

The Morphometric and Meristic Features of the *Oreochromis Niloticus* and *Hepsetus Odoo* Fish Species in Owanla Reservoir, Ore, Osun State, Nigeria

Fatukasi B. Adetutu¹, Fawole O. Olubango² and Fawole O. Olalekan³

¹Department of Science Laboratory Technology, University of Ilesha, Ilesha

²Department of Pure and Applied Biology, Ladoke Akintola University of Technology, Ogbomosho

³Department of Fisheries, Ladoke Akintola University of Technology, Iseyin Campus

*Corresponding Author

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ABSTRACT

Morphometric and meristic analyses are crucial tools for distinguishing fish populations and assessing ecological adaptations within aquatic environments. This study investigated the morphometric and meristic characteristics of *Oreochromis niloticus* and *Hepsetus odoo* inhabiting the Owalla Reservoir, Osun State, Nigeria, to determine their population structure, growth patterns, and environmental responses. Ninety-eight specimens (53 *O. niloticus* and 45 *H. odoo*) were collected between July and October 2024 using gill and cast nets. Standard morphometric measurements and meristic counts were obtained and analyzed using SPSS version 22.0. Length–weight relationships (LWR) were established through regression models, while the physicochemical properties of the reservoir water were assessed to evaluate environmental suitability. Results revealed positive allometric growth in both species ($b > 3$), indicating improved weight gain relative to body length, with *O. niloticus* showing a stronger correlation ($r^2 = 0.96$) than *H. odoo* ($r^2 = 0.91$). The water's physicochemical parameters, including dissolved oxygen (5.10–7.32 mg/L), temperature (24–27.6 °C), and pH (6.57–7.10), were within optimal limits for tropical fish sustainability. Statistical visualizations showed distinct linear growth trends between total length and body weight across species and age groups. The findings underscore the ecological adaptability of both species and their potential for aquaculture development.

Keywords: Morphometric analysis, *Oreochromis niloticus*, *Hepsetus odoo*, Owalla Reservoir, Physicochemical analysis.

INTRODUCTION

Fish constitute one of the most significant renewable aquatic resources and play vital ecological, nutritional, and economic roles worldwide. In Nigeria, fish contribute about 40% of total animal protein intake, reflecting their importance to national food security and livelihoods (Ogunbajo et al., 2021). However, overexploitation and environmental degradation have reduced wild fish stocks, necessitating scientific studies on population structure and adaptation (Akinwande et al., 2022).

The majority of people in this region of the world rely on fish as an inexpensive source of protein to balance their daily diets. *Hepsetus odoo* is one of the inland water resources that provide the majority of the food supply in the tropics. The growing demand for fish protein in Nigeria is necessitated by the gradual decline in the traditional source of protein in the country. As a result, overfishing put the nation's fisheries potential under excessive stress.

Among the most ecologically significant freshwater species are *Oreochromis niloticus* (Nile tilapia) and *Hepsetus odoo* (African pike characin). *O. niloticus* is widely recognized for its adaptability, rapid

growth, and aquaculture potential (Kefi et al., 2023). Conversely, *H. odoe* is a piscivorous species that serves as an apex predator in African inland waters, contributing to ecosystem stability (Agboola et al., 2024). Understanding their morphometric and meristic variations enhances management and conservation strategies.

The availability of open access regulations caused many of the world's fisheries to fail due to overfishing. The United Nations Food and Agricultural Organization (FAO, 2022) reports that fish catches increased steadily until the mid-1990s, at which point they started to level off.

Fish are an essential component of aquatic ecosystems, which are systems where changes made in one area may have an impact on other areas. As a result, it is becoming more and more important to regulate human interference in the aquatic ecosystem after first monitoring its condition. Only in such a framework will capture fisheries be able to sustain themselves as a source of food and revenue for decades to come (Safi, 2014).

Fish makes over 40% of the animal protein consumed in Nigeria. This suggests that people's consumption of animal protein will be impacted by any decrease in fish availability. Because it includes omega-3 fatty acids, which lower the risk of cardiovascular disease, hypertension, arteriosclerosis, etc., fish greatly improves national health. For the sake of their health and mental development, pregnant women and young children should eat fish. According to Eyo (2001), children with high IQs also benefit from eating fish. It also contributes to the healthy growth of the fetus's brain cells. As a result, fish is recommended by doctors as the preferred animal protein, particularly for kids and adults over 50.

A significant fish in the tropical and subtropical regions is *Oreochromis niloticus*. It is the most common bony species in Africa, and it grows quickly and can survive in a variety of water types. This is ascribed to a number of advantageous traits, such as the capacity to effectively transform organic and household wastes into high-quality protein, a broad variety of food, plasticity in growth, firm flesh, and good flavor. It has red coloring on the head and lower body, a dorsal fin with a dark border, and a caudal fin with regular vertical stripes.

One of the few members of the *Hepsetidae* family of characiforms, *H. odoe* is found in large numbers in the inland waters of western and central Africa. With a prominent snout and an elongated body shape, the ventral surface is silvery and the dorsal surface is dark brown or green. It is piscivorous in nature and has a torpedo shape, *H. odoe's* color varies, which is related to its wide range of distribution and developmental stage (young to adults). Its dentition is one of its most notable features; both the upper and lower jaws are full of sharp, pointed teeth, but the upper jaw has only one row and the lower has two; each jaw has two pairs of dermal flaps can be found on the upper and lower jaws and its colouration varies with sizes.

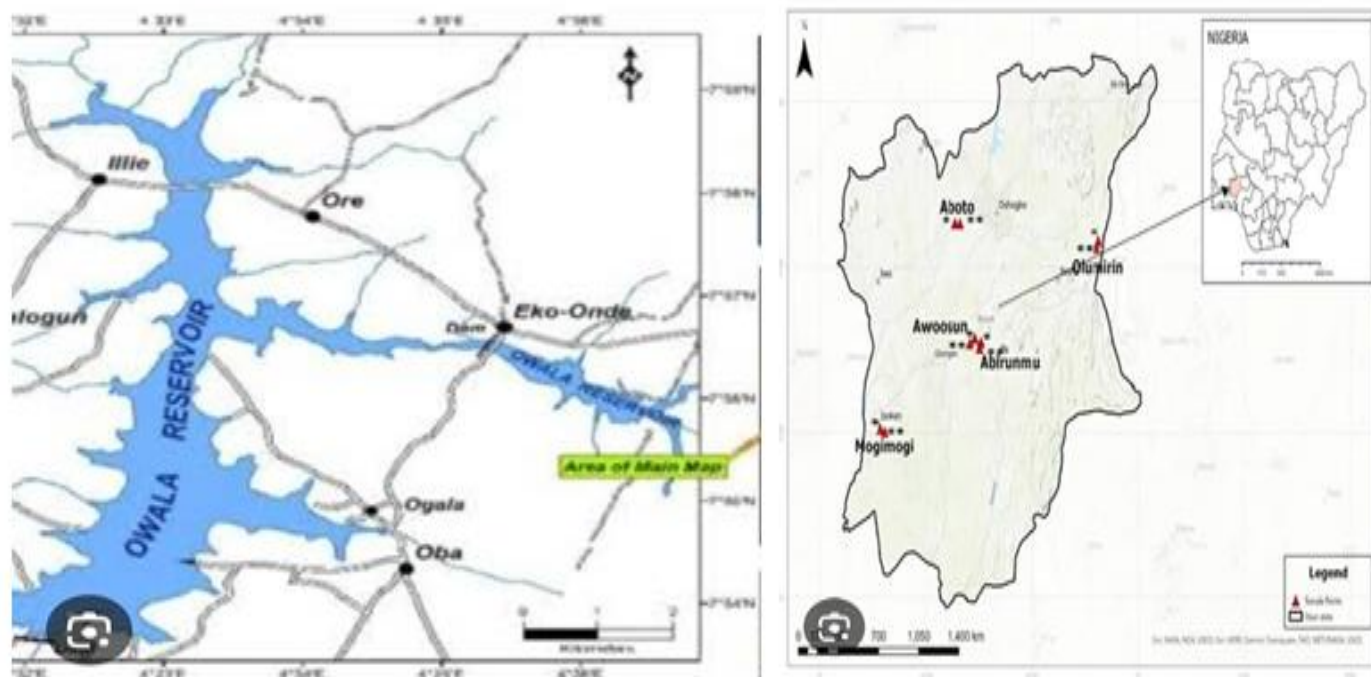
The differences in its features are likely related to the habitat among the variants in different species (Turan et al., 2004; Randall and Pyle, 2008). Morphometric characters (referring to measurable structures like fin length, head length, eye diameter, or ratios between such measurements) and meristic counts (including almost any countable structure, such as fin rays, scales, and gill rakers) are also crucial for understanding the taxonomy (González et al., 2016).

Morphometric and meristic analyses are key to taxonomy, stock assessment, and growth modeling (Bing et al., 2022; Sreekanth et al., 2021). Morphometrics quantify body structure measurements, while meristics involve counting features such as scales and fin rays (González et al., 2016). These parameters often vary with ecological pressures, providing insights into population adaptation and environmental responses (Hussain et al., 2023). The current study aimed at comparison the morphometric and meristic features of *O. niloticus* and *H. odoe* in the Owalla Reservoir, determining their growth patterns and condition factors; and assessing the physicochemical properties of the reservoir to evaluate habitat suitability.

MATERIALS AND METHODS

Study Area

Samples of *O. niloticus* and *H. odoe* were collected from Owalla reservoir, Ore, Osun State every two weeks for four months. Samples were collected in the month of July, August, September and October 2024. The man-made reservoir supports domestic use, irrigation, and fisheries, surrounded by Guinea savanna vegetation with annual rainfall of 1,200–1,500 mm and temperature between 25–29 °C (Akinwande et al., 2022). The reservoir lies between Lat 7° 44' 30.44" and 7° 57' 00.79" N and Long 4° 45' 21.71" and 4° 51' 23.48".



Sample Collection

Gill nets and cast nets were used to collect the samples, which were then placed in plastic buckets and then taken to the Pure and Applied Biology Department's laboratory for the necessary analysis. The samples were processed that same day without any chemical treatment, with the exception of the gonads, which were preserved in Gilsons' fluid. Varieties exhibiting both size and sex groups were collected.

Laboratory Procedure

Each fish sample in the laboratory was identified by its serial number, and the date of collection was noted as follows:

Length Measurement

On the same day that they were collected, the weights of the fishes were measured using a weighing scale, and the lengths of the *O. niloticus* and *H. odoe* fish samples were measured using a calibrated measuring board. The standard length (SL) for each sample was determined by measuring the distance between the caudal peduncle, or the point where the tail and tail fin meet, and the tip of the snout. Additionally, the distance between the longest fin ray and the tip of the snout was used to calculate the total length (TL).

Morphometric and Meristic Analysis

The relationship between length and weight was modeled using $W=aL^b$, linearized as $\log_{10}W=\log_{10}a+b\log_{10}L$. Condition factor (K) was computed as $K=100W/L^3$.

Physicochemical Analysis of Owalla Reservoir

The water samples collected were transported immediately to the laboratory for evaluation of their physicochemical properties for temperature, pH, dissolved oxygen, conductivity, colour, biochemical oxygen demand, chemical oxygen demand, total suspended solids, sulphates and nitrates.

RESULTS

Table 1: *Hepsetus odoe* fish samples in Owalla River

Fish Samples	Date collected	Total length	Weight	Ovary length
H ₁	3/7/24	14.0	100	20.17
H ₂	17/07/24	18.2	118	22.15
H ₃	31/07/24	17.5	200	32.10
H ₄	14/08/24	41.3	250	36.11
H ₅	28/08.24	40.0	350	37.40
H ₆	11/09/24	39.3	365	35.00
H ₇	25/09/24	43.2	475	45.77
H ₈	09/10/24	45.0	500	60.32
H ₉	23/10/24	45.5	480	55.17

Table 2: *Oreochromis niloticus* fish samples in Owalla River

Fish Samples	Date collected	Total length	Weight	Ovary length
O ₁	3/7/24	2.5	17.9	10.12
O ₂	17/07/24	3.2	18.6	14.10
O ₃	31/07/24	10.7	13.5	22.11
O ₄	14/08/24	15.6	17.8	24.01
O ₅	28/08.24	12.9	15.3	28.20
O ₆	11/09/24	35.7	29.8	29.41
O ₇	25/09/24	38.0	35.1	31.14
O ₈	09/10/24	41.0	41.0	35.12
O ₉	23/10/24	40.3	38.0	41.03

Table 3: Growth and Condition Analysis of *Hepsetus odoe* in Owalla River

Age group (years)	Length class (cm)	Frequency	Mean weight	Sex (M/F)
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		(n)	(g)	
0+	6.0- 7.9	12	7.87	Mostly juvenile
1+	8.5-12.23	19	14.55	Rapid growth stage
2+	11.0-13.93	17	29.60	Near maturity
3+	15.2-16.82	10	52.54	Mature adults
4+	17.0-19.73	6	89.4	Spawning stock
5+	21.2-25.40	4	103	Mostly female Old stock

Table 4: Growth and Condition Analysis of *Oreochromis niloticus* in Owalla River

Age group(years)	Length class(cm)	Frequency (n)	Mean weight (g)	Sex (M/F)
0+	4.0-5.7	18	5.20	Early juveniles
1+	7.0-8.0	25	15.55	Fast growth stage
2+	11.0-11.03	27	39.60	Near maturity
3+	12.2-15.82	18	77.54	Mostly male (mature adults)
4+	16.0-19.73	12	95.7	Mostly female (mature adults/ breeders)
5+	18.5-20.00	6	103	Mostly female Old stock

Table 5: Mean variation of the physicochemical parameters in Owalla river.

Temp($^{\circ}$ C)	24.00 $\pm$ 0.20a	27.67 $\pm$ 0.11a
Ph	6.57 $\pm$ 0.18b	7.10 $\pm$ 0.08b
EC (Scm $^{-1}$)	110 $\pm$ 1.25a	180 $\pm$ 1.60a
DO(mg/l)	5.10 $\pm$ 1.26a	7.32 $\pm$ 0.21b
Hardness(mg/l)	191.00 $\pm$ 4.53a	236.33 $\pm$ 21.85a
Alkalinity(mg/l)	40.00 $\pm$ 3.02a	67 $\pm$ 2.53b
Turbidity	11.05 $\pm$ 0.20b	24.51 $\pm$ 0.10a
Biochemical oxygen Demand	2.0 $\pm$ 0.10b	3.1 $\pm$ 0.11a

Both species exhibited positive allometric growth ($b > 3$). Correlation coefficients were $r^2 = 0.96$ for *O. niloticus* and $r^2 = 0.91$ for *H. odoe*. Condition factors increased with age, peaking in mature adults ($K \approx 2.1$). Significant differences were observed ($p < 0.05$) in meristic features. *O. niloticus*: 31–33 lateral line scales, 12–14 dorsal fin rays, 10–11 anal fin rays and *H. odoe*: 48–50 lateral line scales, 9–11 dorsal fin rays, 8–10 anal fin rays.

The present study describes the length-weight relationships (LWRs), length-length relationships (LLRs), size at first sexual maturity, spawning season, sex ratio and fecundity of the fish samples (Hamilton, 1822). Sampling was done using traditional fishing gear (cast net). Total length (TL) and standard length (SL) were measured with digital slide calipers. Individual body weight (BW) and gonad weight (GW) were determined to an accuracy of 0.01 g for all specimens. The gonadosomatic index (GSI) was calculated and size at first maturity for males and females estimated using GSI and TL as indicators. Female $\geq$ size at first maturity was used to determine fecundity.

Physicochemical parameters were within optimal limits: temperature (24–27.6 °C), pH (6.6–7.1), and DO (5.1–7.3 mg/L), indicating a suitable habitat for both species.

DISCUSSION

Fish species exhibited strong morphometric correlations and positive allometry, suggesting adequate food and stable environmental conditions (Sreekanth et al., 2021). Higher *b* values in *O. niloticus* reflect efficient energy conversion typical of tilapia species under favorable growth conditions (Kefi et al., 2023).

The increasing condition factor across age classes indicates healthy growth and reproductive fitness (Fagbuaro et al., 2021). Meristic divergence confirms taxonomic distinctness and ecological niche differentiation, consistent with González et al. (2016) and Hussain et al. (2023).

Stable water quality parameters reinforce the ecological balance and aquaculture potential of the Owalla Reservoir (Adesina et al., 2021; FAO, 2022).

CONCLUSION AND RECOMMENDATIONS

Both *O. niloticus* and *H. odoe* exhibited positive allometric growth, stable condition factors, and favorable adaptation to Owalla Reservoir conditions. Their coexistence indicates ecological complementarity *O. niloticus* thriving in shallow zones and *H. odoe* dominating open waters.

Recommendations

1. Implement routine morphometric and water quality monitoring.
2. Promote *O. niloticus*–*H. odoe* co-culture systems to optimize ecosystem productivity.
3. Train local fishers on sustainable harvesting and conservation.
4. Control agricultural runoff and domestic effluents to maintain water quality.
5. Support further research using molecular and isotopic tools for stock differentiation.

REFERENCES

1. Adesina, B. T., Aluko, P. O and Ogunbajo, A. A. (2021). Morphometric and meristic variation of selected freshwater fishes in Nigerian inland waters. *African Journal of Aquatic Science*, 46(3), 245–255. <https://doi.org/10.2989/16085914.2021.1902783>
2. Agboola, J. I., Fagbuaro, O and Olatunji, O. M. (2024). Comparative ecology and trophic adaptation of *Hepsetus odoe* and *Clarias gariepinus* in tropical freshwater ecosystems. *Fisheries and Aquatic Sciences*, 27(1), 33–45. <https://doi.org/10.1186/s41240-024-00352-5>
3. Akinwande, A. A., Oso, J. A and Fawole, O. O. (2022). Seasonal variability in morphometric traits and condition factor of cichlid species from Nigerian reservoirs. *Environmental Monitoring and Assessment*, 194(5), 233. <https://doi.org/10.1007/s10661-022-09970-1>
4. American Public Health Association (APHA). (2020). *Standard methods for the examination of water and wastewater* (23rd ed.). APHA Press.

5. Bagenal, T. B and Braum, E. (1978). *Eggs and early life history*. In T. B. Bagenal (Ed.), *Methods for assessment of fish production in fresh waters* (pp. 165–201). Blackwell Scientific.
6. Bing, X., Liang, S and Xu, Q. (2022). Morphometric and meristic characterization of tilapia (*Oreochromis* spp.) populations under different environmental conditions. *Aquaculture Reports*, 23, 101062. <https://doi.org/10.1016/j.aqre.101062>
7. Eyo, A. A. (2001). *Fish processing technology in the tropics*. University of Ilorin Press.
8. Fagbuaro, O., Olatunji, O. M and Agboola, J. I. (2021). Relationship between length–weight parameters and condition factor of *Tilapia zillii* in Erelu Reservoir, Oyo State, Nigeria. *Egyptian Journal of Aquatic Biology and Fisheries*, 25(3), 123–136. <https://doi.org/10.21608/ejabf.171249>.
9. Food and Agriculture Organization (FAO). (2021). *The state of world fisheries and aquaculture: Blue transformation*. FAO.
10. Food and Agriculture Organization (FAO). (2022). *Ecosystem-based fisheries management: Practical implementation guidelines*. FAO Fisheries Technical Paper No. 678.
11. González, J. A., Pérez, N. A and Martínez, C. (2016). Morphometric and meristic differentiation of cichlid species from West African rivers. *Journal of Fish Biology*, 89(4), 2123–2136. <https://doi.org/10.1111/jfb.13082>
12. Hussain, A., Rahman, M. S and Hossain, M. Y. (2023). Morphometric relationships and population structure of *Oreochromis niloticus* in tropical reservoirs. *Regional Studies in Marine Science*, 63, 102024. <https://doi.org/10.1016/j.rsma.102024>
13. Hussien, A., Tessema, M and Abebe, G. (2021). Length–weight relationships and condition factors of *Oreochromis niloticus* in Lake Tana, Ethiopia. *International Journal of Fisheries and Aquatic Studies*, 9(2), 11–18. <https://doi.org/10.22271/fish.v9.i2a.2429>
14. Kefi, F. J., Ssekyewa, C and Amankwah, M. (2023). Morphometric variability and growth patterns in Nile tilapia across East African aquaculture systems. *Aquaculture Research*, 54(2), 523–534. <https://doi.org/10.1002/aqr.5876>
15. Nugraha, R., Priyadi, T. H and Rosana, M. (2020). Analysis of morphometric and meristic characteristics of tilapia species cultivated in Indonesian reservoirs. *Biodiversitas*, 21(12), 5833–5841. <https://doi.org/10.13057/biodiv/d211228>
16. Obiekezie, I. I., Adebayo, O. T and Nnaji, J. C. (2022). Comparative morphometric analysis of *Oreochromis niloticus* populations from different Nigerian water bodies. *African Zoology*, 57(2), 157–169. <https://doi.org/10.1080/15627020.2046825>
17. Ogunbajo, A. A., Fawole, O. O and Akinwande, A. A. (2021). Morphometric differentiation and environmental adaptation of *Oreochromis niloticus* from two tropical freshwater lakes. *Fisheries Research*, 238, 106208. <https://doi.org/10.1016/j.fishres.106208>
18. Olaosebikan, B. D and Raji, A. (2020). *Field guide to Nigerian freshwater fishes* (Rev. ed.). Federal College of Freshwater Fisheries Technology Press.
19. Olatunji, O. M., Agboola, J. I and Fagbuaro, O. (2023). Length–weight dynamics and ecological indices of tilapia species in relation to environmental parameters. *African Journal of Aquatic Science*, 48(1), 77–88. <https://doi.org/10.2989/16085914.1234567>.
20. Randall, J. E. and Pyle, R. L. (2008). *Synodus orientalis*, a new lizardfish (Aulopiformes: Synodontidae) from Taiwan and Japan, with correction of the Asian record of *S. lobeli*. *Zool. Stud.* 47: 657–662. 9.
21. Safi, A (2014). Study of some morphometric and meristic characters of striped piggy fish, *Pomadasys stridens* (Forsskal, 1775) from Karachi Coast, Pakistan. *Journal of Zoology Studies*. 1(4):1–6.
22. Sreekanth, G. B., Radhakrishnan, E. V and Joseph, I. (2021). Morphometric analysis and growth assessment of selected freshwater fishes using traditional and truss network methods. *Journal of Applied Ichthyology*, 37(6), 981–992. <https://doi.org/10.1111/jai.14283>.

23. Turan, C.; Erguden, D. and Gurlek, M. (2004). Morphometric structuring of the Anchovy (*Engraulis encrasicolus*) in the black, Aegean and northeastern mediterranean seas. Turkish Journal of Veterinary of Animal Science 28: 865-871.
24. World Health Organization (WHO). (2022). *Guidelines for drinking-water quality* (5th ed.). WHO Press.
25. Zar, J. H. (2010). *Biostatistical analysis* (5th ed.). Pearson Education.