EFFECTS OF SOME ENVIRONMENTAL FACTORS ON THE FECUNDITY OF TILAPIA SPECIES (FAMILY CICHLIDAE) IN KIGERA RESERVOIR NEW BUSSA

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ABSTRACT

The effects of some environmental factors on the fecundity of Tilapia Species (Family cichilidae) was carried out at the Kigera dam. Four Tilapia species caught were Tilapia Zilli Hemichromis fasciatus, Sarotherodon galilaeus and Oreochromis niloticus while the environmental factors considered were water temparature, Dissolved Oxygen, PH value, level of rainfall and rate of sunshine and range of time. 43 Fish comprising of 25 male with (58.1%) and 18 females having (41.9%) were studied with 74 42% been sexually matured. Both high level of rainfall and dissolved Oxygen favoured fecundity. The spawning peak occurred in (July), Environmental factors monitored indicated that dissolved Oxygen ranges from 3.7 to 4.45mg / lit rainfall ranges from (34.90mm to 237.80mm) sunshine ranges from (5hrs – 8hrs.) and PH ranges from (7.35 – 7.45). The spawning of these species in their natural or hatchery condition is therefore best achieved during the peak of rainning season.

INTRODUCTION

The ability to produce new living individuals is a characteristic feature of all living organism and is known as reproduction. Reproduction is the only means by which life is maintained (Sarojini et al. 1979). Jalabert et al (1982), observed that the reproductive behaviour of Tilapia have paradoxical consequences; on one hand, this aptitude which allows easy and rapid propagation in various tropical and subtropical environments, partially explain the economic interest in these species for culture. Another aspet of the reproductive efficiency of Tilapia is precocious sexual maturation which can occur as early as 3 mouth (McBay, 1961) and depends probably, in addition to genetic factors on environmental factors like temperature (Hyder 1970), food availability, socio-factor e.t.c.

Reproductive behaviour could be affected by the environmental factors such as Temperature Dissolved Oxygen, Rainfall, Photo period. According to Lagler et al (1962), both the development period and the hatching period are generally shorter at higher temperature than at lower temperature interestingly, many species normally develop in nature under the temperature condition which area not optimum as determined by laboratory experiments, species differ in their temperature tolerance during developments but generally, there are temperature which are too low and too high for physiological processes (Lagler et al 1962).

Date in years

As soon as sexual maturation is attained and temperature is suitable, most female cichlids spawn between 4 to 6 weeks interval. This usually result in continuous production of fry throughout the year.

In order to breed, Tilapia, the water temperature should be at least 20°c (Huet, 1970: Balarin and Hatton, 1979), but certain species are able to reproduce Tilapia sparrmanii at 16°c (climits 1957) other factors soon to play a releasing role, notably photoperiodicity and light intensity (Balarin and Hatton (1979), as well as the season, via water temperature (temperature linked with grounds) or other mechanism.

In certain tropical and subtropical region low temperature inhibit reproduction; the length of the time depending on the latitude and altitude of the place the duration of the breeding season, the duration of spawning in a year and consequently overall fecundity.

In the study of fish fecundity, different author have defined fecundity in various ways. Lowe (1955) defined fecundity in tropical fishes as the number of eggs produced during the life time of an individual. Nikolsky (1963) and Lowe Mc Connell (1956) defined fecundity as the number of Ova ripening at one time in an ovary. The term absolute fecundity has been used by Bagenal (1968) and Fryer, (1961), as the number of eggs ripening in the female prior to spawning. Therefore in this work fecundity is taken as the ripe Ovaries of an individual matured female fish.

The objectives of this study

The objective of this study are:

(1) To study the spawning peak and its relationship with the environmental factors.
(2) Study the fluctuation in the sexualmaturity of the family cichlidac in Kigera Reservoir
(3) Study sex composition, variation in length and weight.

MATERIALS AND METHODS

Fishing And Material Description:

Fishing was done using gill nets on Thursdays from May to July, various sizes of gill net were used 2", 2.5" and 3" stretched Mesh size, which were set between 5 – 6 p.m and retrieved between 7 – 8 a.m the following morning.

Fish Analysis

Fish collected were taken to the laboratory where all specimens were individually measured using metric ruler calibrated in centimeter and weighed using Harvard trip weighing balances. The standard length was measured from the snout tip to the vertebral column trip, while the total length was measured from the snout tip to the end of caudal fin. Total weight of all samples collected were taken. and Gutted weight were taken as the weight of fish after all visceral materials had been removed. Then the percentage of ranges of the standard length were calculated using formula.

$$\frac{\text{No of Fish in colum}}{\text{Total no of Fish}} \times \frac{100}{1}$$

Sex determination were based on the internal and external Morphologies The genital papilla of females have three openings namely, the anus, transverse genital opening and Oviduct which is scarcely visible to the naked eyes.

The males have openings situated just in front of the anal fin, one is the anus and the other is the aperture sexually matured fish have pink coloration. On dissecting the fish to reveal

the visceral parts the gonad were classified into maturing stages as described by Kesteven, (1960).

The matured eggs were removed and put in a beaker and mixed with little quantity of water, it was shakened to free the eggs from its Ovarian tissue. It was left for some hours. Counting of eggs were done manually with the aid of Magnifying hand lens. The number of matured eggs in each species were tabulated and mean fecundity were calculated for each month using the formular below.

Total no of Matured eggs
No. of Matured female Fish

Water parameter:

Temperature:- The water temperature was taken using mercury glass thermometer graduated in degrees centigrade (^{0}C). Both the level of rainfall and radiation data were collected from NIFFR Headquarters' Meteorological station, Rainfall level measured in (mm) while the sunshine radiation, measures with radiation chart and were graduated in hours.

The PH of the water was taken every Thursday using LOVIBOND COMPARATOR. Dissolved Oxygen was determined using winkler's method.

Result and Discussion

A total number of 43 tilapia were collected comprising 25 males (58.1%) and 18 females (41.9%).

Table 1 shows the total number of each species collected and their correspondence percentages. T. zilli were 17 in number comprising of 9 males and 8 female representing 52.94% and 47.06% respectively. O. niloticus were 15 comprising of 11 males representing 73.33% and 4 females representing 26.67%. S. galilaeus were 8, having 3 males and 5 females representing 37.5% and 62.5% respectively, while H. fasciatus were 3, 2 males and 1 female representing 66.67% and 33.33% respectively. Table 2 show the percentage and ranges of standard length of each species. The percentages of fish with standard length ranging from 11 – 15cm was (37.21%) while the percentage of fish with standard length ranging from 21 – 25cm was 9.3%.

Total number of matured female fish of each species and their fecundity are shown in Table 3. Eight T. zilli had mean fecundity of 725, S. galileus were 5 with mean fecundity of 939, O niloticus were 3, having mean fecundity of 1, 412 while H. fasciatus was 1 with fecundity of 520.

Table 4 show the gonad maturation stages for each month and sex of each species from May – July 74.42% of the total number of 43 tilapia were found to be between stages 4 and 6. The high percentage of sexual maturity shows influence and interaction of the sexual characters with the environmental factors during the period of the research.

Table 5 shows the number of fish that were matured and their monthly mean fecundity while figure 1 shows the relationship between the fecundity and the time in months from May – July. It was observed in T. zilli fecundity was 318 in May. 606 in June, and 1,225 in July, O. niloticus mean fecundity was 915 in May and 1.661 in July. S. galileus has801 in June and 1,031 in July while H. fasciatus was zero in May and 520 in June.

Table 6 shows the temperature for each month (May – July) while figure 2 shows the relationship between the means fecundity and the temperature. It was noted that more riped eggs were obtained within the temperature range of 29 – 31.5^{0}C. temperature is very important to the reproductive behaviour of tilapia. At the water temperature of 34.5^{0}c I. Zilli it has means fecundity of 318 at the temperature of 31.5^{0}c it has means fecundity of 606 and 1,225 at the temperature of

27^0c O. niloticus has means fecundity of 915 at the water temperature of 31.5^0c and 1661 at the temperature of 29^0c.S. galileus has means fecundity of 801 at the temperature of 31.5^0c and 1,031 at 29^0c, while H. fasciatus has no fecundity at the temperature of 29^0c.

Table 6 shows the mean PH value for each month while figure 3 shows the relationship between the mean fecundity and the PH. It was observed that PH value of 7.4 favours greater number of fecundity of 1225 in I. Zilli, 1661 in O. niloticus and 1031 in S. galiteus while PH value of 7.45 favours least number of mean fecundity of 318 in I. Zilli and none in other species.

Figure 4 shows the mean fecundity, dissolved Oxygen and their relationship. It was shown that high level of dissolved Oxygen has no negative effect on the number of fecundity.

Finally, Table 7,8 shows the mean rate of sunshine, and the level of rainfall while figure 5 and 6 shows the fecundity relation with mean radiation and level of rainfall respectively the mean radiation was inversely proportional to the mean fecundity while the level of rainfall was directly proportional to the mean fecundity i.e the lower the rate of sunshine the higher fecundity and the higher the rainfall the higher the fecundity.

CONCLUSION

The result obtained after studying the effects of some environmental factors on fecundity of Tilapia species (family cichlidae) in Kigera Reservoir proved that environment factors have direct effects on fecundity of Tilapia species in Kigera reservoir.

The result shows that high level of rainfall and rate of dissolved Oxygen are directly proportionally to he fecundity while the rate of sunshine and rate of water temperature are inversely related to the fecundity. And pH value of 7. 4 was found to be more productive.

It can be deduced that high level of rainfall and dissolved Oxygen, low water temperature. how rate sunshine and pH of 7.4 have no negative effects on the fecundity of Tilapia species in Kigera reservoir during the experimental period.

Table 1: SEX COMPOSITION OF CICHLID FISHES IN KIGERA RESERVOIR

Species	Total No of fish	Male	%	Female	%	Ratio of male to female
T. zilli	17	9	52.94	8	47.06	1.13:1
O. niloticus	15	11	73.33	4	26.67	2.75.1
S. galileus	8	3	37.5	5	62.5	0.6:1
H. fasciatus	3	2	66.67	1	33.33	2.1

Table 2: STANDARD LENGTH DISTRIBUTION OF CICHLID FISHES IN KIGERA RESERVOIR

Range Species	1 – 5 (cm0	6 – 10(cm)	11 – 15 (cm)	16 – 20	21 – 25	26 – 30
T. zilli		5	7	5	-	-
O. niloticus		1	3	4	-	-
S. galileus		1	5	5	4	-
H. fasciatus		2	1	-	-	-
%		20.93%	37.21%	32.56%	9.30%	-

TABLE 3: FECUNDITY OF CICHLID FISHES IN KIGERA RESERVOIR

Species	No. of Matured female	Max. std. Length	Min. std. Length	Mean length	Min. welght	Max. weight	Min. fecu.	Max. fecu.	Mean fecundity
T. zilli	8	19.2cm	7.8cm	13.36cm	15.7g	314.0g	307	1338	725
O. niloticus	5	10.5cm	10.2cm	16.68cm	111.5g	250g	700	1226	939
S. galileus	3	21.5cm	15.5cm	11.6cm	120.0g	360.5g	915	2220	1412
H. fasciatus	1	9.5cm	9.5cm	9.5cm	28.0g	28.0g	520	520	520

TABLE 4: GONAD MATURATION STAGES OF CICHLID SPECIES IN KIGERA RESERVOIR

Species	Stage sex	I M	F	II M	F	III M	F	IV M	F	V M	F	VI M	F	% of matured fish	% imr fish
	MONTH														
T. zili	MAY	-	-	-	-	-	-	-	1	2	-	1	-	-	-
	JUNE	1	-	1	-	-	-	-	3	-	2	3	-	74.42	25
	JULY	-	-	-	-	1	-	-	-	-	2	-	-	-	-
	AUGUST	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. galileus	MAY	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	JUNE	-	-	-	-	3	-	-	2	-	-	-	-	-	-
	JULY	-	-	-	-	-	-	-	-	3	3	-	-	-	-
	AUGUST	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O. niloticus	MAY	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	JUNE	-	-	2	-	-	-	-	-	4	1	-	-	-	-
	JULY	1	-	1	-	-	1	-	1	1	1	1	-	-	-
	AUGUST														
	MAY														
H. fasciatus	JUNE									1		1	-	-	-
	JULY											1	-	-	-
	AUGUST											-	-	-	-

TABLE 5: FECUNDITY OF CICHLID FISHES IN KIGERA RESERVOIR

Species	No. of Matured female fish	Month	Min. fecun.	Maz. Fec.	Mean fec.
T. zilli	1	MAY	318	318	318
	5	JUNE	307	1015	606
	2	JULY	1112	1338	1225
O. niloticus	-	MAY	-	-	-
	1	JUNE	915	915	915
	2	JULY	1102	2220	1661
S. galileus	-	MAY	-	-	-
	2	JUNE	700	902	801
	3	JULY	895	1226	1031
H. fasciatus	-	MAY	-	-	-
	1	JUNE	520	520	520
	-	JULY	-	-	-

TABLE 6: RESULT OF WATER PARAMETERS IN KIGERA

MONTH	MIN. WATER TEMP. ^{P}C	MAX. WATER TEMP. ^{0}C	MEAN WATER TEMP. ^{0}C
MAY	34	35	34.5
JUNE	28	35	31.5
JULY	28	30	29
MONTH	MIN. $D0_2$	MAX. $D0_2$	MEAN $D0_2$
MAY	3. 2mg / lit	4. 2mg / lit	3. 7mg / lit
JUNE	3. 0 mg / lit	5. 2mg / lit	4. 1mg / lit
JULY	3. 8cm / lit	5. 1mg / lit	4. 45mg / lit
MONTH	MIN. PH	MAX PH	MEAN PH
MAY	7.4	7.5	7.45
JUNE	7.3	74	7.35
JULY	7.4	7.4	7.4

TABLE 7: RATE OF SUNSHINE AND LEVEL OF RAINFALL FLUCTUATION DURING THE EXPERIMENTAL PERIOD IN KIGERA RESERVOIR

DATE OF SUNSHINE DURING HE EXPERIMENTAL PERIOD

MONTH	MIN. RADIAITON	MAX. RADIATION	MEAN RADIATION
MAY	4½ hrs.	8½ hrs.	6½ hrs
JUNE	1 hrs	8½ hrs	43/4 hrs
JULY	½ hr	5 hrs	23/4 hrs

TABLE 8: LEVEL OF RAINFALL DUIRNG HE EXPERIMENTAL

MONTH	TOTAL RAINFALL PER MONTH
MAY	34. 90mm
JUNE	120. 0mm
JULY	237. 80mm

REFERENCES

Baganal, T. B. 1968) Fecundity in method for assessement of fish production in freshwater (ed. Ricker, W.E.) I. B. P. Hand book No. 3 Block well: Oxford 160- 169.

Balarin, J.D. and J. P. Hatton (1979) Tilapia: Aguide to their Biology and culture In African. University of stirling U. K. P. 29

Chimits, P. (1959); Tilapia and their cuture, a second review and Bioliography. FAO Fish Bull; 10 (1): 1 – 24.

Fryer, G. (1961); Observation on the Biology of the cichlid fish Tilapia Variabilis Boxlenger in northern waters of lake Victoria (East Africa). Rev. Zool, Bot. Afr. 64: 1 – 33.

Huet, M. (1976); Text Book of Fish culture: Breweding and cultivation of Fish Translated by H. Kohn. Fishing News Led. Farnham, survey, Enland. 436p.

Hyder, H. (1970) Gonadal and reproductive pattern in Tilapia leucosticta (Teleostei, cichlidae) in an equatorial lake, lake Naivasha (Kenya). Zool. Lond. 162.174-195

Jalabert, B. and Zohar, Y (1982): Reproductive physiology in cichlid fishes, with Particular reference to Tilapia and sarotherodon, p. 129 – 140

Kesteren, G. L. (1960) Manual of field Methods in fishes biology. FAO. Man. Fish. Sci. 1:152p.

Lagler, K. F., Bardach, J. E. and Miller, R. R. (1962) Icthyology Wiley and Sons; New York. London.

Lowe, R. H. (1955) The fecundity of Tilapia species E. Afr. Agric. 45 – 52

Lowe Mc conell, R. H. (1956). The breeding behavious of Tilapia species (Pisces; cichlidae) in natural waers; obervations on I. Kanwo (Poll) and I. Variabilis Boulenger. Behaviour P. 146 – 163

Mc Bay, L. G. (1961) The Biology of TilapiaTilapia nilotica (Linueus proc. 15th Ann. Conf. S. E. Assoc. Game and fish. Commissioners, Oct. 22 – 25: 208 – 218.

Nikolsky, G. V. (1963) The ecology of fhshes, Academic press London and New York 352 p.

Sarojini, T. R. Sheila, P. and Charles, T. P. (1979); Modern Biology for Secodary Schools.