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Research Article

Gonadal Maturation and Fecundity of *Schilbe mystus* (Linnaeus, 1758) from River Taraba at Tella, Nigeria

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ABSTRACT
African butter catfish (*Schilbe mystus*) is a freshwater species widely distributed across inland waters in Africa, including rivers, lakes, and floodplains. The study was conducted in the laboratory of the Department of Zoology at Taraba State University, Jalingo, to investigate the reproductive biology of *Schilbe mystus* from River Taraba at Tella, Nigeria, to inform sustainable fisheries management and conservation efforts. A total of 300 specimens were collected monthly over 12 months from January to December 2024. Data on sex ratio, gonadosomatic index (GSI), maturity stages, and fecundity were analyzed. The sex ratio (1.1:1; female: male) did not significantly deviate from the expected 1:1 ratio ($\chi^2 = 1.067$, $p > 0.05$). GSI values peaked between March and July, indicating the main spawning season occurs during the early rainy season. Five gonadal maturity stages were identified in females, with ripe ovaries most common from April to June. Fecundity ranged from 3,200 to 22,400 eggs per female, and showed a strong positive correlation with total length ($r = 0.78$, $p < 0.01$) and body weight ($r = 0.81$, $p < 0.01$). These findings indicate that *S. mystus* is a multiple spawner with a seasonal breeding pattern, underscoring the need to regulate fishing pressure during peak reproductive periods.

Keywords: Breeding pattern; Gonadosomatic index (GSI); Seasonal variations; Sex ratio; Spawning Period

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INTRODUCTION

African butter catfish (*Schilbe mystus*), is a freshwater species widely distributed across inland waters in Africa, including rivers, lakes, and floodplains (Skelton, 2001; Olaosebikan and Raji, 2013). Belonging to the family Schilbeidae, this species is of high commercial and ecological value due to its palatability, nutritional quality, and contribution to artisanal fisheries in Nigeria and other West African countries (Adebayo and Fagbenro, 2004). Understanding the reproductive biology of *S. mystus* is critical for developing sustainable fisheries and aquaculture management strategies. Key reproductive parameters such as sex ratio, gonadosomatic index (GSI), fecundity, and maturity stages are important indicators of reproductive status and spawning seasonality (King, 1991; Offem *et al*., 2007).

Several studies have investigated the gonadal maturation and fecundity of *Schilbe mystus*, a commercially important freshwater fish species widely distributed across African inland waters. Gonadal development in *S. mystus* is typically seasonal and influenced by environmental factors such as rainfall, water temperature, and photoperiod, which trigger spawning activities in riverine systems (Ayinla & Nwadukwe, 1988; Eyo *et al*., 2020). Fecundity in this species has been reported to vary with fish size, weight, and condition factor, with larger females producing significantly more eggs (Fagade & Adebisi, 1979; Nwani *et al*., 2011). In Nigerian waters, regional

variations in fecundity and maturation patterns have been observed, likely reflecting habitat-specific ecological conditions. Despite the economic and ecological importance of *S. mystus*, there is limited literature focusing on populations in the River Taraba region, particularly at Tella, highlighting the need for localized studies to inform species-specific management and conservation strategies.

River Taraba, a tributary of the River Benue, serves as an important aquatic resource in northeastern Nigeria, supporting diverse fish species and serving as a source of livelihood to rural fishing communities. However, increasing fishing pressure and environmental degradation necessitate the need for biological studies to inform conservation and management efforts (Inyang *et al*., 2020). Therefore, this study aims to provide detailed insights into the reproductive biology of *Schilbe mystus* from River Taraba at Tella, including analysis of sex ratio, gonadosomatic index, fecundity, and spawning period. These findings are expected to guide effective resource management and support potential aquaculture initiatives for the species.

MATERIALS AND METHODS

Study Area

The study was conducted in River Taraba at Tella (Latitude 8.0833° N; Longitude 10.7500° E), located in Gassol Local Government Area of Taraba State, Nigeria figure 1. The river is part of the upper Benue River Basin and supports a significant population of artisanal fishers.

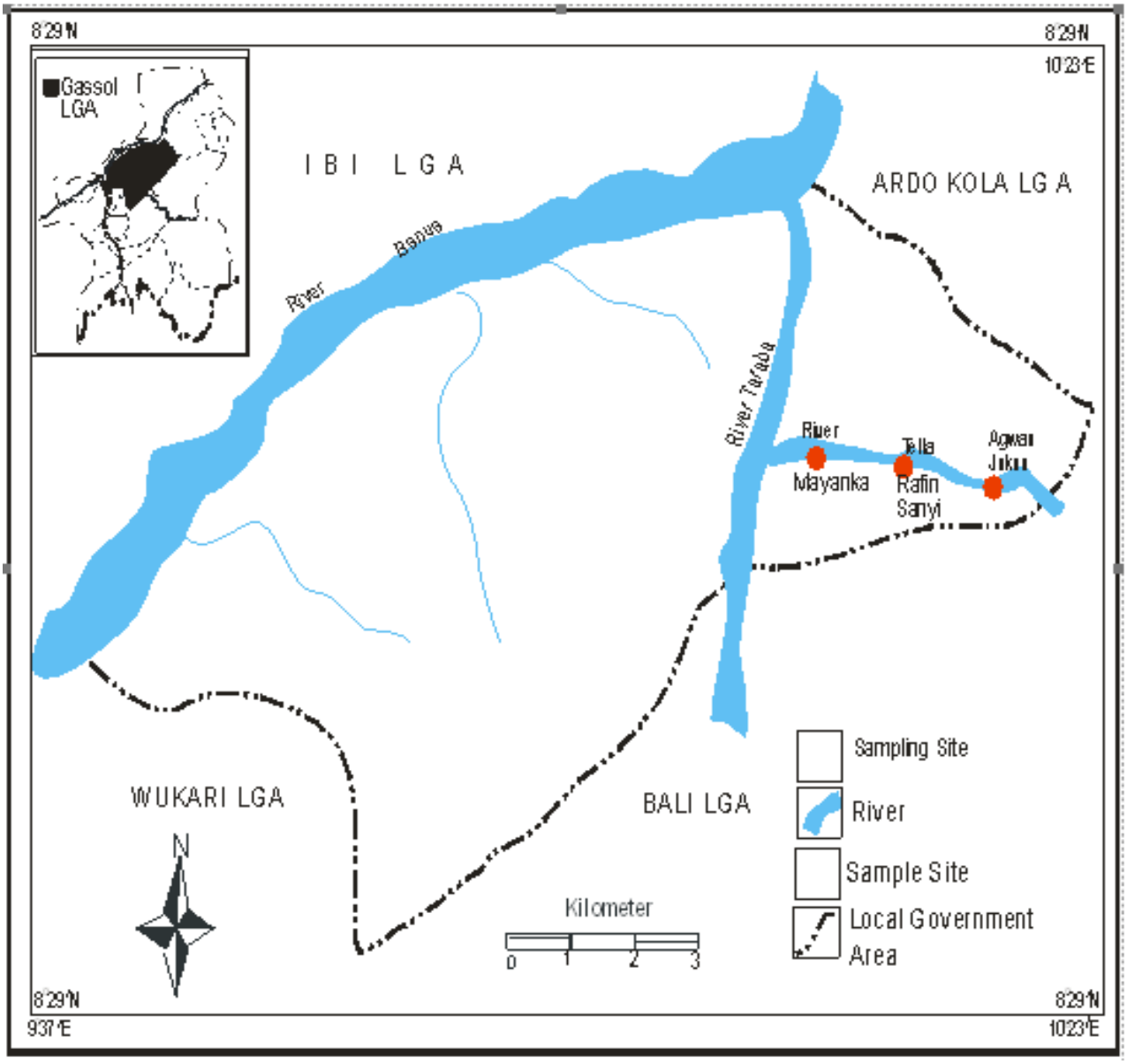

Figure 1: Map showing River Taraba Tella, Nigeria
Source: Ministry of land and survey Jalingo, Taraba State

Sample Collection

Fish samples were collected monthly from January to December 2024 using gill nets, cast nets, and traps, with the assistance of local fishermen. A total of 300 specimens of *Schilbe mystus* were examined. The fishes were transported in ice boxes to the laboratory of the Department of Zoology, Taraba State University, for analysis.

Sex Determination and Gonadal Examination

In the laboratory, each fish was weighed (to the nearest 0.01 g) and measured for total length (cm), following standard procedures for biometric assessment in fish studies (Bagenal & Tesch, 1978; King, 2007; Froese, 2006). Dissections were performed to expose the gonads, which were examined macroscopically to determine sex and maturity stage using the scale of Nikolsky (1963). The gonads were also weighed to calculate the gonadosomatic index (GSI):

$$GSI = \frac{Gonad\ weight}{Total\ body\ weight} \times 100$$

Fecundity Estimation

Absolute fecundity was estimated by gravimetric subsampling. Ovaries from ripe females were preserved in 10% formalin. A known weight of the ovary was taken, and the number of eggs in the sub-sample was extrapolated to estimate total fecundity (Lagler, 1978; Murua *et al*., 2003).

Statistical Analysis

Descriptive statistics were applied. Chi-square (χ^2) test was used to analyze deviations in sex ratio from the expected 1:1 ratio. Seasonal variations in GSI were evaluated using one-way ANOVA, followed by Tukey's test for multiple comparisons. Pearson correlation was used to analyze the relationship between fecundity and fish size (length and weight). All analyses were performed at a 5% significance level using SPSS v23.

RESULTS

Sex Ratio

Out of 300 specimens examined, 158 were females and 142 were males, resulting in a sex ratio of 1.1:1 (female: male), which did not differ significantly from the expected 1:1 ratio ($\chi^2 = 1.067$, $p > 0.05$).

Gonadosomatic Index (GSI) and Spawning Period

GSI values ranged from 0.31% to 13.21%. The highest GSI values in females were observed from March to July, with a peak in May, indicating the major spawning season (Table 2). Males showed a similar but slightly earlier trend, suggesting reproductive synchronization.

Maturity Stages

Five gonadal maturity stages were identified in females and four in males. Stage IV (ripe) females were most common between April and June, while Stage V (spent) was prevalent in July and August.

Fecundity

Fecundity ranged from 3,200 to 22,400 eggs per female. There was a strong positive correlation between fecundity and total length ($r = 0.78$, $p < 0.01$), and between fecundity and body weight ($r = 0.81$, $p < 0.01$), indicating that larger females produced more eggs (Table 3).

Table 1: Monthly Sex Distribution of *Schilbe mystus* from River Taraba, Tella

Month	No. of Males	No. of Females	Total	Sex Ratio (F:M)	χ^2 Value	Significance (p)
January	12	13	25	1.08:1	0.04	> 0.05
February	11	14	25	1.27:1	0.36	> 0.05
March	10	15	25	1.50:1	1.00	> 0.05
April	11	14	25	1.27:1	0.36	> 0.05
May	9	16	25	1.78:1	1.96	> 0.05
June	10	15	25	1.50:1	1.00	> 0.05
July	12	13	25	1.08:1	0.04	> 0.05
August	13	12	25	0.92:1	0.04	> 0.05
September	14	11	25	0.78:1	0.36	> 0.05
October	15	10	25	0.67:1	1.00	> 0.05
November	13	12	25	0.92:1	0.04	> 0.05
December	12	13	25	1.08:1	0.04	> 0.05
Total	142	158	300	1.11:1	1.067	> 0.05

Note: P > 0.05 significance difference

Table 2: Monthly Variation in Gonadosomatic Index (GSI) of Male and Female *Schilbe mystus*

Month	Mean GSI (%) – Males	Mean GSI (%) – Females
January	0.74 ± 0.14	1.22 ± 0.38
February	1.03 ± 0.28	2.01 ± 0.54
March	1.55 ± 0.41	3.78 ± 0.92
April	2.21 ± 0.68	6.85 ± 1.12
May	2.87 ± 0.84	13.21 ± 1.46
June	2.11 ± 0.57	9.45 ± 1.31
July	1.43 ± 0.38	5.62 ± 0.94
August	0.93 ± 0.21	3.14 ± 0.76
September	0.75 ± 0.16	1.98 ± 0.43
October	0.68 ± 0.12	1.32 ± 0.39
November	0.61 ± 0.09	1.18 ± 0.34
December	0.54 ± 0.08	1.04 ± 0.29

Note: GSI; Gonadosomatic Index

Table 3: Fecundity and Relationship with Total Length and Body Weight in Female *Schilbe mystus*

Parameter	Minimum	Maximum	Mean ± SD	Correlation Coefficient (r)	Significance (p)
Total length (cm)	14.2	28.5	20.6 ± 3.1	-	-
Body weight (g)	48.3	198.7	112.4 ± 28.9	-	-
Fecundity (eggs)	3,200	22,400	9,765 ± 2,483	-	-
Fecundity vs Length	-	-	-	0.78	< 0.01
Fecundity vs Weight	-	-	-	0.81	< 0.01

DISCUSSION

The sex ratio of *Schilbe mystus* in this study, although slightly skewed towards females, did not deviate significantly from the expected 1:1 ratio, which aligns with findings from other Nigerian inland waters (Offem *et al*., 2008; Olopade *et al*., 2021). This suggests a balanced reproductive population structure in the River Taraba population. The observed peak Gonadosomatic Index (GSI) in May indicates a pronounced spawning season during the early rainy season, which is consistent with earlier studies from the Niger and Benue basins (Adebisi, 1987; Ekanem, 2000). Environmental factors such as increased water level and food availability likely trigger spawning during this period.

The fecundity values obtained in this study are within the reported range for the species in other ecosystems (Eyo *et al*., 2020; Nwani *et al*., 2011). The positive correlation between fecundity and body size confirms the species' strategy of producing numerous eggs to enhance reproductive success in fluctuating riverine environments (Anyanwu *et al*., 2022). Multiple maturity stages observed across months indicate that *Schilbe mystus* may have an extended breeding season, with potential for fractional spawning. This strategy enhances reproductive output and survival in variable hydrological conditions (Akombo *et al*., 2020; Olanrewaju *et al*., 2023).

CONCLUSION

This study provides a comprehensive account of the reproductive biology of *Schilbe mystus* from River Taraba, Tella, Nigeria. The results indicate a relatively balanced sex ratio, a well-defined spawning season from March to July, and significant correlations between fecundity and fish size. The presence of multiple gonadal maturity stages suggests that *S. mystus* is a fractional spawner, an adaptive trait in riverine species subjected to environmental variability.

To ensure sustainability of this economically important species, conservation measures such as seasonal fishing restrictions during peak spawning periods and protection of nursery habitats are recommended. The reproductive traits observed also present useful information for broodstock selection in aquaculture. Further studies focusing on hormonal profiling, larval development, and genetic diversity would complement these findings and support domestication efforts.

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