

Some reproductive aspects of *Chrysichthys nigrodigitatus* (Lacépède: 1803) in Oguta Lake, Southeastern Nigeria

Original Article

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Abstract:

The silver catfish, *Chrysichthys nigrodigitatus* (Siluriformes: Bagridae) is a commercially important species in Oguta Lake, but in recent years, its yield from most capture fisheries in Nigeria is stagnating. The aim of this study is to determine the fecundity, egg size, spawning period and gonadosomatic index of *C. nigrodigitatus* with respect to its sustainability and aquaculture potentials. Sampling was conducted once every month from March 2023 to February 2025 with gill nets, cast nets and basket traps. A total of 171 specimens were collected comprising 100 females and 71 males. Six stages of gonad maturity of *C. nigrodigitatus* were recorded while fecundity showed that mean weight of 305.78 g (total length of 36.10 cm) and 174.3g (Total length of 29.50 cm) had the highest mean number (4761.08) and lowest mean number (2325) of eggs, respectively. Body weight proportionally increased as the standard length increased with a high positive correlation ($r = 0.9829$). Mean egg diameter ranged between 2.46 mm to 2.61 mm between May and September. Mean gonadosomatic index (GSI) was highest in May in both females (13.40) and males (2.63) respectively. Lowest GSI was recorded in October. Gonadosomatic index increased during the wet season in both sexes. Our results have indicated that *C. nigrodigitatus* showed appreciable fecundity and a sizeable egg diameter which are important parameters in breeding of species.

Key words:

egg diameter, fecundity, gill net, gonad maturity, gonadosomatic index, Oguta Lake.

Apstrakt:

Neki reproduktivni aspekti vrste *Chrysichthys nigrodigitatus* (Lacépède, 1803) u jezeru Oguta, jugoistočna Nigerija

Srebrni som, *Chrysichthys nigrodigitatus* (Siluriformes: Bagridae), predstavlja komercijalno značajnu vrstu u jezeru Oguta, ali je posljednjih godina njegov ulov u većini privrednih ribolova u Nigeriji u stagnaciji. Cilj ovog istraživanja bio je da se utvrde plodnost (fekunditet), veličina jaja, period mresta i gonadosomatski indeks vrste *C. nigrodigitatus* u kontekstu njenog održivog korišćenja i potencijala za akvakulturu. Uzorci su prikupljeni jednom mesečno od marta 2023. do februara 2025. godine korišćenjem mreža stajaćica, bacačkih mreža i korpi-zamki. Ukupno je sakupljen 171 primerak, od čega 100 ženki i 71 mužjak. Zabeleženo je šest stadijuma polne zrelosti gonada vrste *C. nigrodigitatus*. Analiza fekunditeta pokazala je da su ženke prosečne mase 305.78 g (ukupne dužine 36.10 cm) imale najveći prosečan broj jaja (4761.08), dok su ženke prosečne mase 174.3 g (ukupne dužine 29.50 cm) imale najmanji prosečan broj jaja (2325). Telesna masa se proporcionalno povećavala sa porastom standardne dužine tela, uz veoma visoku pozitivnu korelaciju ($r = 0.9829$). Prosečan prečnik jaja kretao se od 2.46 mm do 2.61 mm u periodu između maja i septembra. Najveće prosečne vrednosti gonadosomatskog indeksa (GSI) zabeležene su u maju, kako kod ženki (13.40), tako i kod mužjaka (2.63). Najniže vrednosti GSI registrovane su u oktobru. Kod oba pola gonadosomatski indeks se povećavao tokom kišne sezone. Dobijeni rezultati ukazuju da *C. nigrodigitatus* poseduje značajnu plodnost i relativno krupan prečnik jaja, što su važni parametri za uspešno razmnožavanje i uzgoj ove vrste.

Ključne reči:

prečnik jaja, fekunditet, mreža stajaćica, polna zrelost gonada, gonadosomatski indeks, jezero Oguta.



Introduction

The silver catfish, *Chrysichthys nigrodigitatus* (Lacépède 1803) occurs in most tropical rivers and lakes in Africa such as Nigeria, Senegal, Gambia and Ivory Coast. Other countries are Liberia, Zaire, and Gabon (Offem et al., 2008). It is highly valued and sought after because of its flavor, protein rich flesh plus other chemical compounds (Akinsanya et al., 2007; Saliu 2008; Olarinmoye et al., 2009). Ama-Abasi et al. (2017) reported that in the Cross River system, *C. nigrodigitatus* is the most important single species of commercial importance occurring all year round with peak abundance in the rainy season. Lately the species commands relevance in the international market thereby making it a source of foreign exchange earnings in Nigeria (Ama-Abasi & Uyoh, 2020).

Abundance of reports exist on *C. nigrodigitatus* in Nigeria waters but are mostly limited to some aspects of the biology of *C. nigrodigitatus* with scanty information on its reproductive biology. There are published data on ecology and population dynamics (Ama-abasi & Uyoh, 2020), gut content analysis (Esenowo et al., 2017), food and feeding ecology (George & Atakpa, 2015), diet composition, feeding habits and condition factor (Uneke, 2014), condition factor and diet (Atobatele & Ugwumba, 2011), morphometry and diet (Lawal et al., 2010), food habits (Yem et al., 2009), food and feeding habits (Kusemiju & Olaniyan (1989), age and growth determination (Ezenwa & Kusemiju, 1981), taxonomic description (Reed et al., 1967). It is also recorded that natural populations of *C. nigrodigitatus* in Nigeria freshwater ecosystems are on decline (Oluwale, 2019). Clear evidence that the species is endangered has been portrayed by Ayotunde & Ada (2013) in Cross River. *Chrysichthys nigrodigitatus* is one of the most threatened catfish species with the highest rate of extinction (Araoye, 1999; Craig, 2000). Some of the reasons for declining population of this species in the wild includes higher demand, habitat loss, pollution and degradation (Ayotunde & Ada, 2013), environmental degradations and overfishing (Asuquo et al., 2013). Adite et al. (2006) pointed out that the biology of *C. nigrodigitatus* has not been extensively studied, despite its acute decreasing population, while poor advancement in propagation protocols for this species may be partly due to inadequate information on its reproductive biology.

A key parameter in the reproductive biology of *C. nigrodigitatus* is fecundity, which expresses the capacity of fish in terms of eggs production and has been defined by Gupta & Gupta (2006) as the number of ripening eggs in the ovaries of female

before spawning. According to Eyo et al. (2013) fecundity is an index which measures the number of eggs carried by a gravid female fish or shrimp. Fish fecundity, as the number of ripe eggs, varies among as well as within populations (Demeke et al., 2015). According to Oniye & Onimisi (2011), fecundity varies from one fish species to the other, and it is also a function of body weight and length (Akpaniteaku, 2012). Studies has also been conducted to establish relationships between length, weight, and ovary weight (Usman et al., 2013), as well as to develop numerical relationships between egg production and recruitment (Sarker et al., 2002; Amin et al., 2009).

Knowledge of fish fecundity is very important because it has much relevance to fish population studies. It is important to evaluate the productive potentials of the species, (Duarte & Araujo, 2002) as it gives essential information needed for planning a breeding programme such as determining how many eggs would be spawned or stripped, the amount of rearing facilities required and the extent to which various culture equipment would be needed (Egwui et al., 2007). Information on fecundity is also very important in order to evaluate a fish for its commercial potentialities (Lawson, 2011). During selection of species for aquaculture, fecundity is one of the important characteristics considered by scientists (Shinkafi & Ipinjolu, 2012). Fecundity is also used to evaluate the performance of aquaculture feed especially when a new feed is benchmarked (Eyo et al., 2016).

Fecundity, together with size at sexual maturity, size of egg, sex ratio and gonadosomatic index are also important aspects of life history theory formulations (Mekkawy & Hassan, 2011). The gonadosomatic index (GSI) is an important indicator of the general health of an organism. It is used to estimate or measure reproductive capacity and reproduction is the most critical stage in the life cycle of a species, which determines its survival and success (Al-Deghayem et al., 2017). The GSI measures the ratio of the mass of gonads relative to total body weight and is one of the indices in monitoring changes in nutritional and energy status (Hirpo, 2012). Gonadosomatic index which is an index of gonad size relative to fish size is a good indicator of gonadal development in fish. According to Amtiyaz et al. (2013) the percentage of body weight of fish that is used for production of eggs is determined by the gonadosomatic index. Studies has also been conducted to establish relationships between length, weight, and ovary weight (Usman et al., 2013), as well as to develop numerical relationships between egg production and recruitment (Sarker et al., 2002; Amin et al., 2009).

Several workers have reported on the GSI and

egg size of different fish species from Nigerian waters and these include Shinkafi et al. (2002), Saliu & Fagade (2003), Anene & Okorie (2008) and Fawole & Arawomo (2009) among others. Similar studies conducted on species of *Chrysichthys* in Nigeria include the work on egg size of *C. auratus* in Lake Kainji (Ajayi, 1972) and that of *C. walker* in Lekki Lagoon (Ikusemiju, 1976), reproductive biology of *C. filamentosus* in Oguta Lake (Nwadiaro & Okorie, 1986), fecundity, egg size and condition factor of *C. nigrodigitatus* in Cross River (Ekanem, 2000), fecundity and condition of *C. nigrodigitatus* in Yewa Lagoon (Taiwo et al., 2013). No such studies have been conducted on *C. nigrodigitatus* of Oguta Lake. This study, therefore, compliments the efforts of Nwadiaro & Okorie (1986) by focusing on the Oguta Lake population of *C. nigrodigitatus*. The aim of this study is to determine the fecundity, egg size, spawning period and gonadosomatic index of *C. nigrodigitatus* to provide data on the reproductive and breeding potentials of the Oguta Lake population of *C. nigrodigitatus*.

Materials and Methods

Description of the study area

Geographically, Oguta Lake (Fig. 1 and Fig. 2) is located between latitudes 5°41' and 5°44' N and longitudes 6°45' and 6°56' E, with an average annual rainfall of 3100 mm. Its surface area is 1.80 km² at peak flood, with a maximum depth of 7 m and a mean depth of 5.50 m during the dry season. The lake is fed mainly by the Njaba and Awbana rivers and drains into the River Niger system through the Orashi River (Uzoka et al., 2024).

Most parts of the shoreline are lined with communities of bank macrophytes, consisting of grasses such as *Panicum senegalense* and sparse populations of floating macrophytes such as *Pistia stratiotes*, *Azolla africana*, *Salvinia auriculata*, *Ceratophyllum demersum*, *Utricularia inflexa*, and water lilies (*Nymphaea lotus* and *N. macrantha*). Plant life is poor and restricted to the littoral zone (<1.5 m depth). Four water bodies are associated with Oguta Lake: the

Njaba River, Awbana River, Utu Stream, and Orashi River. The Njaba and Awbana rivers discharge into the lake throughout the year, while the Utu Stream flows into the lake during the rainy season. The Orashi River flows past the southwestern portion of the lake. The total annual inflow from these rivers and stream is about 25801.60 m³ (Ahiarakwem, 2006; Umunnakwe, 2014). The rainy season (April–September) is characterized by moderate temperatures and high relative humidity, whereas the dry season (October–March) is characterized by scant rainfall, higher temperatures, and lower relative humidity.

Study stations

Four sampling sites were selected within the lake

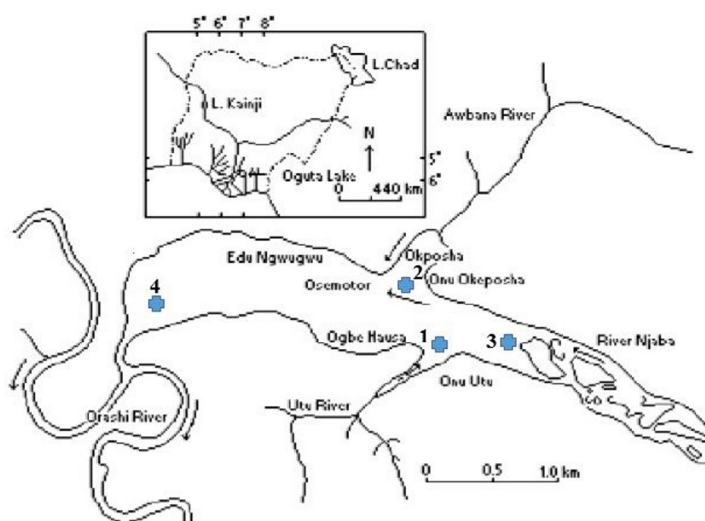


Fig. 1. Map of Oguta Lake showing sampling locations (Source: Adaka et al., 2017)



Fig. 2. A pictorial view of Oguta Lake

at the points where the associated rivers and stream connect with Oguta Lake. Utu Station is located where the Utu Stream enters Oguta Lake and has a mean depth of 5.63 ± 0.460 m. Osemoto Station is situated where the Awbana River joins Oguta Lake. Anthropogenic activities such as cassava and breadfruit processing, refuse disposal, and the use of open latrines are predominant at this station, which has a mean depth of 5.40 ± 0.732 m. Njaba Station is located where the Njaba River joins Oguta Lake, where intensive sand mining is practiced; the station has a mean depth of 5.42 ± 0.681 m. Orashi Station is situated where Oguta Lake drains into the Orashi River. This station is relatively calm and deeper than the other sampling sites, with a mean depth of 6.27 ± 0.630 m.

Sample collection

Sampling was done mainly with gill nets of various mesh sizes between March 2023 and February 2025. Gill nets are essentially a curtain of netting hanging vertically in the water. The dimension of a gill net is 30.48 m by 365.76 m but can be adjusted to meet the requirements of the fisherman. Mesh sizes of 25 mm, 30 mm, 40 mm and 50 mm were used. Sampling was also conducted through scheduled, monthly fishing trials by the use of cast net and basket trap. These are the most common fishing gears used by the local fishermen (Figs 3, 4 and 5). Additional to the scheduled fishing trials, individuals caught with the same fishing gears were also assessed from small scale fishermen. For the gill net, one net from the mesh sizes was randomly selected and set overnight at each sampling station. Basket trap was also placed at chosen locations at the sampling stations.

Fish identification

Chrysichthys nigrodigitatus samples were selected from the total catch and chilled in ice blocks at the point of collection before being carefully transported to the laboratory. The weight of each fish specimen was measured using a Metlar-2000D electronic weighing balance to the nearest 0.1 g. The body depth (BD), total length (TL), standard length (SL) and forked length (FL) were measured in centimetres (cm) using measuring tape. Identification of fish species was done using taxonomic keys of Reed et al. (1967), Olaosebikan and Raji (1998) and sexed by visual observation of the gonad after dissection.

Fecundity estimation and egg diameter

The visual approach was used to determine the maturity stages of the fishes. Firstly, the abdominal area of samples was gently pressed to see if milt

or eggs will extrude and afterwards dissected by cutting away the abdominal wall to expose the gonads. The gonads were removed with a razor blade, drained, and weighed at 0.01 g on a sensitive



Fig. 3. A gill net



Fig. 4. A cast net

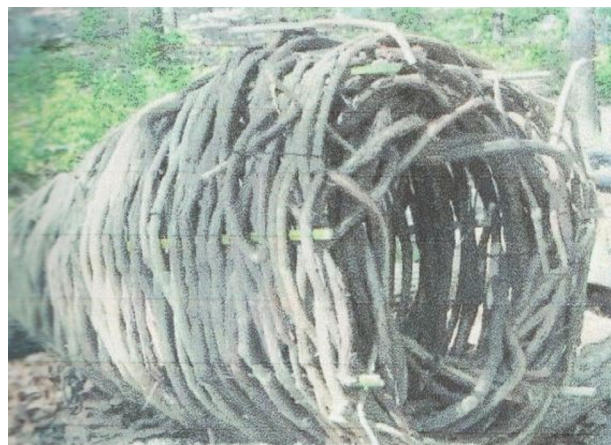


Fig. 5. A basket trap

electronic scale (Metra electronic weighing balance FA2104). The ripe ovaries removed from the gravid fish were preserved in Gilson's fluid. Based on the sexual maturity scale of ovaries as established by Gecely (2008), 53 females of *C. nigrodigitatus* at stage V of sexual maturity were selected for the estimation of fecundity.

For egg diameter, the preserved ovaries were washed several times in distilled water to get rid of the preservative, eggs were later separated from the ovaries and placed on filter paper to remove excess water. Clumped eggs were carefully separated and air dried at room temperature. Ten eggs from each ovary were randomly picked, and their diameter measured using a calibrated micrometer mounted on the eyepiece of a monocular microscope (one division = 0.02 mm) (Absalom et al., 2017).

Gravimetric method was employed to estimate the number of eggs in each of the gravid fish. In this method, all the eggs in each fish were weighed. Three sub-samples of 200 eggs from each fish were selected randomly and weighed. The total weight of eggs divided by the mean weight of the sub-samples and multiplied by 200 gives the estimated fecundity of the fish (Absalom et al., 2017).

Fecundity (F) is estimated from the following relationship:

$$\frac{N}{n} = \frac{W}{w}, \text{ from which } N = \frac{nW}{w}$$

N = F (total number of eggs),

n = number of eggs in sub-sample (=200),

W = weight of all eggs (g),

w = mean weight of 200 eggs (g).

Gonadosomatic index (GSI)

The body weights of the fishes with their corresponding gonad weights were used to calculate the gonadosomatic index (GSI). This was determined according to the method of Allison et al. (2008):

$$GSI = \frac{W}{B} \times \frac{100}{1}$$

W = weight of gonad (g),

B = weight of the fish (g).

Statistical analysis

The coefficient of correlation (r) between standard length and weight of *C. nigrodigitatus* was obtained using linear regression (Zar, 1984). Data obtained were log transformed before analysis and the linear regression is calculated by using the following equation:

$$\text{Log } Y = a + b \log X$$

Y = weight (g),

X = standard length (cm),

a and b = regression constants.

Results

Morphometrics of *C. nigrodigitatus*

The total lengths of *C. nigrodigitatus* from Oguta Lake ranged from 9.50 cm to 36.10 cm while the standard lengths ranged from 5.20 cm to 30.60 cm. The forked length ranged from 6.30 cm to 31.90 cm. The weight of *C. nigrodigitatus* ranged from 22.20 g to 431.00 g.

The body weight – standard length relationship of *C. nigrodigitatus* showed that body weight proportionally increased as the standard length increased with a high positive correlation ($r = 0.9829$) (Fig. 6). Female dominance was observed in the species, as female: male sex ratio (1:0.7) was observed. This is a deviation from the expected sex ratio of 1:1 with females more numerous in all the months of sampling. A summary of the weight distribution and biometric characteristics of the 171 sampled *Chrysichthys nigrodigitatus* is presented in Tab. 1.

Gonad maturation

The stages of gonad maturity of *C. nigrodigitatus* in Oguta Lake, Nigeria during the period of study is presented in Tab. 2. The maturity stages showed variations among sampled males and female specimens. Stage V of gonadal development (59.48%) was highest in both male and female specimens while stage I (5.23%) was the lowest.

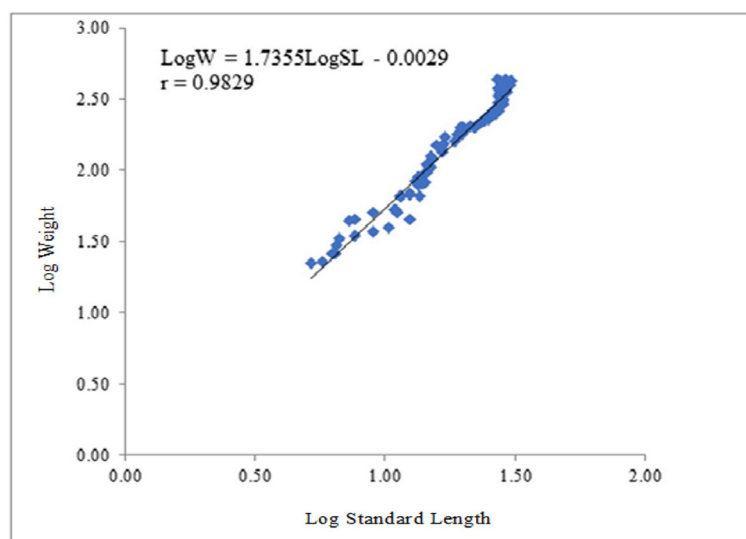


Fig. 6. Length–weight relationship of *Chrysichthys nigrodigitatus*

Tab. 1. Size distribution of *Chrysichthys nigrodigitatus*

Sex	Total No collected	Range in weight (g)	Range in total length (cm)	Range in standard length (cm)	Range in forked length (cm)
Male	71	26.00–42.0	10.30–34.5	6.40–29.10	7.50–30.40
Female	100	22.20–43.1	9.50–36.1	5.20–30.60	6.30–31.90
Combined	171	22.20–43.1	9.50–36.10	5.20–30.60	6.30–31.90

Tab. 2. Stages of gonad maturity of *C. nigrodigitatus* in Oguta Lake

Stages	Description	Male	Female
I	Immature virgin	3	5
II	Developing virgin	7	6
III	Developing	7	6
IV	Maturing	4	6
V	Mature/ripe	38	53
VI	Spent	8	10
Total		67	86

Fecundity and egg diameter

Tab. 3 shows fecundity and egg diameter of *C. nigrodigitatus* observed during the period of study. Out of the 53 samples of gravid *C. nigrodigitatus* examined, mean weight of 305.78 g and 174.3 g had the highest mean number (4761.08) and lowest mean number (2325) of eggs, respectively. Mean egg diameter of *C. nigrodigitatus* ranged between 2.46 mm to 2.61 mm between May and September.

Gonadosomatic index

The mean gonadosomatic index (GSI) of females and males of *C. nigrodigitatus* in Oguta Lake, during the period of study is presented in **Tab. 4** and **Tab. 5** while **Fig. 7** shows the graphical representation of the monthly changes in GSI. For the females, mean gonadosomatic index (GSI) was highest in May (13.40), followed by June (11.06) and least in

October (1.00). The males showed similar pattern by having maximum GSI in May (2.63), followed by June (1.91) and least in October (0.20). Gonadosomatic index increased during the wet season but decreased during the dry season in both sexes.

Discussion**Fecundity and egg size**

Out of the 53 samples of gravid *C. nigrodigitatus* examined, mean weight of 305.78 g and 174.3 g had the highest mean number (4761.08) and lowest mean number (2325) of eggs, respectively. The absolute fecundity recorded in this study is very low compared to the absolute fecundity of 32,436 eggs reported by Okey et al. (2018) for *Chrysichthys nigrodigitatus* in Cross River at Ahaha and also lower than 10,180 eggs reported by Oboh & Omoigberale (2014) from Jamieson River. It is lower than 28,086 eggs and 25,905 eggs reported by Ekanem (2000) and Offem et al. (2008) for *C. nigrodigitatus* from Cross River, respectively. Ama-Abasi & Uduakobong (2014) in Lower Cross River discovered an absolute fecundity of 41,535.9 while 26,040 eggs were recorded by Adite et al. (2017) from a man-made lake in Southern Benin. However, the highest mean value of 4761.08 eggs recorded in this study was higher than 4300 eggs recorded by Ajayi (1972) from Lake Kainji for *Chrysichthys sp.* Fagade & Ad'ebisi (1979) counted 2884 oocytes in Asejire Lake. Claudine et al. (2020) also observed an absolute fecundity of 1374 ± 1022 oocytes for females with a mean weight of 107.3 ± 111.9 g and

Tab. 3. Fecundity and egg diameter of *C. nigrodigitatus* in Oguta Lake

Month	Number observed	Total length in (cm)	Weight (g)	Mean Weight (g)	Total No. of eggs	Mean No of eggs	Mean egg diameter (mm)
May	4	18.50–29.50	120.00–242.00	174.3	9300	2325	2.46
Jun	12	17.05–36.10	83.80–431.00	245.66	39036	3253	2.51
Jul	11	17.80–34.00	95.30–320.00	246.14	46330	4211.82	2.56
Aug	12	18.11–33.00	100.50–395.00	305.78	57133	4761.08	2.61
Sep	14	17.50–36.10	83.00–430.00	309.7	64485	4606.07	2.59
Total	53						

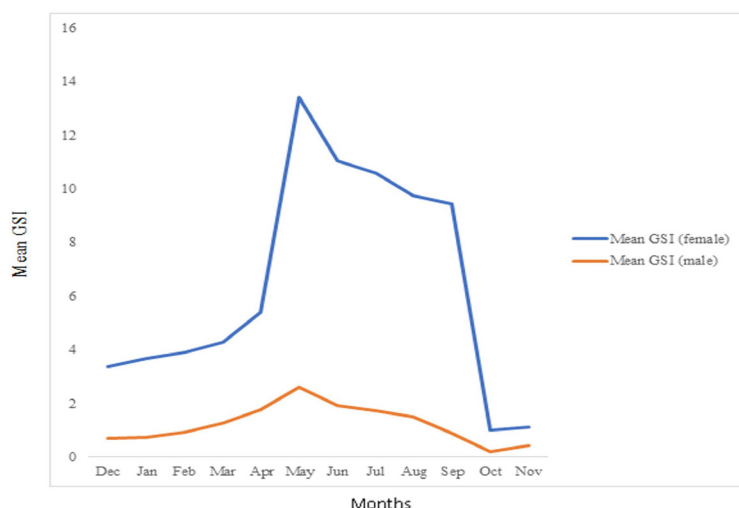


Fig. 7. Monthly variations in mean GSI of male and female *C. nigrodigitatus*

a mean total length of 211 ± 52.8 mm in Nkam river Cameroon. These findings show that fecundity varies from one region to another and from one water body to another and it would certainly be linked to environmental factors (Claudine et al., 2020). It is also strongly related to the weight and length of individuals (Offem et al., 2008).

In this study, egg sizes ranging from 2.46 to 2.61 mm, observed between May and September, represent the stock of eggs to be spawned, while the remaining maturing stock will develop subsequently. Egg diameters observed were comparable to other catfishes. Inyang & Ezenwaji (2004) found egg size range of 1.5 mm-2.5 mm diameter in *Chrysichthys*

auratus and between 1.5 mm-2.6 mm in *Chrysichthys nigrodigitatus* in Agulu lake, while Offem et al. (2008) observed egg size ranging from 0.2 mm to 4.7 mm in *C. nigrodigitatus* in Cross River. In his finding, Ekanem (2000) observed that the mean egg diameter of *Chrysichthys nigrodigitatus* varied from 0.65 mm to 3.54 mm. Elsewhere, Adite et al. (2017) recorded egg diameter of *C. nigrodigitatus* as 0.30 mm to 3.10 mm in a man-made lake in Southern Benin. The maximum egg size for this species exceeded 2.1 mm that Ajayi (1972) reported as the maximum egg diameter for *C. auratus*, and the 2.40 mm reported for *C. walkeri* by Ikusemiju (1976), showing that *C. nigrodigitatus* has bigger eggs than the other two members

of the genus. Observations in this study that ovaries carried immature (December – January) and mature eggs (May - September) separated from each other by maturing eggs (April - May) indicated that *C. nigrodigitatus* has a long spawning period, which extends from May to September.

Gonadosomatic index (GSI)

The mean gonadosomatic index (GSI) of both female and male *C. nigrodigitatus* in Oguta Lake during the study period showed that females had the highest GSI in May (13.40), followed by June (11.06), while males also recorded the highest value in May (2.63), followed by June (1.91). Lowest GSI

Tab. 4. Monthly changes in gonad maturity and GSI in female *C. nigrodigitatus*

Maturity stages	Month	Sample size	Mean weight (g)	Mean gonad (g)	Mean GSI
I Immature virgin	Dec	5	160	5.4	3.38
II Developing virgin	Jan	2	141	5.2	3.69
-	Feb	4	156	6.07	3.89
III Developing	Mar	6	142	6.1	4.3
IV Maturing	Apr	6	191	10.3	5.39
V Mature/Ripe	May	4	174.3	23.7	13.4
	Jun	12	245.66	27.17	11.06
	Jul	11	246.14	26.03	10.57
	Aug	12	305.78	29.74	9.73
	Sep	14	309.7	29.19	9.43
VI Spent	Oct	3	210	2.1	1
	Nov	7	201	2.3	1.14
Total		86			

Tab. 5. Monthly changes in gonad maturity and GSI in male *C. nigrodigitatus*

Maturity stage	Month	Sample size	Mean weight (g)	Mean gonad (g)	Mean GSI
I Immature virgin	Dec	3	123.19	0.85	0.69
II Developing virgin	Jan	2	165.52	1.2	0.73
	Feb	5	137.57	1.3	0.95
III Developing	Mar	7	155.04	2	1.29
IV Maturing	Apr	4	179.37	3.2	1.78
V Mature/Ripe	May	4	182.8	4.8	2.63
	Jun	5	235.29	4.5	1.91
	Jul	8	190.91	3.3	1.73
	Aug	11	230.76	3.5	1.52
	Sep	10	317.47	2.8	0.88
VI Spent	Oct	3	155	0.31	0.2
	Nov	5	139.53	0.6	0.43
Total		67			

was recorded in October for both females (1.00) and males (0.20). Gonadosomatic index increased during the wet season but decreased during the dry season in both sexes. The dominance of females especially between the months of June and September may be due to migration of female species to breeding sites where the fishing gears were set. Peak of GSI for this species between May and September confirmed by the high frequency of the matured phases during this period is an evidence of a single annual spawning. GSI for females was always higher than that for males probably due to heavier ripe female gonads. Maximum gonadosomatic index of 9.43 to 13.40 were obtained at the mature/ripe stages. The monthly gradual and progressive increase in the GSI is an indication that *C. nigrodigitatus* reaches spawning period up to September. According to Okey et al. (2018), the increase in GSI is an indication of fish maturity and reaches its maximum at the peak of gonad maturity. Similar findings have reported that the breeding period of most *Chrysichthys* species falls between April and September. These includes Offem et al. (2008) and Okey et al. (2018) for *C. nigrodigitatus* in Cross River, Ama-Abasi & Uduakobong (2014) for *C. nigrodigitatus* in lower Cross River, Adite et al. (2017) in a man-made lake in Southern Benin and Claudine et al. (2020) in Nkam River, Cameroon. The authors have also suggested that flood among other things provides expanded habitat and abundant food resources to ensure the survival of the huge number of young fishes produced. Idodo-Umeh (2003) also observed that most tropical fish breed during the rainy season,

when water levels are high, thereby extending nursery grounds. The peak GSI values recorded during the rainy season in this study also agree with those reported earlier for tropical freshwater fishes (Ikpi & Okey, 2010; Oboh & Omoigberale, 2014).

The present study has demonstrated potentials of *C. nigrodigitatus* in its reproductive aspects such as Fecundity, Egg size, Spawning period, Stages of gonad maturation and Gonadosomatic index in Oguta Lake. This study is part of ongoing studies on the reproduction of this species. Thus, further studies about the domestication and culturing of this species and its applications in commercial fields could be initiated from this research.

Conclusion

The result of this study conducted on some aspects of the reproductive biology of *C. nigrodigitatus* in Oguta Lake showed a six stage gonad maturation process with appreciable fecundity and a spawnable egg diameter of 2.46 mm - 2.61 mm. The mean gonadosomatic index (GSI) of *Chrysichthys nigrodigitatus* was highest in May and lowest in October for both males and females. Gonadosomatic index increased during the wet season but decreased during the dry season in both sexes. This study could be utilized by fishery experts involved in domestication of species for enhanced productivity.

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