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AGE DETERMINATION IN *Citharinus citharus* (Pisces: Citharinidae) AND *Synodontis nigrita* (Pisces: mochokidae) IN LAKE ONA, SOUTHERN NIGERIA

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ABSTRACT

Age determination of *Citharinus citharus* (Pisces: Citharinidae) and *Synodontis nigrita* (Pisces: mochokidae) in Lake Ona, Southern Nigeria were made in a study that spanned 2001 to 2003. The fish species were caught, using varied fishing gears that included:- bottom set and surface set gill nets of mesh sizes 1.0, 3.0 and 5.0cm, with each having a length of 25.0m and a depth of 3.0m; cast net with stretched mesh size of 6.4cm; fish baskets, non-return valve traps which along with fences, fish pots and a set of long-lines of length 35.0m. Fish Aggregating Devices (FAD) was deployed to aggregate fishes and invariably increased fishing success. Sampling was at three stations (I, III and V) established on the Lake. In the Laboratory, specimens collected were identified and sexed, their total and standard lengths were measured in centimetres while their body weights were taken in grams. The age of fish species were determined by analysis of Frequency distribution of Ocular Lens Diameters (OLD) measured in Millimeters (mm) and validated by means of Length-Weight frequency distribution. Catch statistics were, 288 specimens of *S.nigrita* with a sex ratio of 1.6:1, TL range of 06.0-21.5cm and BW range of 05.8-581.2g. Results of the Frequency distributions of OLD in *S. nigrita* studied indicate the population was made up of one age group with modal class interval of 10.0-12.5cm. In *C. citharus*, a single age group was clearly evident with modal class interval of 15.0-17.5cm. A lone class interval of 25.0-27.5cm, distal from the bulk may suggest another age group of *C.citharus* not fully represented in the sample. Length and weight Frequency distributions of both species equally followed the same pattern as the OLD frequency distribution confirming mainly single age groups in the studies populations. Results obtained equally indicate there was a significant difference ($P<0.05$) between the left and right OLD in both species irrespective of sex. In *C. citharus*, all the left lenses were bigger than the right ones. In *S. nigrita* however, 253 (88.77%) of the population had bigger left OLD while the remaining 32 (11.23%) had the right OLD bigger than the left ones. Since all other features used in identifying the specimens were the same, except for the observed differences in the eye lens of *S. nigrita*, it is suggestive that we may have seen the outset of speciation.

Keywords: *Length-weight, Ocular lens diameter, Frequency distribution, Sex ratio, Lake Ona, Southern Nigeria.*

INTRODUCTION

Age distribution and growth are important aspects of fisheries management. Age studies can furnish other basic data such as stock age structure, age at first maturity, spawning frequency, individual and stock responses to changes in the habitat, recruitment success etc. Age and growth data can in actual fact enhance determination of population changes due to fishing rates. A number of methods have been used to age varied species of fish. Such method involved the counting of annual or year marks or growth checks on hard structures of fish. Such hard structures include:- Scale (Lagler, 1947; Ottawa; 1978, Ottawa and Simkiss, 1979), Otolith (Poinsard and Troadec, 1996, Pannella, 1971, 1974, 1980), opercular bones Fagade 1974 on *Tilapia* melanotheron), spines (Brennan, 1988; Brennan and Cailiet, 1989, 1991, Rossitar et al., 1995; Steveson and Secor, 1999; Sun et al., 2000). In addition, is the popular Petersen Method first described by Petersen (1891) (Sparre et al., 1989; Pauly, 1982; Morgan and Pauly, 1987). All these methods have numerous but specific drawbacks which include the requirement of a large number of specimens to be reasonably valid (Fletcher, 1991). In addition are, the drudgery in preparation of slides for instance, and reading of growth marks that culminate in systematic and random errors (Bearnish, 1969). Numerous readings are therefore adopted in order to validate whatever age is assigned to the specimen (Sandeman, 1969).

In order terrestrial animals, measurement of ocular lens is employed for their age determination. Typical examples being mammals and birds (Lord, 1959; Friend, 1967). Following confirmation of such methods as reliable, the technique has been applied to estimate the age of fishes (Al-Hassan and Al-Sayab, 1974, Al-Hassan et al, 1991, 1992). The present study focuses on two dominant species, *Citharinuscitharus* and *Synodontis nigrita*, in Lake Ona, a natural freshwater lake in Oshimili South Local Government Area of Delta State in Southern Nigeria. Among earlier studies on *Citharinus citharus* were Bakare (1970), Imevbore and Bakare (1970), and Aramowo (1976) who looked at the food and feeding habits of this fish in River Niger at Kainji. Idodo-Umeh and Victor (1990) studied some aspects of ecology of *Synodontis nigrita* in River Ase, Southern Nigeria while Olojo *et al*. (2003) cosndiered the food and feeding habits of the same species in River Ogun, Southern Nigeria. From available literature, there is dearth of knowledge with respect to ageing of these species. The present study aims at determination of age of two dominant species to bridge the gap.

MATERIALS AND METHODS

Study Area: The location, topography and vegetation of the study area, have been described elsewhere by the present authors. For clarity however, the map of the study area showing the specially established experimental stations is shown in Fig. 1.

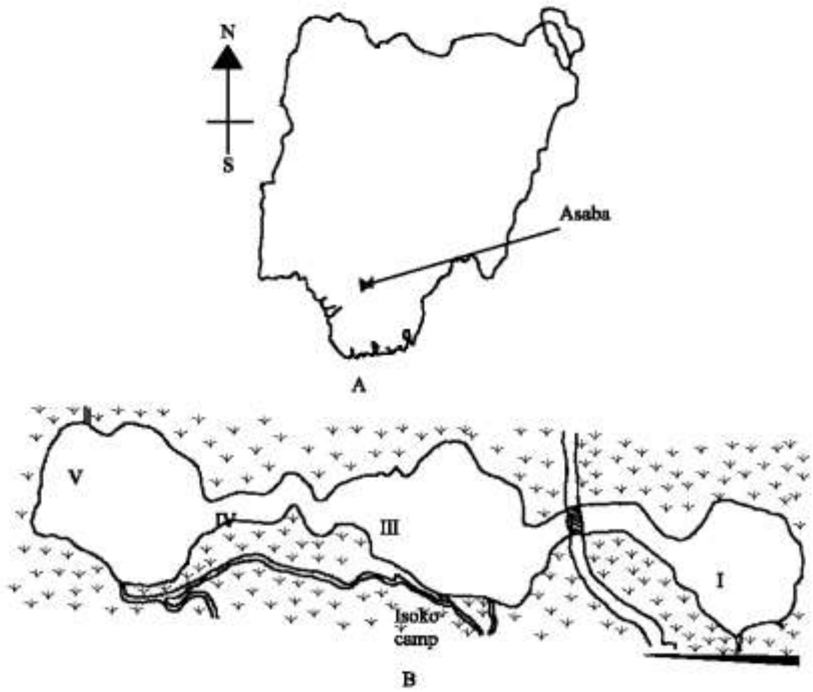

Fig 1: (a) Is Map of Nigeria, (B) shows details of study stations- I, II, III, IV and V on Lake Ona.

Sampling for Fish: Fish samples used for the study were collected at fortnightly intervals between August 2001 and July 2003 from three stations designated I, III and V, which are the main channels of the lake. For the purpose of sampling one fisherman and a boatman were engaged for each station. At each station, three bottom set and three surface set gill nets of mesh sizes 1.0, 3.0 and 5.0cm were used for sampling. Each net had a length of 25.0m and a depth of 3.0m. In study to these nets, one segmented cast net with pocket of stretched mesh size 6.4cm was used at each of the stations. To take care of the bottom dwellers, five sets each of fish baskets, locally called manly and the non-return value traps were similarly used at each station. There was also a set of long-lines of length 35.0m which ran along the edges of the fringing vegetation of the three stations. In the dry season months, Fish Aggregating Devices (FAD0 and fences were used to aggregate and catch fish. The gears used were tended twice on sampling days between 06.00-7.30h and 17.00-18.30h. All fish samples caught were washed, packaged in iced plastic buckets and transported to the laboratory, where they were sorted and identified up to the species level according to Reed, (1967), Holden et al (1978) and Idodo-Umeh (2003). They were then counted and all measurements (total length, standard length and weight) were taken and recorded to the nearest 0.1cm and 0.1g respectively. The ocular lens diameters of both eyes of the two most dominant species – *Citharinuscitharus* and *Synodontis nigrita*, were measured in mm. Data collected were subjected to analysis of variance and means were separated using Duncan's Multiple Range Test. Data were further analyzed using T-test and Pearson's Correlation.

RESULT

Catch Data: A total of 1,394 fishes were caught during the sampling period. However, attention in the present study focused on two dominant species whose data are summarized in Table 1. The catch data presented in Table 1 shows that the species and their occurrence by number were:- *Synodontis nigrita* (288 by number) and *Citharinus citharus* (308 by number). Analysis of variance showed a significant difference among the monthly number of fish at the three stations of the lake P<0.05. DMRT showed that the monthly number of fish at Station I was significantly different from those of stations III and V, P<0.05.

Table 1: Catch data on experimental species of fish in Lake Ona

Family	Genus	Species	Station I	Station II	Station III	Total per sp.
Mochokidae	*Synodontis*	*Synodontis nigrita*	8	103	177	288
Citharinidae	*Citharinus*	*Citharinus citharus*	9	187	112	308
Total number of fish per station			17	290	289	

Meristic data: Presented in Table 2 are range of values of Total Length(TL) in centimeters (cm) and Body Weight (BW) in grams (g) which were the two basic meristic features considered. Total length for *S. nigrita*, ranged from 04.5cm to 18.0cm while its Body weight ranged from o5.8g to 56.3g in Lake Ona (Table 2). Across Lake Ona, TL for *C. citharus* ranged from 06.0 to 27.0cm while the BW ranged from 05.8g to 581.2g.

Table 2: Range of values of meristic features of experimental fish species in Lake Ona

Species	Range of Parameters	Station I	Station II	Station III
Synodontis	TL (cm)	05.8-10.9	04.5-18.0	05.2-16.5
nigrita	BW (g)	09.1-16.3	05.8-45.0	05.5-56.3
Citharinus	TL (cm)	08.1-15.2	08.5-27.0	06.0-21.5
citharus	BW (g)	33.0-132.0	15.2-581.2	05.8-125.1

TL = Total Length, BW = Body Weight

Ocular Lens Diameter (OLD) of the two dominant species in Lake Ona

C. citharus: A total of three hundred (300) observations were made on OLD of *C. citharus* from the three Stations (I, III and V) where active fishing took place. This number was made up of 173 males and 127 females. The sex ration was therefore 1.4:1 while the results are presented in Table 3.In all fish samples, it was consistently observed that the left ocular lenses are bigger than those of the right irrespective of sex (Table 3).

Table 3: Observations of Ocular Lens Diameter for *C. citharus* at different stations

Sex	Comparative dimension of Ocular lens Right>Left			Comparative dimension of Ocular lens Left t>Right		
	Station I	Station II	Station II	Station I	Station II	Station II
Male	-	-	-	6	98	69
Female	-	-	-	3	79	45
Total	-	-	-	9	177	114

T-test conducted on data to determine the difference between the left and right ocular lens diameters in the three stations were significantly different. At Station I P<0.001, while at Stations III and V P<0.01.

Pearson's correlation for Stations I, III and V were respectively 0.998599,0950459 and 0.996558.Regression of mean ocular lens diameter on standard length for Stations I, III and V. There was a positive correlation in all three stations. The regression coefficient at Station I was r = 0.2996 P>0.05. results for Stations III and C were respectively r = 0.7278 and r = 0.9532, P<0.001.

S. nigrita: Results of observations made on OLD of *S. nigrita* are presented in Table 4.Total number of observations made from the three stations was 285broken-down as 173 males and 112 females implying a Sex Ratio of 1.6:1. Of these, 253 (88.77% of all observations) had their left ocular lens bigger than the right, while the remaining 32 (11.23%) had their right ocular lens bigger than the left (Table 4). T-tests conducted on the left and right ocular lens diameters showed they were significantly different from each other in all the Stations (P<0.01).Pearson's correlation coefficient were 0.999408, 0.892539 and 0.907294at Stations I, III and V, respectively. Results of regression of mean ocular lens diameter on weight for stations I, III and V, showed a positive correlation in all the stations, with a correlation coefficient of r = 0.6659 at Station I (P>0.05),0.6308 at Station III and 0.7017 at Station V, P>0.001 respectively. Regression of mean ocular lens diameter on Showed a coefficient "r" at Station I to be 0.656 P<0.05, while at Station III, r = 0.7144, P<0.01 and Station V r = 0.9629, P<0.001 respectively.

Table 4: Observations of Ocular Lens Diameter for *S. nigrita* at different stations

Sex	Comparative dimension of Ocular lens Right>Left			Comparative dimension of Ocular lens Left t>Right		
	Station I	Station II	Station II	Station I	Station II	Station II
Male	-	9	9	5	51	99
Female	-	8	6	3	35	60
Total	-	17(16.50%)	15(8.62%)	8(100%)	86(83.50%)	159(91.38%)

Length and weight frequencies as indices for age determination in fish species: The length-frequency distribution of *S. nigrita* in Lake Ona is presented in Fig. 1.

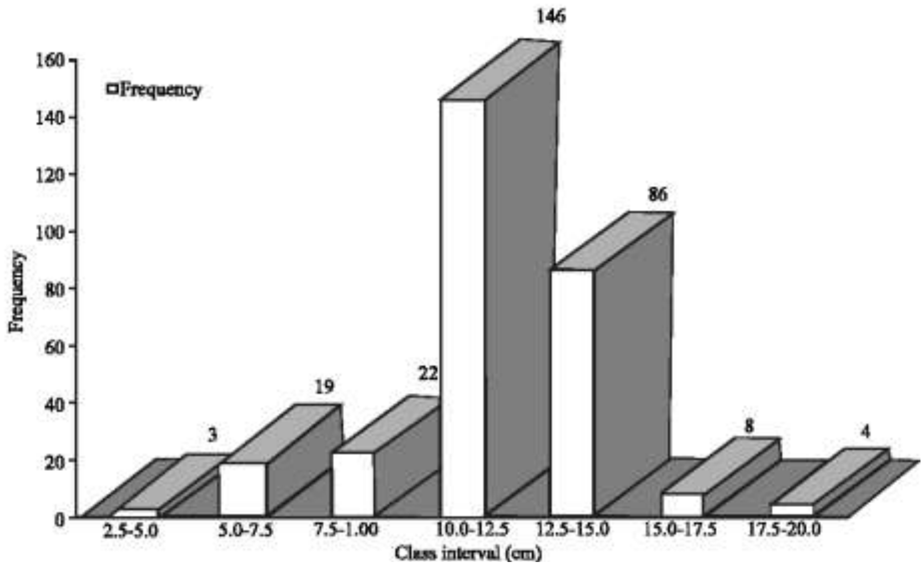

Fig. 1: Length (cm) frequency distribution for *Synodontis nigrita*

Results of length-frequency distribution for *S. nigrita* revealed one mode in the population with the modal class interval 10.0-12.5cm.Length-Frequency Distribution of *C. citharus* in Lake Ona is presented in Fig. 2.

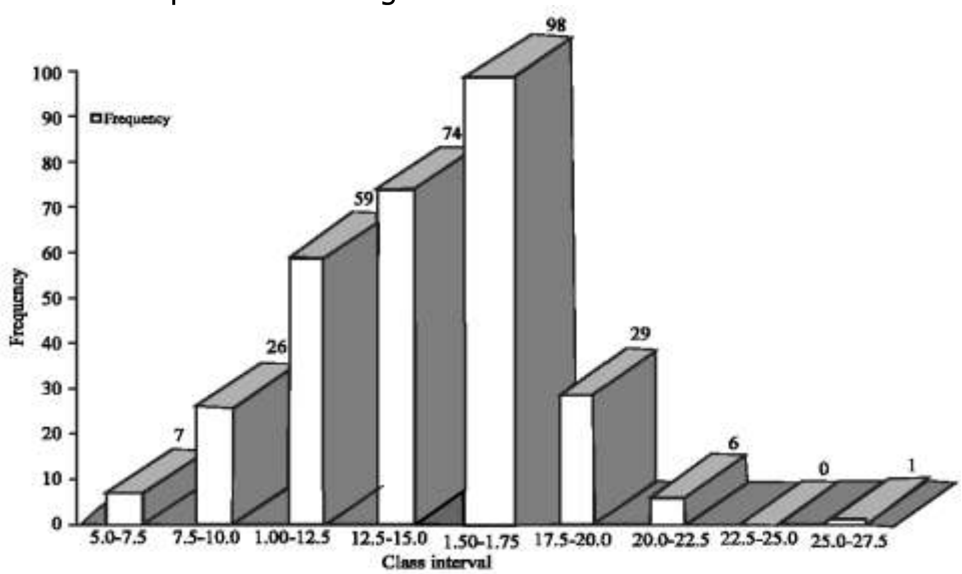

Fig 2: Length (cm) frequency distribution for *Citharinus citharus*

Weight-Frequency distribution for *Synodontis nigrita*:

The Weight-Frequency Distribution for *S. nigrita* obtained is presented inFig. 3.A unimodal weight-frequency is illustrated with a modal class interval of 20.0-25.0g.

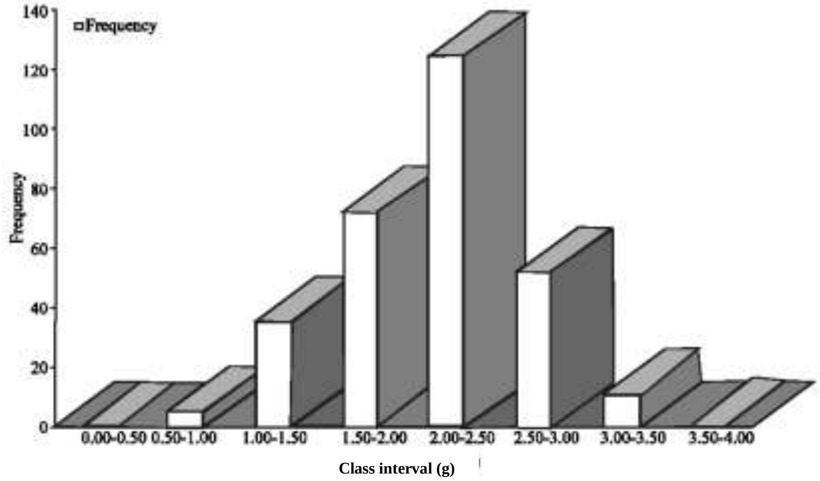

Fig. 3: Weight (g) frequency distribution for *Synodontis nigrita*

Weight-frequency distribution for *Citharinus citharus*:
The result of weight-frequency distribution obtained is presented in Fig. 4.Like what was obtained for *S. nigrita*, a unimodal weight-frequency is illustrated with a modal class-interval of 50-100. The distribution tapers to 1 with a class-interval of 200-250. Another class-interval of 550-600g had a frequency of 1.

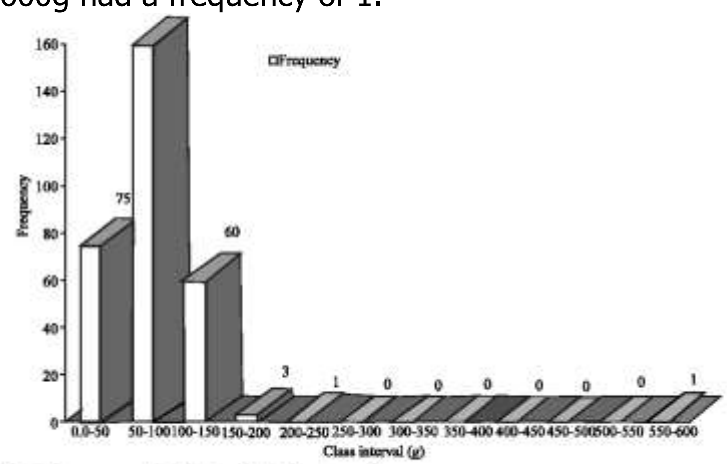

Fig. 4: Weight (g) frequency distribution for *Citharinus citharus*

Ocular lens diameter frequency distribution for *Synodontis nigrita:* Presented in Fig. 5, is the Ocular lens diameter frequency distribution for *S. nigrita*. A unimodal distribution is clearly evident with a modal class interval of 2.00-2.50mm.

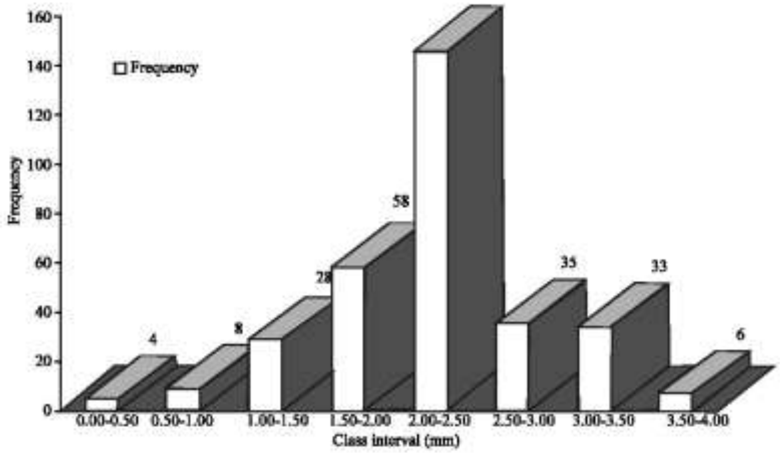

Fig. 5: Ocular (mm) diameter frequency distribution for *Citharinus citharus*

Ocular lens diameter frequency distribution for *Citharinus citharus*: Presented in Fig. 6 is the Ocular lens diameter frequency distribution for *C. citharus*. Like for *S. nigrita*, a unimodal distribution with class-interval of 2.00-10250mm and modal frequency of 124 were obtained for *C. citharus* (Fig. 6).

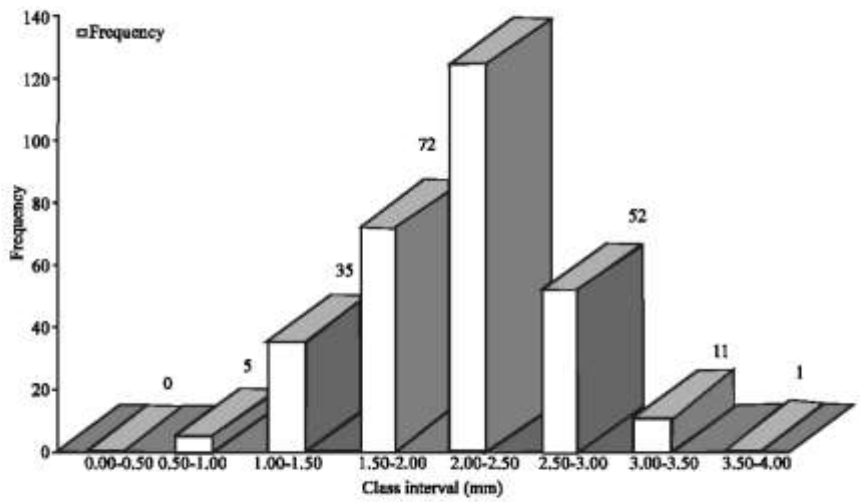

Fig. 6: Ocular (mm) diameter frequency distribution for *Citharinus citharus*

DISCUSSION

The unimodal frequency distributions of OLD for the two most dominant fish species viz *S. nigrita* and *C. citharus* obtained in this study, indicate that the fish species comprised of single age groups. In the case of *C. citharus*, an additional single class interval obtained distally to the right extremity of the prominent modal class points to existence to another age group that was excluded by the fishing gears from the catch.

The highly significant ($P<0.001$) positive regression coefficient 'r' obtained from regression analysis on OLD-standard length as well as OLD bodyweight for both *S. nigrita* and *C.*

citharus indicate that OLD can indeed be employed in age determination of fish species studied and other species in general. The findings obtained from the present study are in agreement with those of Conides and AL-Hassan (2000) who reported that the eye lens diameter increases with the age, in their study of the average ocular lens diameter of *Lithognathus mormyrus* and *Diplodus vulgar is*, to estimate the age of a population of the two fish species. As per Bagenal (1978), length is an indicator of the likely age of a fish. The results obtained were validated by the Petersen method as reported by Bagenal (1978), in which age of fish can be determined from the length frequency distribution. By this method the length composition ofa fish population will most often exhibit modes among the small fish which correspond to the youngest age group. Close to the modes, all, or nearly allof the fish may be expected to be of one age group.

In the present study, results of length and weight frequency distributions for *S. nigrita* and *C. citharus*, revealed an age group in the population of both species. In *C. citharus* however, at the far end of the frequency polygon, a frequency of 1 obtained for the class interval of 550-600g, may indicate the lower limits of another age group much older than the abundant group. The results of the length and weight frequency distribution obtained for both species therefore confirm the validity of those obtained from OLD frequency distribution.
In this study, with the exception of the observed differences in OLD in *S. nigrita*, there were no observed differences in the morphological and meristic features among the individuals of the two species. Applying the ponderal index to the population of *S. nigrita*, individuals with the left ocular lens diameter bigger than the right ocular lens diameter as well as those with the right ocular lens diameter bigger left ocular lens diameter were both dominant in the population. It is therefore concluded that two stains of *S. nigrita* are present in Lake Ona and this may be beginning of speciation.

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