadromous fish, such as Pacific and Atlantic salmon, play a crucial role in ecosystem services by migrating from the ocean to freshwater rivers to spawn, providing essential nutrient flux between marine and freshwater ecosystems (Davies *et al*., 2023).These fish contribute marine-derived nutrients (MDNs) in the form of eggs, sperm, waste, and carcasses, enhancing the productivity of freshwater rivers (Samways *et al*., 2018). Variability in age at sea migration and vulnerability to environmental fluctuations are observed in anadromous species like red-spotted carp salmon, impacting their migration patterns (Harder & Christie, 2022). Nutrient subsidies from anadromous fish, including suckers, enrich river food webs, with stable isotopes confirming the integration of these subsidies into the ecosystem, underscoring the significance of migratory fish in sustaining river productivity. While *T. ilisha* is not specifically mentioned in the provided contexts, the general information on anadromous fish and their ecosystem services can be applied to highlight the importance of *T. ilisha* in maintaining nutrient flux and enhancing river ecosystems.

The *Tenualosa.ilisha*, commonly known as Hilsa fish, is a riverine species found in Bangladesh, known for its significant contribution to the country's fish production and economy (Das *et al*., 2022; Rahman, 2020). The research indicates that Hilsa fish has a prolonged spawning season, with a major peak in October–November, particularly in October, in both the Meghna River and Tentulia River in Bangladesh (Das *et al*., 2022). Additionally, the study highlights that smaller-sized Hilsa fish are predominantly males, with a few small functionally female fish present in the water bodies of Bangladesh (Rahman, 2020). Therefore, the habitat type of *T. ilisha* is primarily riverine, specifically in the Meghna River and Tentulia River, where they exhibit distinct peak spawning seasons in October, contributing significantly to the country's fishery

Factors influencing this population density include historical migration patterns, cultural practices, religious affiliations, economic activities such as farming and trading, as well as environmental factors like the availability of resources and land use changes (Wolfe & Davey, 2020). Additionally, socio-demographic characteristics like gender, ethnicity, residency, marital status, occupation, and income status can impact population density in the area (Navarrete *et al.*, 2018). Furthermore, factors such as urbanization, unemployment rate, marriage rate, and divorce rate have been identified as influencing total fertility rate (TFR) in Iran, which could indirectly affect population density in different regions (Ojomah & Onoyeyan, 2016) Understanding these diverse factors is crucial for assessing and managing the population dynamics of the *T. ilisha* area effectively.

Research on the population density of *T. ilisha* fish, also known as Hilsa shad, has shown significant findings. A study conducted on Tilapia fish in Bangladesh revealed that different population densities (200, 400, and 600 fish per decimal) resulted in varying growth rates and production levels, with the lower density showing the best specific growth rate and profit-cost analysis (Jafari *et al*., 2016). Additionally, a scientometric analysis on Hilsa shad research highlighted the importance of understanding population structure for sustainable fisheries management, emphasizing the need for advanced techniques in stock assessment and genetics to gain a comprehensive understanding of the species (Okoye *et al*., 2016). Furthermore, a study on the elongate *T.ilisha* fish population genetics across China, Korea, and Japan indicated weak population differentiation and a high level of genetic diversity, with past population expansions suggested by neutrality tests (Lök *et al*., 2022). These findings underscore the importance of population density studies in managing and conserving *T. ilisha* fish populations effectively.

MATERIALS AND METHODS

This research is exploratory descriptive research. This research was conducted in the down stream of Barumun River in January - April 2023. The research location was divided into 3 sampling points. Determination of sampling point sampling point was based on information from local fisherman (**Figure 1**).

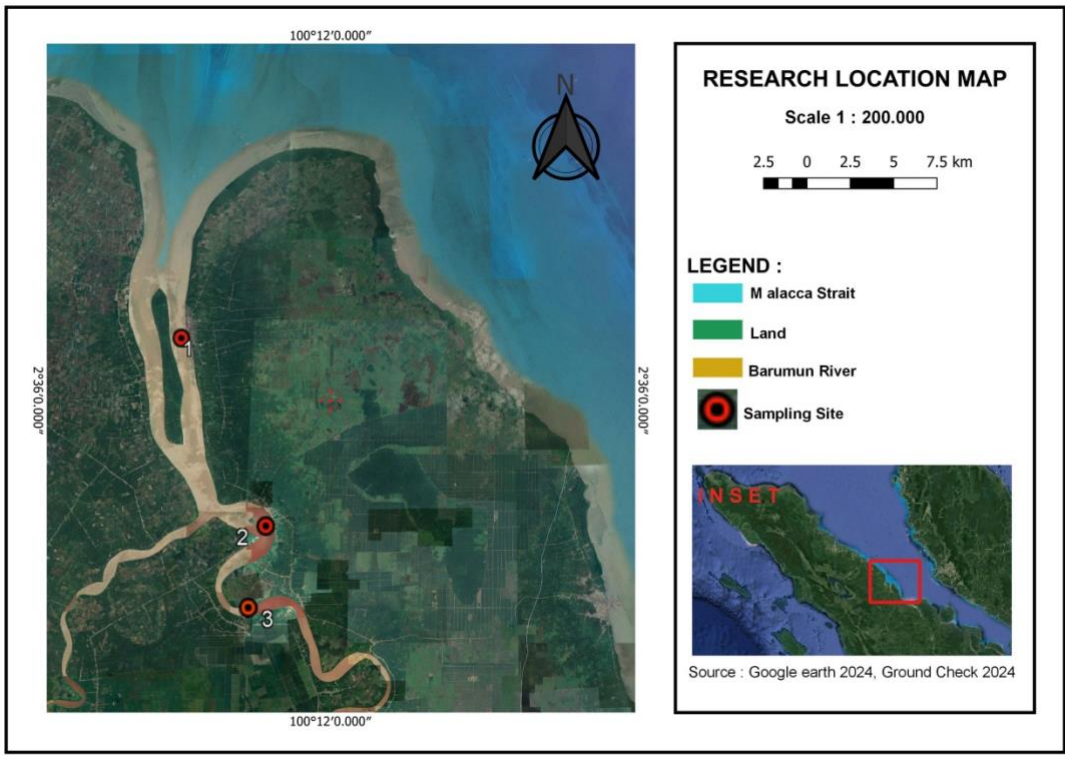

Figure 1. Research location map of the hills *(T.ilisha)*

Sampling of anchovy using gill net gear with 3 different mesh sizes (2, 3, 4 inches). (2, 3, 4 inches). Net deployment was carried out 4 times starting at 07:00 - 16:00 hrs. 07:00 AM - 16:00 PM. Fish caught will be counted based on the observation station. Water quality parameters observed are temperature, pH, Dissolved Oxygen (DO), Nitrate, Phosphate, Salinitas. For the analysis of physical factors chemical factor analysis was carried out at the Shafera Enviro laboratory.

Population Density of Terubuk Fish *(T.ilisha)* was calculated by the catch per unit of effort method (Krebs, 1985):

$$D = N/S$$

Where:
D = Population density
N = Number of fish caught
S = Space

Meanwhile, to determine the relationship between physico-chemical factors of waters with the density of *T.ilisha* population, a Pearson correlation analysis was conducted with the help of the software SPSS Version 22 for Windows.

RESULTS AND DISCUSSION

The population density of anchovy differs at each observation station. observation station. The population density level of tadpoles was in the range of 0.14-0.11 individual/100 m^2 **(Figure 2).**

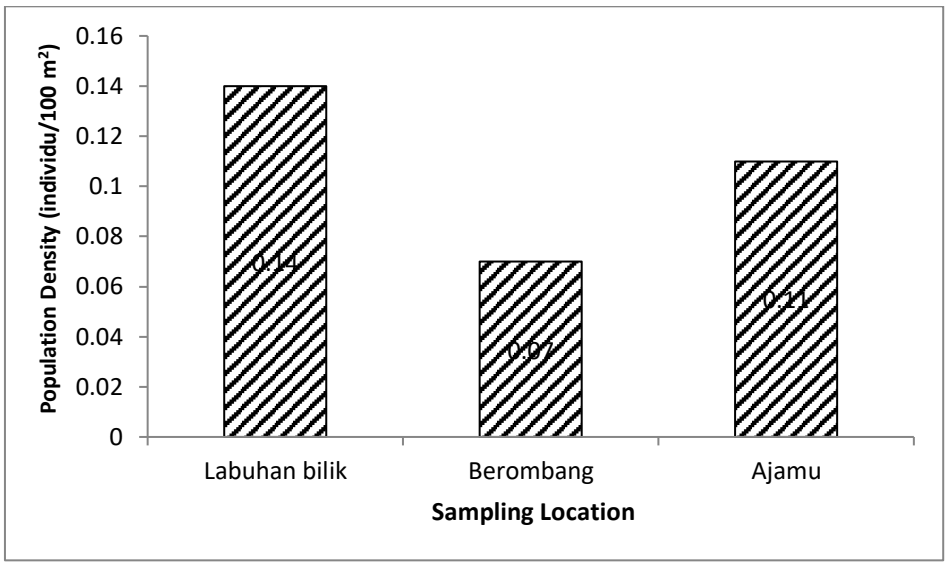

Figure 2. Population Density Chart of Terubuk *(T.ilisha)* in the Upper Barumun River).

Water Quality Parameters

Research parameters for water quality analysis included temperature, salinity, turbidity, DO (dissolved oxygen), nitrate, phosphate, and TSS. The survey results are shown in **Table 1**.

Table 1. Water Quality Parameter

No	Parameters	Unit	Quality Book**	Observation Station			Average
				1*	2*	3*	
1	Temperature	oC	28-32	28.13	26.63	27.38	**26.63**
2	Turbidity	NTUs		99.40	76.95	76.25	**99.4**
3	TSS	mg/l		101.75	165.75	130.25	**132.58**
4	Sal	mg/l	-	14.13	18.38	6.25	**12.92**
5	DO	mg/l	>4	5.45	6.13	5.22	**5.675**
6	Nitrate	mg/l	-	2.45	3.26	5.22	**3.64**
7	Phosphate	mg/l	0,2	0.00	0.00	0.00	**0.00**

Note: *Average measurement from January - April .
** Quality standard based on PP No. 82/2001 concerning Water Quality Management and Water Pollution Control.

Correlation between Water Quality and Population Density

The relationship between water quality parameters and the population density of terubuk fish was calculated by Pearson correlation analysis with the help of SPSS ver 22 for windows software. The results of the analysis can be seen in **Table 2**.

Table 2. Correlation table between water quality and population density

No	Parameter	Population Density
1.	Temperature	0,052
2.	Sal	0,723
3.	Turbidity	0,403
4.	DO	0,437
5.	TSS	0,12
6.	Nitrate	0,182
7.	Phosphate	0,386

Correlation analysis results show that salinity has the highest correlation coefficient of 0.723, while other parameters have correlation coefficients below 0.5.

Population Density of Terubuk *(T.ilisha)*

The population density of Terubuk *(T. ilisha)* in the study site ranged from 0.14-0.11 fish/100 m^2. in Bengkalis waters, it was reported that the population density of Terubuk *(T. macrura)* was 0.001-0.401 fish/1000 m^3. Furthermore, the density of *T. macrura* was reported at 0.24 kg/recruit in Bengkalis waters, and 147 T. toil during May 2010 - April 2011 in Batang Lupar and Batang Saribas waters, Serawak, Malaysia. Meanwhile, in the Persian Gulf Waters of Iran, it was reported that the population density of tadpoles *(T.ilisha)* was 164 fishes during April - September 2010. In Meghna River Bangladesh T.ilisha was found as many as 517 fish during January-December 2013 (Machrizal *et al.*, 2019).

The population density of *T. ilisha*, commonly known as Hilsa fish, is influenced by a combination of environmental factors and genetic differentiation within the population. Environmental parameters such as temperature, dissolved oxygen, pH, and salinity play a crucial role in gonadal maturation, with temperature showing a strong correlation with gonadosomatic index (GSI) across different habitats (Ahammad *et al.*, 2021). Genetic studies have revealed that *T. ilisha* populations exhibit genetic heterogeneity, with distinct groups found in Peninsular Malaysia and the broader Indian Ocean region, including Thailand, India, and Bangladesh (Arai *et al.*, 2019). Additionally, studies on the population structure of Hilsa in the Bay of Bengal highlight the importance of understanding life history parameters like growth, exploitation, and mortality for sustainable management, emphasizing the impact of overfishing on juvenile and growing Hilsa populations (Dutta *et al.*, 2019). These findings underscore the complex interplay between environmental and genetic factors in shaping the population density of *T. ilisha.*

The correlation between water quality and population density is evident in various river ecosystems. Studies in the Kelani River in Sri Lanka show a strong correlation between population growth and water quality parameters such as biochemical oxygen demand (BOD), and *dissolved oxygen* (DO) (Liyanage & Yamada, 2017). Similarly, research in the Lower Mekong Basin highlights how increasing population density, urbanization, and agricultural activities lead to declining water quality, with higher concentrations of nitrogen and phosphorus compounds observed in areas with higher population densities (Tromboni *et al.*, 2021). Furthermore, in the Ciliwung River in Jakarta, Indonesia, the density of *Pterygoplichthys pardalis* population is significantly influenced by water quality parameters like *dissolved oxygen* (DO), *biochemical oxygen demand* (BOD), pH, turbidity, and ammonia levels, showcasing the direct impact of water quality on aquatic biota populations (Elfidasari *et al.*, 2020).

The population density of *Tenualosa ilisha* during the spawning period can be affected by water quality parameters such as *dissolved oxygen* (DO), *biological oxygen demand* (BOD), pH, turbidity, and ammonia levels (Elfidasari *et al.*, 2020). Studies on hilsa shad have shown that the peak spawning season in Bangladesh occurs in October, with different peaks in this month, indicating the importance of water quality during this period (Das *et al.*, 2022). In addition, studies on hilsa migration patterns revealed that innate

immune parameters such as White Blood Cell count, lysozyme, and complement activity can be affected during spawning, with some parameters being depressed while others increased post-spawning, suggesting a suppressive effect of spawning on fish immunity. Therefore, maintaining optimal water quality conditions, especially during the peak spawning season, is critical to the population density and overall reproductive success of *T. ilisha*.

CONCLUSION

The population density of anchovy *(T. ilisha)* in the downstream Barumun River was different in 3 stations. The condition of physico-chemical factors of water including salinity causes this difference. So it can be concluded that salinity is a factor that affects the population density of tadpoles *(T.ilisha)* in the Barumun River, Labuhanbatu Regency**.**

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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