P-ISSN: 2304-3075; E-ISSN: 2305-4360
International Journal of Veterinary Science
www.ijvets.com; editor@ijvets.com

Research Article

Morphomeristic Characteristics of Selected Cichlid Fishes from Two Aquatic Environments in Imo State, Nigeria

Ezeafulukwe CF[1], Njoku DC[1], Ekeledo CB[2] and Adaka GS[1]

[1]Department of Fisheries and Aquacultural Technology, Federal University of Technology Owerri, Imo State, Nigeria;
[2]Department of Fisheries Technology, Federal Polytechnic Nekede, Owerri, Nigeria
***Corresponding author:** emmaocy@yahoo.com

Article History: Received: May 01, 2015 Revised: May 08, 2015 Accepted: May 10, 2015

ABSTRACT

Morphomeristic variation between three (3) cichlids species were investigated from two aquatic ecosystems (pond and river) in Imo state using morphometnc and meristic characteristics. The purpose was to analyze the morphomeristic characters of this species and investigate possible variation in those characters. To achieve this, seven inorphometric measurements (body depth, standard length, total length head length, head width, caudal fin length and caudal peduncle width), Five meristic counts dorsal fin rays, anal fin rays, number of scales on lateral line, number of gill rakers on first bronchial arch and density/pigmentation of pharyngeal teeth).Three external morphological features (shape of caudal fin, colour of body, dorsal, anal, throat, caudal and flank, network on caudal (colour mix) were made on each of the studied fish specimen population (Oreochrornis niloticus, *Hemichromis fasciatus*, *tilapia zilli*). The morphometric analysis on the test fish samples from the river showed significant variation (P>0.05) in head length of *tilapia zilli*. Both depth and caudal peduncle width in *Hemichromis fasciatus* from the fish samples from the pond. The meristic count from the test fish samples from the river showed no variation from the test fish samples from the pond. These results indicated that the small differences were not necessarily apparent in individual specimens but only in the average of the large population tested. These specimens could be grouped into their respective collection site based on the morphometric characters. The morphometric difference between the populations may have appeared due to size, weight or genetic differences or environmental factors. The 15 characters extracted from the morphomeristic analysis played important role in identification and morphological differentiation of the selected fish species.

Key words: *Hemichromis fasciatus*, Morphomeristic characteristics, *Oreochrornis niloticus*, Tilapia

INTRODUCTION

Morphometric variation between stocks can provide a basis for stock structure and may be applicable for studying short-term environmentally induced variation geared towards successful fisheries management (Murta, 2002; Pinheiro *et al*., 2005). Morphometric measurements are widely used to identify differences between fish populations (Tzeng, 2004; Cheng *et al*, 2005: Buj *et al.*, 2008; Torres *et al.*, 2010) and remains the simplest and most direct method of species identification (Creech, 1992; Mamuris *et al.*, 1998, Bronte *et al*., 1999; Hockeday *et al.*, 2000). A number of morphological, physiological, behavioral and biochemical characteristics are used in identification and classification of fishes (Sokal *et al.*, 2009). It is understood that the analysis of phenotypic variation in morphometric characters or meristic counts is the method most commonly used to delineate stocks of fish.

Many animal and plant species are subdivided into morphologically and genetically distinct groups, which can be recognized as races or subspecies. Most of such groups are thought to have adapted to different ecological conditions through different selection regimes acting on geographically separated populations (Largiader *et al*,. 1994). In general, the body shape of an organism is determined by both genetic and ecological (or environmental) factors fish are known to exhibit a large component of environmentally induced morphological variation. Morphological plasticity according to environmental variability is commonly found among many fish species, predominantly in freshwater fish species. Phenotypic variation according to environmental variability has been widely used by ichthyologists to

Cite This Article as: Ezeafulukwe CF, Njoku DC, Ekeledo CB and Adaka GS, 2015. Morphomeristic characteristics of selected cichlid fishes from two aquatic environments in Imo State, Nigeria. Inter J Vet Sci, 4(3): 131-135. www.ijvets.com

differentiate among species and among populations within a species (Njoku and Keke, 2003). Morphological variability of fish is considered an important adaptive strategy for populations experiencing inconsistent environments (Scheimer, 1993; Sokal and Rohlt, 1981). Various physical characters (for example coat, colour, body size and shape) and behavioral traits, immunological (major histocompatibility complex differences), biochemical (Isoenzymes) and molecular (Simple sequence - length polymorphism) (Sharp *et al.* 2004 and Quilang *et al.*, 2007) have been utilized to discriminate different inbred strains. This study investigates the variability in the morphomeristic characteristics amongst selected cichlid fishes from two different aquatic ecosystems (river and pond) in Imo State, Nigeria.

In Nigeria, an assessment of morphometric differentiation of indigenous fish species using multivariate mathematical approach has not been exploited (Omoniyi and Agbon, 2004). Therefore, the present investigation aimed at examining the morphorneristic variability between *Orechromis niloticus*, *Heinichromts fasciatus* and *Tilapia zilli* found in a natural environment (river) and *Oreochromis niloticus*, *Hemichromis fasciatus.* Tilapia zilli found in artificial culture system (pond) can provide a solid base for the rational management in terms of culture medium suitable for this species, proper identification and taxonomic classification of this species, the contribution and effect of environmental factors to the morphomeristic characteristics of these species.

Tilapia fish is an indigenous African fish that is widely cultivated especially in Asia and the Middle East (Machena and Moehl, 2001). The Red-belly tilapia can grow to a little over one foot in length. They have large mouth and their heads tend to be wider than the rest of the bodies. A distinguishing character in Tilapia zilli is the blood red or pinkish belly seen in adults during all times of the year (Fish Base, 2014).

The Nile tilapia has a regular, vertical stripes extending as far down the body as the bottom edge of the caudal fin, with variable coloration. Adults reach up to 60cm (24 in) in length and tolerate brackish water. It is much appreciated by consumers, being a good and affordable source of protein. It has fast growth and it can be easily reproduced on many confined water bodies throughout the region (Wikipedia, 2014 a, b).

MATERIALS AND METHODS

Study area

The study was conducted on Otamiri River and fishponds all in Owerri, Imo State, Nigeria (Fig. 2). The Otamiri River is one of the main rivers in Owerri, Imo State, Nigeria The study area (Owerri) lies within latitude 50 29’ and 5°:48’’ North of the equator and longitude 7° 02’ and 70 35’ East of the Greenwich. The study area lies within the rainfore0st region of West Africa with annual rainfall varying from 1,500 mm to 2,200 mm and average annual temperature above 20°C (68°F). The area has a relative humidity of 75% to 90% annually. The climate of the region is distinguished into two distinct seasons; the rainy season, which lasts from March to October, and the dry season that is experienced from November to March.

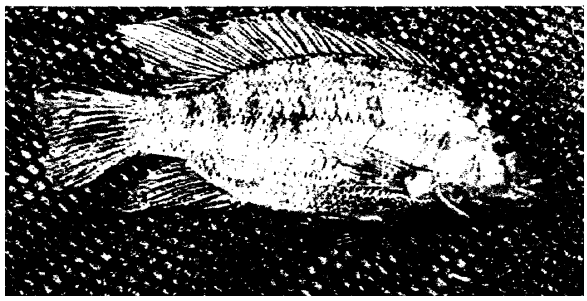

Fig. 1: The Nile Tilapia

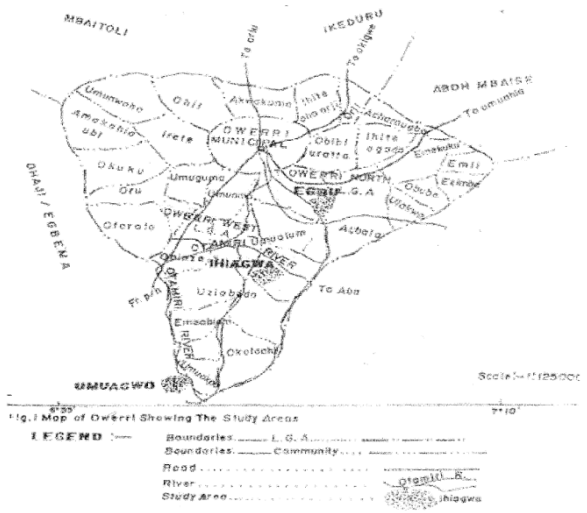

Fig. 2: Map of Owerri Showing the Study Area

Sampling design and data collection

Two sampling stations were designated along the course of the river based on fish landing sites by fishermen as follows: station A (Ihiagwa) and station B (Umuagwo). This was done in order to randomize the sampling and to ensuring adequate coverage. Sampling took place simultaneously on both the river and pond systems. Each station was sampled bi-weekly for a period of three month (April, May and June) for morphomeristic analysis of three fishes belong to two genera (Hemichromis jrisciatus, Tilapia and Oreochromis niloticus,). Each station on the river was sampled for five times per specimens of each fish species bi-weekly while five (5) specimens of each fish species were sampled from fish ponds (the choice of fish pond depended on which ponds the species are pond). From this sampling design, 45 specimens of the different species were to be sourced from the river and are from the pond systems bi-weekly, which would correspond to 90 specimens from river and 30 from ponds per sampling period. Consequently, 360 fish specimens were analyzed in the study made up to 270 from the river and 90 from ponds.

The layout of the sampling design is shown in Table 1. Bi-weekly fish specimens landed from the different ecological habitats were carefully transported to the laboratory in iced boxes. II was ascertained that no damage is done to the fins and other characteristics of morphomeristic relevance. The fish species- were then identified using combination of keys by Leveque *et al.*,

Table 1: Experimental design and layout

Aquatic ecosystem	Location Landing sites	T.zilli	H.fasciatus	O.niloticus	Bi-weekly	
River	A	5	5	5	15	45
	B	5	5	5	15	
	C	5	5	5	15	
Pond	Pond	5	5	5	15	
Total		20	20	20	60	

Table 2: Morpho meristic analysis of cultured *Tilapia zilli* (number examined = 40)

Morphomeristic analysis (as percentage of standard length, cm)	Study	KEY % SL	P(0.05)
Body depth	4.1 - 4.9	20%-80%	
Head length	3.4 - 3.8	-	NS
Head width	3.9 - 4.6	-	-
Caudal fin length	2.8 - 3.4	-	-
Caudal peduncle width	1.6 - 1.9		
B. Meristic analysis (counter per fish)			
Dorsalfinsoftrays	11 - 12	11 - 13	--
Dorsal fin spines	XV	XIV - XVI	--
Anal fin sofi rays	7 - 9	7 - 10	NS
Anal fin spines	III	III	--
No of gill rakers on Istbranchial arch	8- 11	8 - 10	--
No of scales on lateral line Density/pigmentation of	27-29	27 - 29	NS
pharyngeal teeth	Slightly dense/bromshred	--	--
C. External morphological analysis			
I. Shape of Caudal fin	Subtruncate		
II. Colour			
- Body	Grey/olive		NS
- Flanks	Olive with vertical bars		--
- Throats	Pinkish tinge		--
- Dorsal	Dark		NS
- Anal	Dark		NS
- Caudal	Brownish olive		--
III. Network of caudal (colour mix)	Greyish maculation blotche		NS

(1990). Samples were then preserved in cold room or refrigerator for subsequent analysis.

RESULTS

Morphomeristic characteristic and the identity of wild tilapia from Otamiri River

Table 1 shows the results of the analysis of the morphomeristic features measured in wild Tilapia ziili (plate 1). Morphometric features evaluated includes; body depth (2.5-5.0%). head length (3.7-4.2%). head width (2.4 -4.5%), caudal fin length (1.7-3.4%) and caudal peduncle width (1.0 - 1.7%). All the features analyzed confirmed to the aIues reported in the identification key (p 0.05). Meristic features analyzed, include dorsal fin ray count (soft rays 10-12, spines XIV -XVI), anal fin rays (soft rays = 7-9, spines III), number of gill rakers on lst branchial arch 18 - 12) and number of scales on lateral line (25 - 28). All the meristic count made confirmed with the number reported in the key, thus confirming the identity of the wild Tilapia zillin Otamiri River. Similarly the external morphological features examined on life specimens, including shape of caudal fin and color (body, throat, flank, dorsal fin, anal fin and caudal fin) all agreed with key descriptions.

Observations on morphomeristic characteristics between wild and captive tilapia zilli meristic analysis

Vidalis *et al*., (1994) argued that meristic characters might follow a predetermined variability at a very narrow range, because divergence of the meristic counts from a standard range could be fatal for the individual. The results on the meristic analysis of T. zith showed low viability in meristic characters (P>0.05). From the Tables 2, it could be seen that the population could hardly be differentiated from one location to the other. Moreover, modes of meristic values among populations were equal or close to each other, indicating there were only low intra species variations. The constant values of fin rays observed in the population agree with the findings of Holden and Reed (1972) that fin rays of the tribe Tilapia do not vary much.

Morphometric analysis

In contrast to the analysis of meristic characters, multivariate analysis of morphometric characters revealed little or no variation among populations except in head length of the fish sample from wild (3.59±0.08) which revealed significant difference from the fish sample from pond (3.60± 0.02) at p0.05. These result (Table 2) on the morphometric analysis indicated that the small difference were not necessarily apparent in individual specimen but only in an average of the large population tested. Morphometric of the head and body depth have been regarded as the most important characters for discrimination of fish populations for example anglerfish (Lophiusvormarmus), Pacific herring (Clupeapallagi) and Orange roughy (Hopiostethusatlanticus). (Haddon and Willis, 1995). The observed differences in HD may have appeared due to size, weight, genetic or enviromnental factors such as temperature, turbidity, water flow or water depth Swain and Foote (1999) stated that phenotypic

variation in morpho-meristic characters might not only be genetic but maybe environmentally induced.

Conclusion

With comparable studies from Leveque (1997) this investigation showed that the fresh water species *Hemichromis fasciaius and Tiiapia ziii* from pond are phenotypically separable from the same species from pond. Although, meristic characters showed no significant variation (P<0.05) in all species (*H. faciatus, T. zziii, O.niiotzcus*) from both pond and river, significant variations (P<0.05) were observed in a few morphometric analyses (head, length, body depth and caudal peduncle width) between wild and pond specimens of Tilapia zilli and Hemichromzs Jäscialus. Larger body size were also observed in species in the wild samples compared to the same species from the pond including O. niloticus, though there were no significant difference in both the meristic and morphometric characters both in pond and wild samples. These observed differences in HD of T zilli and BD and CPW of *Hemichramis jäsciatus* could mark the beginning of differentiation between the wild and pond populations of these species. External morphological analysis also showed no significant variation (p 0.05) thus morphomeristic analysis proved to be a valuable and effective tool in investigation of variation between species.

REFERENCES

Bronte CR, GW Fleischer, SG Mastrenko and NM Pronin, 1999. Stock structure of Lake Baikal omul as determined by whole body morphology. J Fish Biol, 54:787-798.

Buj I, M Podnar, M Mrakovcic, M Caleta, P Mustafic, D Zanella and Z Marcic, 2008. Morphological and genetic diversity of sabanejewiabaicanica in Croatia Folia Zool, 57: 100-10.

Cheng Q, D Lu and L Ma, 2005. Morphological differences between close Populations discernible by multi van ate analysis: A case study of genus coilia (*Teleostei*: *Clupeiforms*). Aquat. Living Resour, 18: 187-92.

Creech S, 1992. A multivariate morphometric investigation of Atherina. Boyeri Risso. (1810) and a presbyter Cuvier(1 829) (*Teleostei: Atherinidae*). Morphometric evidence in support of the two species. J Fish Aquat Sci, No.1531.

Fish Base, 2014. The Red Belly Tilapia (Tilapia zflhz). World Wide Web electronic publication. www. fishbase.org.

Haddon M and TJ Willis, 1995. Morphometric and meristic comparison of orange roughy (*Hoplostethusatlanticus*: *trachichthyidae*) from the Puysegur Bank and Lord Howe Rise, New Zealand and its implications for stock structure. Mar Biol, 123: 19-27.

Hockaclay S, TA Beddow, M Stone, P Hancock and LG Ross, 2000. Using truss network to estimate the biomass of Oreochromisniioticus arid to investigate shape characters. J Fish Biol, 57: 981-1000.

Holden M and W Reed, 1972. West African Freshwater Fishes, Longman Pubhshers, London. 68p.

Largiader CR, CP Klingenberg and M Zimmermann, 1994. Morphometric variation in a hybrid zone of two subspecies of Gerris costae (*Heteroptera. gerridae*) in the Maritime Alps. J Evolution Biol, 7: 697-712.

Leveque C, 1997. Biodiversity, Dynamics and conservation. The freshwater fish of Tropical Africa Cambridge University press, Orstom.

Machena C and J Moehi, 2000. Sub-Saharan African Aquaculture: Aregionatsummary. In, Subasmghe RP, Bueno P, Philips MJ, Hough C, MacGladdery SE, andArthur J R(Eds). Aquaculture in the Third Millenmum. Technical Proceedings of the Conference on Aquaculture in the Third Millennium, Bangkok, Thailand, 20-25 February. Rome, NACABangkok and FAO, 2001, pp: 345-55.

Mamuris Z, AP Apostolidis, P Panagiotaki, AJ Theodorou and C Triantaphilidis, 1998. Morphological variation between red mullet populations in Greece. J Fish Biol, 152: 107-117.

Murta AG, 2002. Morphological variation of horse mackerel (Trachurusirachurus) in the iberian and North African Atlantic: implications for stock identification, .1 Mar Sci, 57: 1240.

Njoku DC and IR Keke, 2003. A Comparative Study on Water Quality Criteria of Demili River in Jos, Plateau State of Nigeria. ASSET Series A, 3: 143-153.

Omoniyi IT and AO Agbon, 2004. Morphological variation of *Sarotherodon melanotheron* (Pisces: IHLIDE4) from the Brackish and Freshwater habitats in South West Nigeria. Proc. of the 29th Annual Conference of the Genetic Society of Nigeria, Oct. 11-14, 2004, Abeokuta, Nigeria, University of Agriculture, pp: 20-2.

Pinheiro A, CM Teixeira, AL Rego, JF Marques and HN Cabral, 2005. Genetic and Morphological variation of solealascarIs (Risso, 1810) along the Portuguese coast. Fish Res, 73: 67-78.

Quilang JP, ZU Basiao, RC Pagulayan, RR Roderos and EB Barrios, 2007. Meristic and morphometric variation in the silver perch, *Leiopotherapon plumbeus* (Kner, 1864), from three lakes in the Philippines. J Appl Ichthyol, 23: 561-567.

Sokal M and A Oktener, 2009. Biometry of the fishes Barbusplebejus and Barbuscapito from Coruh Basin, Turkey. Rev, Biol Trop, 57: 159-165.

Sokal RR and FJ Rohlt, 1981. In WH Freeman, Sanfrancisco RK, WS Modi and SJ0 Brien, 1986. Morphologv variability and asymmetry in the chectab (*Acinonyx. jubaius*) a genetically uniform species. Evolution, 40: 78-85.

Swain DP and CJ Foote, 1999. Stocks and chameleons the use of phenotypic variation in stock identification. Fish Res, 43,113,128.

Torres RGA, Gonzalez PS and SE Pena, 2010. Anatomical, histological and ultra structural description of the gills and liver of the tilapia (Orechromisniioticus). mt. I Morphol, 28: 703-12.

Tzeng TD, 2004. Morphological variation between populations of spotted mackerel (scomberaustr-cz1asicus) off Taiwan. Fish Res, 68: 45-55.

Vidalis K, G Markakis and N Tsimenides, 1994. Discrimination between populations of picarel (Spicarasmaris L., 1758) in the Aegean Sea, using multivariate analysis of phonetic characters. Fish Res, 30: 191-197.

Wikipedia, 2014a. The Banded Jewelflsh Hemichromis nlloticus).www.wikipedia. org.

Wikipedia 2014b. The Nile Tilapia (OreochromIs niloticus). www.wikipedia.org.