Bayero Journal of Pure and Applied Sciences, 4(2): 178 – 181
Received: February, 2011
Accepted: December, 2011
ISSN 2006 – 6996

ASPECT OF REPRODUCTIVE BIOLOGY OF FISH OF COMMERCIAL IMPORTANCE IN SABKE RESERVOIR, KATSINA STATE

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ABSTRACT
Aspects of the reproductive biology of the most economically important fish species in Sabke reservoir was investigated such as Fecundity for females, average egg diameter, Gonado Somatic Index (GSI), for a period of twelve month (from March 2009 to February 2010).Samples of fish were collected through both experimental gears and commercial catches from local fishermen fortnightly. Fecundity range of 222 – 9642, and mean of 14652 ± 2600, 197 – 4414, 1110 ± 1162, 77 – 2007, 712 ± 541, 183 – 3290, 1178 ± 901, 265 – 2467, 854 ± 677 was calculated for Clarias gariepinus, Lates niloticus, Tilapia zilli, Oreochromis niloticus and S. galilaeus respectively. Mean annual GSI and average egg diameter of C. gariepinus, L. niloticus, T. zilli, O. niloticus and S. galilaeus of 0.85mm, and 0.60mm, 0.63, and 0.84mm, 1.36 and 1.68mm, 1.83,and 2.02mm, 2.26, and 2.82mm respectively. In general Sabke reservoir indicates positive indices for high fisheries potential.

Key words: Fecundity, egg diameter, Gonado Somatic Index

INTRODUCTION

Fecundity is defined as the number of ripe eggs found in the female just prior to the next spawning period. For an individual fish it is called absolute fecundity.

Many factors could affect fecundity in fish, some resulting in the death of eggs and young fish and other causing dramatic effects on the reproductive potential such as extreme pH which causes decrease in productive potential (Johnstons *et al.,* 1983).

Absolute fecundity (F) is define as the number of ripe eggs in the ovary prior to the next spawning of an individual female of an individual fish (Bagenal,1978).This attribute is important in determining the reproductive life history of fishes and is important in understanding various aspects of fish Biology(King,1978).

The size of eggs varies tremendously across species (Coleman, 1991). A larger egg may not translate in to larger hatchlings for several reasons. For example, a given measure of egg size may not be a true representation of the energetic and material resources of the egg. This could be the case if larger eggs are simply filled with more water than smaller eggs, and size differences may solely be accounted for by water content. In such a case, the difference in egg size may be insignificant to the resulting hatchlings. This is particularly plausible because fish eggs are hydrated and expand to some extent when they leave the female (Coleman, 1991). An ideal measurement of egg size may involve a complete bio-chemical analysis of the contents of an egg, reporting protein, lipid, and carbohydrate content (Coleman, 1991). Indeed, for situations when the eggs are particularly small and yet must be kept alive, even weighing individual eggs or measuring their volume can be difficult (Coleman and Galvani, 1998).

Fish eggs display an astonishing variety of colors, shapes, appendages, sizes and places of development: buoyant (pelagic); on the bottom (demersal); fixed on plant or stone; in sand or gravel; in open nest; in covered nest (i.e., burrow or tunnel); in bubble nest; in mouth (mouthbreeders); attached to parental body; in brood pouch; in female (live-bearers); outside the water; in another animal (i.e., bivalve); other.

The Shape of egg can be classified as: spherical, ovoid or elongated.

The Attributes of the egg can be: smooth; sculptured; with filaments; with tendrils; with stalk; in jelly matrix; other. In addition, the eggs can be sticky or not sticky.

The Color of eggs can be: transparent, white, yellow, orange, amber, brown, black, gray, or green.

The aim of the research was to document information on the reproductive Biology of some fish species of commercial importance in Sabke reservoir, Katsina State.

MATERIALS AND METHODS

Study Site

Sabke reservoir is located at Longitude 13º 4' North and Latitude 8º 10' E at 451 meters above sea, and 35km northwest of Daura, Katsina state. The reservoir was impounded in 1999 with the damming of two major seasonal rivers: Babbar Ruga (at the west bank) and Bulbula (at the eastern bank) in Mashi and Maiadua local government areas respectively. These two rivers are however supported by minor streams including spill-over from Daberam Dam.

The reservoir has an active storage capacity of 31.60 million cubic meters of water and a flood storage capacity of 56 million cubic meters (Enplane, 1997). An area of 7.7km² is covered by the reservoir at spill way level and the reservoir catchments area is about 1,318km covering an area of 7.7 million square (770ha) meters at full capacity (Abubakar, 2008).

Collection of Samples

A fleet of gillnet made up of nine (9) multi filament nets was used to sample the shore, surface and bottom water of the reservoir. Each net measured 30m long and 3m deep. The nets were set at approximately 2 hours before sunset and lifted two hours after sun rise to ensure uniform catch from all sample sizes and all member of the population. Data was collected fortnightly from both experimental fish sampling and Artisanal sampling of the commercial catches of the fishermen.

Gonado Somatic Index (GSI)

Gonado Somatic index (GSI) was calculated as percentage Gonad weight per body weight (Cailliet *et al.*, 1986, Gunn *et al.,* 1989).

Gonado-somatic index (GSI) =Gonad weight/body weight×1000

Gonad Analysis

The eggs was classified using a visual examination in to maturing/ripening (eggs opaque and visible to the naked eyes, spawning (translucent or hydrated eggs in the ovary) and spent (whitish gray or bluish gray, shrunken, soft and flabby with whitish cast) (Morrison,1990).

Fecundity

Gravimetric method was used. After the eggs have been liberated from the ovarian tissues using forceps and needle they were then spread on paper to dry on air. The total number of eggs is then weighed and random samples taken and weighed. The total number of eggs in the ovary is then obtained from the equation:

$$F=\frac{nG}{g}$$

Where: F=fecundity, n=number of eggs in the sub sample, G=total weight of the ovary, g=weight of the subsample (FAO, 2000)

Calculation of Egg Diameter

Fish eggs are not spherical but generally described as prolate spheroids (elongated spheres). To compare non-spherical eggs Coleman (1991), Coleman and Galvani (1998) proposed using the effective diameter which is the diameter the egg would have if it's content where reshaped in to a perfect sphere. Average egg diameter was therefore calculated according to which involves multiplying cube root of the major axis by the square root of the minor axis of the egg i.e.

Cube root of the major axis multiplied by the square root of the minor axis i.e

Cube root of length × square root of width (Coleman and Galvani, 1978).

RESULTS AND DISCUSSION

The mean fecundity estimate (Table 1) of this study was 1465,1110,1162,1178,858,for *O. niloticus, S. galilaeus and T. zilli, L. niloticus and C. gariepinus* respectively while the range for the estimate varies from 222-9642, 197-4414,77-2007,183-3290 and 265-2467 for *C. gariepinus, L. niloticus. T.zilli. O. niloticus and S. galilaeus* respectively. Bagenal and Braun (1978) had reported that fecundity in fish species varies among individuals of the same age. Komolafe and Aramawo (2007) had reported a mean fecundity of 1048 and range of 598 to 3960 for *S. galilaeus* in IITA Lake in Ibadan. Ben Tuvia (1960) had reported a mean fecundity estimate of 5010 for *T. galialeus* and a fecundity range of 30-457 for *Chromidotilapia guntheri* in Ikpa river. Camara (1984) had reported a fecundity range of 339-1881 for *Tilapia marie* in New Calabar river, 953 to 3200 in Iba Oku stream. A range of 2136 to 37250, and 2746 to 54216 for *Clarias macromystax and C. ebulensis* respectively was calculated in Anambra river (Ezenwaji, 1992). Fish species exhibited wide fluctuation in fecundity among member of the same species, size and age. Fagede *et al.,* (1984) suggested the fluctuation may be due to differential abundance of food. Welcomme (1967) recorded 56-498 eggs for *Tilapia leucostica*. This is in agreement with the general observations on fecundity in *Cichlids* done by Fagede (1979) in Lagos lagoon, Nigeria who recorded 107-580 eggs for *T. melanotheron*. Haruna (1992) recorded 258-480 eggs for *O. niloticus*; 268-405 eggs for *Sarotherodon galilaeus*; 300-475 eggs for *H. fasciatus*, 107-280 eggs for *H. bimaculatus* in jakara lake in kano state, Nigeria. Haruna (2005) recorded 180-355 eggs for *O. niloticus*; 210-405 eggs for *S. galilaeus;* 162-420 eggs for *T. monodi*; 102-215 eggs for *H. bimaculatus* in magaga lake, kano state, Nigeria. These results were lower than the value of 325-392 eggs for *T. aurea* reported by Dadzie (1980), Siddiqui (1977) also recorded 320-1328 eggs for *T. leucostica* in kenya.

Haruna, (1992) recorded 1002 – 1416 for *Clarias gariepinus* in Jakara lake, kano state, Nigeria. In contrast, Hamisu (1993) recorded 542-940 eggs for *C. gariepinus* in Magaga Lake in Kano State, Nigeria. Gonado somatic index (GSI) range of 0.40 to 1.04 was calculated for *T. zilli* with the minimum value obtain in February and the maximum value obtain in July (Table 2). A range of 0.29 to 0.91 with the minimum value also obtains in February and the maximum value also obtains in May and August was calculated for *L. niloticus*. For *S. galilaeus* the calculated GSI range was 0.20 and 2.11 with the minimum value obtain in January and the maximum value obtain in July. The range of 0.069 to 1.12 and 0.19 to 1.49 was also calculated for *C. gariepinus and O. niloticus* respectively.

A lesser value and range of 0.03 to 1.67 was calculated with the highest value obtain in January and the highest value in September for *O. niloticus* in Opa reservoir, Ile Ife reservoir, Nigeria (Komolafe and Aramawo, 2007). Also higher values of 0.60 to 3.94 and 0.97 to 5.83 was also calculated in *O. niloticus* and *S. galilaeus* in River Nassau in Egypt (FAO, 2005) with the lowest value calculated in October to December and the highest value calculated in April to May for *T. zilli*.

The lowest value calculated for *S. galilaeus* was in June to August and the highest value was February to March. A moderate range of 0.52 to 5.14 was also calculated with the lowest value obtain in September and the highest obtain in February to June in the same river Nassau Egypt FAO (2005).

In conclusion, all the above differences could be due to the differences their spawning seasons, absolute fecundity, brood protection, individual sizes of the samples used in the research, habitat, etc, there is need also for further research to determine the Biological significance of those differences.

The mean egg diameter of 1.68mm, 1.83mm.2.82mm.2.26mm, 2.82mm for *T. zilli, O. niloticus, S. galilaeus and L. niloticus* calculated in this study agrees with the finding of Fryer and Iles (1972) who reported that *S. galilaeus* had a maximum egg diameter of 2.2mm while Fagade *et al.,* 1984) reported a range of 0.7mm to 3.6mm for *S. galilaeus* in Lita lake. Komolafe and Aramawo (2007) also reported a mean egg diameter of 2.49 in Opa reservoir. A wide range of egg size may be associated with fishes that spawn more than once. As the new eggs begin to mature there is a demand for space such that the previously matured eggs have to be shed to accommodate them.

This may explain why females have to spawn after the ripening of a set of eggs (Allison *et al.*, 2005). Egg sizes reflects maternal investment and reflect both maternal and offspring fitness and correlations were made with other life history traits (McEdward and Coulter, 1987). Within the family *Cichlidae*, the size of eggs varies tremendously across species (Fries and Iles 1972). Sizes ranges from the small size of 0.9mm of Rams (*Microgeophagus ramirezi*) to the massive eggs (4,5mm in diameter) of some of the African mouth breeding Cichlids such as *Cyphotilapia frontoso*. it is obvious difference in egg dimension has been treated as one in most papers regardless of causal relationship between the species and its habitat, while in other literatures differences have been related to spawning season, fish individual size, brood protection or absolute fecundity, however, what is certain studies of fish size egg what seem to be true in one specie may not be true in another meaning their is no unifying theory which will explain the phenomenon (Malgorza *et al.*, 2001). In general Sabke reservoir indicates positive indices for high fisheries potential and very stable aquatic ecology.

Table 1: Variation of fecundity estimate of the important commercial fish species in Sabke reservoir during the study period

Months	*C. gariepinus*	*L. niloticus*	*T. zilli*	*O. niloticus*	*S. galilaeus*
March	258	197	548	881	917
April	1254	883	1008	3290	2467
May	9642	2041	601	1471	268
June	1113	4414	2007	750	357
July	450	1583	363	823	610
August	885	689	77	1745	283
September	966	825	325	700	346
October	535	324	517	183	265
November	350	571	1402	2339	1731
December	1183	516	309	664	1096
January	718	616	863	276	953
February	222	658	483	1020	955
Mean	1464.7	1109.8	708.6	1178.5	854

Table 2: Variation of Gonado-Somatic Indices (GSI) at Sabke reservoir during the study period.

Period	*C. gariepinus*	*L. niloticus*	*T. zilli*	*O. niloticus*	*S. galilaeus*
March	0.41±0.915	0.66±0.172	0.84±0.521	0.88±0.064	1.19±0.008
April	0.75±0.111	0.82±0.471	0.90±0.063	0.94±0.958	1.95±0.073
May	0.93±0.056	0.91±0.005	0.95±0.377	1.39±0.619	2.07±0.774
June	0.95±0.120	0.45±0.239	0.96±0.182	1.32±0.384	1.88±0.681
July	0.98±0.533	0.89±0.091	1.04±0.140	1.34±0.093	2.11±0.639
August	1.12±0.205	0.91±0.103	1.01±0.101	1.49±0.067	2.16±0.509
September	0.76±0.125	0.82±0.382	1.02±0.046	1.12±0.084	2.52±0.172
October	0.59±0.115	0.72±0.029	0.85±0.094	0.58±0.071	1.10±0.438
November	0.34±0.061	0.49±0.079	0.59±0.375	0.38±0.055	0.93±0.275
December	0.19±0.061	0.46±0.082	0.36±0.286	0.36±0.190	0.31±0.003
January	0.24±0.065	0.33±0.195	0.22±0.005	0.25±0.474	0.20±0.051
February	0.069±0.042	0.29±0.418	0.40±0.083	0.19±0.006	0.25±0.009

Values are mean GSI ± standard error (SE)

Table 3: Variation of average Egg Diameter (ED) (mm) at Sabke reservoir during the study period.

Period	*T. zilli*	*O. niloticus*	*S. galilaeus*	*C. gariepinus*	*L. niloticus*
March	0.98±0.578	1.89±2.117	3.09±2.073	1.56±1.909	2.01±2.061
April	0.92±0.694	2.11±1.023	4.23±2.160	2.61±2.342	3.31±2.747
May	1.26±1.138	2.74±1.963	2.78±1.965	1.91±1.725	2.90±2.099
June	2.06±1.011	2.30±1.90	3.11±2.113	1.52±0.984	4.68±2.728
July	2.44±1.529	2.37±1.632	4.14±3.095	1.69±0.915	4.68±2.728
August	1.61±0.762	1.91±0.973	4.06±2.372	2.38±1.276	4.19±2.760
September	1.83±1.391	2.22±2.562	3.69±2.521	1.67±0.782	1.97±1.763
October	1.08±1.196	2.01±2.56	3.32±2.728	3.04±1.668	1.85±1.904
November	0.84±0.431	1.51±2.641	2.89±2.063	2.28±1.629	2.78±1.430
December	1.12±0.963	1.38±1.006	2.41±2.550	1.47±0.874	4.30±2.973
January	0.81±1.629	2.66±0.946	3.17±2.997	1.85±1.582	3.63±2.251
February	1.40±1.090	1.28±1.859	2.99±1.738	2.32±1.294	0.96±0.568

Values are mean egg diameter (ED) ± standard error (SE)

Acknowledgement
The authors wish to express their appreciation to Malam Usman and Malam Lawal all of Tsabu village who helped us in the field obtaining samples of fishes from the commercial fishermen and also help us in setting our experimental fishing net throughout the research period.

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