EFFECT OF FEMALE WEIGHT ON REPRODUCTIVE PERFORMANCE OF NILE TILAPIA (*Oreochromis niloticus*)

Waheed O. Mohammed[1],Sabry M. A. Shehata[2], Gamal O. El-Nagar[1], Ahmed M. M. Khater[3] and Mahmoud K. Mahmoud[2]

1- World Fish Center, Abbassa, Abu-Hammad, Sharkia.
2- Marine Biology and Fishes Sector, Zoology Department, Faculty of Science, Al-Azhar University, Cairo.
3- laboratory for aquaculture, Abbassa, Abu-Hammad,Sharkia.

ABSTRACT

The present study aimed to investigate the effect of broodstock size on the reproductive performance of Nile tilapia and to see whether this identifies possible broodstock management strategies that may be adopted by hatcheries to improve seed production. Total of 360 females and 120 males were used in this study. Female broodstocks was classified into three sizegroups: small-sized (85-105 g), medium-sized (150 – 180 g) and large-sized group (250 – 280 g) and allowed to be paired with male broodstocks in a ratio of 3 females to 1 male. The result showed that the fry number, egg number and egg diameter was significantly (P<0.001 and 0.01) affected with female size at the beginning of hatching period, while the fry weight was insignificant affected with the female weight. The highest number of eggs was recorded at large female weight.The fry number was increased to 200.03% and 122.50%, on large and medium female groups respectively, when compared with the small female group. The initial body weight of fry was increased to 71.43% and 35.71%, respectively in large female and medium female groups than those of the small female group. The final body length of fry after 60 days increased with increasing stock female size. The condition factor ratio was significant (P<0.01) affected with female weight. The condition factor ratio of fry was increased to 13.16% and 7.89%, in large and medium female groups respectively .than those of the small female group. The values of daily body gain of fry during the experimental period was significantly (P<0.001) affected with female size. On the other hand, the survival rate was insignificant affected with female weight. The ovary weight and Gonado somatic index were significantly (P<0.001) affected with the female size. The highest value of ovary weight and Gonado somatic index were recorded at large size while decreased for medium and small size respectively. The values of absolute fecundity and relative fecundity was significantly (P<0.001) affected with the different size. The highest value of absolute fecundity and relative fecundity were increased significantly at large size while decreased for medium and small size respectively. The highest value of ovary weight, Gonado somatic index and absolute fecundity were recorded at May month while decreased at April and March, respectively and reached to the lowest value at February month.

Key word: broodstock size, reproduction, Gonado somatic index, fecundity, Nile tilapia.

INTRODUCTION

Tilapia has developed into the second most important cultured freshwater fish, behind the carp. Tilapia production is growing exponentially with the global output standing at 2.5 million tonnes annually, and has therefore, been dubbed as the twenty-first century's most culture able fish (**Shelton and Popma, 2006,Fitzsimmons, 2010**).The world's total tilapia production in 2010 was 3.49 million tons (**FAO, 2012**). The last three decades have seen significant developments in farming of tilapias worldwide. They are being farmed in about 85 countries worldwide. Egypt has been expanding its culturing industry in recent years and is now producing 200000 tons (**FAO, 2008**). Currently, tilapia is farmed commercially in almost 100 countries worldwide, with over 98 percent of the production occurring outside their original habitats (**FAO, 2011**).

Tilapia spawn easily in captivity, use a wide range of natural foods as well as formulated diets, tolerate poor water quality and grows well at warm temperatures. These attributes, along with relatively low input costs, have made tilapia the most widely cultured freshwater fish in tropical and subtropical countries (**Borgeson e*t al.*, 2006, El-Saidy and Gaber, 2005 and Fasakin *et al.*, 2005**).

Bhujel (2000) found that in commercial seed production, medium-size tilapia brood stock (150–250 g) are preferred, brood stock are usually discarded after attaining more than 300 g as bigger fish are difficult to handle during harvesting of seed handle during harvesting of seed. **Nandlal and Pickering (2004**) also found the best size of female for breeding is 150–300g. On average a 200g breeder would produce 200–500 fry per month. **El-Saidy and Gaber (2005)** reported that small Nile tilapia brood stock produced many more eggs, with shorter inter- spawning period than large fish. It was also found that large eggs contained more yolk and led to larger fry with better growth and higher resistance to starvation and severe environmental conditions. Also, **Tsadik**, and **Bar (2007)** indicatethat the larger females produce more eggs spawn^{-1} than smaller females.

Farag (2003) found highest relative fecundity increased with the decreased female body weight. Female with low body weight has more relative fecundity. Also females with Intermediate body weight have intermediate relative fecundity. The optimal reproductive performance occurs through summer season during April, May and June, The optimal water temperature range from 28 to 31 °C, females with the highest body weight started to spawn first and gave more total fries before the intermediate body weight and water temperature affected merely spawning frequency, but not the volume of fry's production per spawn. **Shalloof and Salama (2008**) found that the total number of ripe eggs in the ovary (fecundity) ranged between 289-1456 eggs with an egg diameter ranged from 1.99-2.45 mm corresponding to fish total length of *O. niloticus* is 10-23 cm. The fecundity ranged between 104-709 eggs corresponding to fish length of *O. niloticus* is 12.5-20.9 cm, with an egg diameter of 1.0-3.0 mm, also **Gómez-Márquez *et al.*(2003)**was found that a fecundity ranged from 243-847 eggs per fish (*O. niloticus*) in Zapata dam, Mexico with egg diameter from 300-3 700 µm.

The aim of the present work therefore was to investigate the effects of brood stock size on the reproductive performance of Nile tilapia brood stock and to see whether this identifies possible brood stock management strategies that may be adopted by hatcheries to improve seed production.

MATERIALS AND METHODS

Four hundred and eighty (480) *O. niloticus* Brood stock were used in the experiment at the hatchery unit at the experimental station of the World Fish Center (WFC), Abbassa, Abou-Hammad, Sharkia, Egypt. Where three hundred and sixty (360) females and one hundred and twenty (120) males were in this experiment. Female broodstocks were taken from the ponds, kept in concrete tanks of 12 m^2 filled with filtered canal water from Ismailia canal to maintain a water depth of seventy (70) cm and supplied with compressed air through air diffusers to assure maintaining near optimum dissolved oxygen levels in the tank water. The experiment stared from (1febraoury to 30 June 2013).

Female broodstocks was classified into three treatment with four replicates: small-sized (85-105 g), medium-sized (150 – 180 g) and large-sized group (250 – 280 g) and allowed tobe paired with male broodstocks in a ratio of 3 females to 1 male. They were fed a commercial diet containing 30%crude protein. First treatment was stocked with thirty (30) sexually mature *O. niloticus* females with average weight of 85 ± 20 g. and ten (10) *O. niloticus* males with total body weight average of 110 ± 10 g. for each tank and second treatment was stocked with thirty (30) sexually mature *O. niloticus* females with average weight of 160 ± 20 g. and ten (10) *O. niloticus* males with total body weight average of 180 ± 10 g. for each tank and third treatment was stocked with thirty (30) sexually mature *O. niloticus* females with average weight of 260± 20 g. and ten (10) *O. niloticus* males with total body weight average of 280 ± 20 g. for each tank. To determine where the size of the brood fish will have an effect on egg and fry production. Fish in all tanks was fed the designated diet 30% crud protein at the rate of 3% of their total body weight twice a day at 10:00 am and 2:00 pm six days a week.

All tanks were checked daily to look for any presence of newly hatching tilapia fry and once any fry were seen in any of the tanks a collection process of the fry from the tanks was done by pulling a net through the tank from one end to the other. The net was made of soft materials and had a small mesh size that was small enough to collect all the fish and fry present in the tank. Once the fish were collected in the net, all brood fish were checked inside the tank for any eggs or fry being incubated in the mother's mouth and if any eggs or fry were present, those were collected and transferred to collection containers to be counted and recorded. Checked brood fish were held in a separate hapa until the fry collection process ended in the tank and the tank was completely cleaned of any sediments and wastes and refilled with clean water then broodstock were counted and returned back to their tank.

Tanks were covered with plastic sheets (2 mm thickness) extended over a metallic frame of arched iron bars similar to those used in agricultural greenhouses. Collection of seeds, swim-up fry first appeared after 15 days of pairing. The seeds (fertile oval, new hatched larvae with yolk sac and swim-up fry) were collected and counted every 10 days. Fry were collected for each tank of all treatment and were either placed in hapa. Hapa installation hapa nets with a mesh size of 1.5 mm and surface area dimension of 2x1 m were prepared and suspended in the experimental pond to maintain a water depth of 0.6 m inside the hapa. Fry in each hapa were fed a 40% crude protein diet according to table (1).

Fish were individually weighed and all eggs that were removed from the mouth of incubating female. Eggs from each female were categorized into groups according to their stages of development and directly counted to determine fecundity.

1- Total weight gain, average daily gain, specific growth rate, feed conversion ratio protein and energy utilization was determined according to **Recker, (1975)** and **Castell and Tiews, (1980**) as follow: Total gain (g/fish) = (W_T-W_I).

Where:

W_T= Final means weight of fish in grams.

W_I= Initial means weight of fish in grams.

Average daily gain (ADG) (fish/g day) = total gain / duration period.

Survival rate%= Number of fish at the end of the experiment/ Number of fish at the start of the experiment*100

Table 1. Formulation and proximate analysis of the experiment.

Ingredients %	Brood stock diet(30% crude protein)	Fry diet(40% crude protein)
Fish meal(g)	5	10
Soy bean meal (g)	46	63
Ground corn(g)	35	17
Wheat flour(g)	5	5
Cod liver oil(g)	3	1.3
corn oil(g)	5	2.6
Dicalcium phosphate	1	1
Mineral mix(g)	0.1	0.1
Vitamine mix(g)	0.04	0.04
Vitamine C	0.03	0.03
Sum	100.1	100.1

[1] Each Kg vitamin & mineral mixture premix contained Vitamin D_3, 0.8 million IU; A, 4.8 million IU; E, 4 g; K, 0.8 g; B_1, 0.4 g; Riboflavin, 1.6 g; B_6, 0.6 g, B_{12}, 4 mg; Pantothenic acid, 4 g; Nicotinic acid, 8 g; Folic acid, 0.4 g Biotin,20 mg , Mn, 22 g; Zn, 22 g; Fe, 12 g; Cu, 4 g; I, 0.4 g, Selenium, 0.4 g and Co, 4.8 mg,

[2] Estimated based on values of the diet ingredients (NRC, 1993).

Condition factor (K) was estimated according to **Bagenal and Tesch(1978)**as follows:, where K is the condition factor.

$$K = \frac{\textit{Body}\ \text{Weight}}{(\textit{Total}\ \text{Length cm})^3} \times 100$$

A total of 60 ovaries were used to investigate fecundity of *O. niloticus*. The following parameters were recorded: total body weight and ovary weight (g). Fecundity was processed in a Petri dish, after discarding of extraneous tissues and drying the ovaries on a filter paper eggs were weighted to the nearest 0.001gm. Three weighted sub-samples of eggs were taken, then eggs were counted and the average number was calculated .The following equation was used to estimate absolute fecundity of *O. niloticus*(**El-Sayed, 1996**) **F= (W / w) * X,** where **F** is the absolute fecundity, **W**: the weight of gonad, **w:** the mean weight of sub-samples and **X**: the counted number of mature eggs in the sub-sample.

Absolute average fecundity of *O. niloticus* was calculated as the number of eggs per ovary of mature fish during the spawning season (**BagenalandTesch, 1978**), whereas relative fecundity is the number of eggs per unit length or weigh of fish. Egg diameter was measured to the nearest mm by ocular micrometer fixed in the eye piece of a light microscope.

Gonad somatic index = [weight of ovary (g) / female body weight (g)] × 100.

Mean egg diameter (mm) =long axis length+ short axis length/2.

Statistically analysis

The data of fry performance were statistically analyzed using **SAS (2002)** program according to the following model: $X_{ij} = \mu + S_i + e_{ijk}$, where, μ is the overall mean, S_i is the fixed effect of i^{th} female size (i = 1 …3) and e_{ijk} is the random error.

The data of broodstock performance were statistically analyzed according to the following model: $Y_{ijk} = \mu + S_i + M_j + SM_{ij} + e_{ijk}$, where, μ is the overall mean, S is the fixed effect of female size (i = 1 …3), M is the fixed effect of year month (j = 1 …4), SM is the fixed effect of the interaction between female size and year month and $e_{ijk}$is random error. Means were tested for significant differences using Duncan's Multiple Range test (**Duncan, 1955).**

RESULTSAND DISCUSSION

Fry performance

The data showed that the fry number, egg number and egg diameter was significantly (P<0.001 and 0.01) affected with female weight at the beginning of hatching period (Table 2). The data showed that the fry weight was insignificant affected with the female weight. The fry number was significantly to 200.03% and 122.50%, on large female group (250-280 g) and the medium female group (150-180 g) respectively, when compared with the small female group. The highest number of eggs was recorded at large female weight.

The initial and final fry weight and length insignificant affected with female weight (Tables 3). The initial body weight of fry was increased to 71.43% and 35.71%, in large female and medium female groups respectively than those of the small female group. The highest initial body weight was obtained on large female weight group. The final body weight of fry was increased to 10.0 and 10.0%, respectively in large female and medium female groups than those of the small female group. The final body length of fry at 60 days increased with increasing stock female weight.

Table(2). Fry performance as affected with female weight of*O. niloticus* reared in concrete tanks.

Treatment	Fry number	Fry weight (g)	Egg number	Egg diameter (mm)
Group1	7432.50±743.57^{c}	0.015±0.0004^{a}	1100.0±465.98^{b}	1.73±0.05^{c}
Group2	16537.50±635.53^{b}	0.017±0.0008^{a}	562.50±290.28^{b}	2.18±0.06^{b}
Group3	22300.0±398.21^{a}	0.052±0.028^{a}	2300.00±364.98^{a}	2.37±0.044^{a}
significance	***	NS	**	***

The mean of latter the same column bearing different superscript are significantly different at (P<0.05).Means followed by the same letter are not significant, but different letters are significant. N.s =non significant differences in data. * Significant differences at P< 0.05.
** Significant differences at P< 0.01.*** Significant differences at P< 0.001.

The condition factor ratio significant (P<0.01) affected with female weight (Tables 3). The highest values was recorded at large size then decreased gradually for medium and small size respectively. The condition factor ratio of fry was increased with 13.16 and 7.89%, in large female and medium female group's respectively than those of the small female group.

Table (3). Fry growth performance of *O. niloticus* as affected with female weight during the experimental period (60 days).

Treatment	Initial weight(g)	Final weight(g)	Initial length (mm)	Final length(cm)	condition factor	Daily gain (g)	Survival rate%
Group1	0.014±0.001	12.75±0.12	10.00±0.00	7.55±0.08^{a}	3.04± 0.08^{b}	0.19±0.0021^{a}	85.84±2.36
Group2	0.019±0.002	12.89±0.14	11.00±0.00	7.44±0.09^{ab}	3.28±0.10^{ab}	0.18±0.002^{b}	89.44±0.45
Group3	0.024±0.002	12.87±0.15	11.00±0.00	7.17±0.10^{b}	3.44± 0.14^{a}	0.16±0.002^{c}	89.6±0.49
significance	ns	ns	ns	*	**	***	***

The mean of latter the same column bearing different superscript are significantly different at (P<0.05).Means followed by the same letter are not significant, but different letters are significant. N.s non significant differences in data. * Significant differences at P< 0.05.
** Significant differences at P< 0.01.*** Significant differences at P< 0.001.

The values of daily body gain of fry during the experimental period was significantly (P<0.001) affected with female size (Tables 3). On the other hand, the survival rate of the fry was insignificant affected with female weight.

As obtained data, the average fry production/pond for the studied was affected with the female stock weight. However, **Shamsuddin *et al.* (2012)** concluded that average female *Tilapia nilotica* 200 g breeder would produce 200-500 fry per month. Nile tilapias (75 to 500 g) deposit from 50 to 2,000 eggs. Also **Bucur *et al.* (2012)** found the number of eggs per female of Nile tilapia according to the weight category 75–116 grelative prolificacy at 26 – 28°C ranged from 370 to 1562. In autumn at20°C the number of eggs/female was just of 48 – 233, in the weight category 470 – 534 g the number of eggs/female at 26 – 28°C was just of 978 – 1890. **Rana (1986)** reported that Nile tilapia females of larger size were found to produce more and bigger eggs and more fry per female but smaller females spawn more frequently.

Nandlal and Pickering (2004) found the best size of female for breeding is 150 –300g. On average a 200g breeder would produce 200–500 fry per month. **Macintosh (1985)**reported that larger females produce more eggs per batch than smaller females, although there is high variability associated with the number of eggs per spawning. Also, **Hughes and Behrends (1983)** reported that the highest total seed production from *Oreochromis niloticus* differed with respect to age and mean weight of females.

On other hand **El- Sayed and Gaber (2005)** reported that small Nile tilapia broodstock produced many more eggs, with shorter inter- spawning period than large fish. It was also found that large eggs contained more yolk and led to larger fry with better growth and higher resistance to starvation and severe environmental conditions.

Also**, Bhujel (2000)** found that In commercial seed production, medium-size tilapia brood stock (150–250 g) are preferred, brood stock are usually discarded after attaining more than 300 g as bigger fish are difficult to handle during harvesting of seed handle during harvesting of seed

Brood stock performance

The date showed that the body weight and length was significantly (P<0.001) affected with the different size (Table 4). The highest body weight and length was recorded at large size while decreased for medium and small size respectively.

The ovary weight and Gonado somatic index were significantly (P<0.001) affected with the different size (Table 4). The highest ovary weight and Gonado somatic index were recorded at large size while it was decreased for medium and small size respectively.

Table (4). Square means and standard error for the reproductive characteristics of *O. niloticus* three different sizes during different months.

Treatment	Female length (cm)	Female weight (g)	Ovary weight (g)	GSI	AF	RF
Small size	15.87±0.76^{c}	100.75±1.18^{c}	1.68±0.23^{c}	1.69±0.25^{a}	224.25±52.23^{c}	104.78±28.37^{b}
Medium size	20.95±0.16^{b}	179.24±2.27^{b}	2.27±0.32^{b}	1.24±0.19^{b}	474.32±78.24^{b}	198.80±43.91^{b}
Large size	25.01±0.27^{a}	268.45±3.52^{a}	2.77±0.34^{a}	1.01±0.11^{c}	891.70±85.16^{a}	374.58± 53.57^{a}
significance	***	***	***	***	***	***
Month effect:						
February	20.98±0.96^{a}	182.13±18.08^{a}	0.96±0.09^{d}	0.55±0.04^{d}	198.33±109.88^{c}	140.57±77.49^{b}
March	20.38±0.82^{a}	179.76±16.99^{a}	1.58±0.18^{c}	0.87±0.09^{c}	437.02±115.65^{b}	244.60±67.15^{ab}
April	20.95±0.96^{a}	183.33±18.50^{a}	2.25±0.20^{b}	1.33±0.11^{b}	720.66±71.36^{a}	338.46±38.01^{a}
May	20.14±1.62^{a}	186.02±20.38^{a}	4.18±0.25^{a}	2.52±0.21^{a}	764.33±72.53^{a}	180.59±12.49^{b}
significance	ns	ns	***	***	***	*
Interaction effect between treatment and month:						
Small size						
February	16.60±0.24	100.80±1.49^{d}	0.70±0.044	0.69±0.048^{efg}	0.00±0.00	0.00±0.00
March	16.50±0.15	103.60±1.28^{d}	1.08±0.11	1.037±0.100^{ed}	0.00±0.00	0.00±0.00
April	16.60±0.24	99.80±2.31^{d}	1.66±0.16	1.67±0.17^{c}	445.20±25.14	282.56±40.05^{abcd}
May	13.80±3.07	98.80±3.76^{d}	3.31±0.186	3.39±0.28^{a}	451.80±30.30	136.57±7.07^{de}
Medium size						
February	20.90±0.10	180.40±5.47^{c}	0.82±0.135	0.44±0.061^{g}	0.00±0.00	0.00±0.00
March	20.90±0.53	178.36±4.50^{c}	1.58±0.33	0.77±0.24^{efg}	362.20±93.41	231.054±75.20^{bcde}
April	21.0±0.316	181.80±2.81^{c}	2.38±0.39	1.31±0.21^{cd}	769.08±60.04	384.70±109.46^{abc}
May	21.0±0.31	176.40±6.02^{c}	4.31±0.28	2.44±0.14^{b}	766.0±40.04	179.47±11.45^{cde}
Large size						
February	25.44±0.16	265.20±4.87^{b}	4.31±0.11	0.51±0.05fg	595.0±260.34	421.71±182.79^{ab}
March	23.74±0.46	257.32±7.38^{b}	2.08±0.30	0.81±0.12efg	948.88±130.67	502.77±100.13^{a}
April	25.26±0.47	268.40±5.33^{b}	2.72±0.34	1.01±0.12edf	947.72±129.56	348.11±15.73^{abcd}
May	25.62±0.66	282.88±6.64^{a}	4.92±0.50	1.73±0.15c	1075.20±64.33	225.73±21.52^{bcde}
significance	ns	ns	ns	**	ns	*

The mean of latter the same column bearing different superscript are significantly different at (P<0.05).Means followed by the same letter are not significant, but different letters are significant. N.s non significant differences in data.* Significant differences at P< 0.05. ** Significant differences at P< 0.01.*** Significant differences at P< 0.001.

The values of absolute fecundity and relative fecundity was significantly (P<0.001) affected with the different size. The highest of absolute fecundity and relative fecundity were obtained at large size while, there values were lowered for medium and small size respectively.

The data showed that the body weight and length insignificantly affected with the year month (Table 4), while the values of ovary weight and absolute fecundity was significantly (P<0.001) affected with the different months (Table 4). The highest ovary weight and Gonado somatic index were recorded at May month while it decreased at April and March, respectively and reached to the lowest value at February month.

Fecundity was defined here as the number of eggs in a freshly spawned egg clutch (**Rana, 1988**) Many previous studies of tilapia have adopted the 'classical' definition of fecundity, i.e., the number of maturing oocytes in the ovaries prior to spawning (**Marshall, 1979; Payne and Collinson, 1983**). **Njiru, *et al.* (2006**) reported that most tilapia species breed continuously throughout the year with increased breeding during periods of intense sunshine or rainfall.

In the present study, total fecundity increased with increasing body size of female broodstock, also the relative fecundity was significantly higher in bigger-sized *O. niloticus*. The obtained result was in agreement with those reported by **Bombata and Megbowon, (2012),** who found that a progressive increase in the (absolute fecundity) from larger fish to smaller one of Cichlid. **Duponchelle, and Legendre(2000)** found that fecundity increases linearly with female body weight. **Watanabe (1985)** reported that, absolute fecundity increase by using large and old tilapia. Also, **Bhujel*et al.*(2007)** indicated that, absolute fecundity is related to body weight in *O. niloticus*. On the other hand, **Fath El-Bab *et al.* (2011)**reported that body weight of females' *O. niloticus* had a significant effect on both absolute and relative fecundity. And Female weights 300g were better than female weight 400 and 500g for traits, egg weight per gm fish, relative fecundity, hatchability % and body weight of fry. Female weight 400g is better than female weight 300 and 500g in traits egg weight per fish, absolute fecundity fry number per fish. Also **Farag, (2003)**found that the highest relative fecundity increased with the decreased female body weight. Female with low body weight has more relative fecundity. Also; females with Intermediate body weight have intermediate relative fecundity. The optimal reproductive performance occurs through summer season during April, May and June, The optimal water temperature range from 28 to 31°C, females with the highest body weight started to spawn first and gave more total fries before the intermediate body weight and water temperature affected merely spawning frequency, but not the volume of fry's production per spawn..Size of female *O. niloticus* is more important than age in terms of fecundity and total number of eggs produced (**Rana,**

1986 and Rana, 1988).**Mohamed *et al.* (2013)** found that total fecundity increased with increasing body size of female brood stock but also relative fecundity was significantly higher in bigger-sized *O. mossambicus* female broodstock. Gonado somatic index (GSI) increased with increasing size of the female parent. The fry body weight and length did not significantly vary in small, medium or large female parent. However, survival rate of the hatched fry was significantly better in those produced by the large female parent than did those by small and medium parents.**Jaspe and Caipang, (2011)**foundthat there were no significant differences in total fecundity in all the size groups of *O. mossambicus*. Furthermore, they report that relative fecundity decrease with increasing size of female broodstocks large female parent. Also **Hussein and Farag (2002)** found that the relative fecundity of *Oreochromis niloticus* in hapa ranged from 2.29 to 3.62 fries / g female body weight through spawning season. **Hashem and El-Agamy (1977)** revealed that fecundity is a function related to length, weight and age of different fish species and it increased with increase in these parameters.

References

Bagenal, T. B. and Tesch, F. W. (1978).Age and Growth in Methods for Assessment of Fish Production in Freshwater. (W.E. Ricker, ed.) pp. 101-136.

Bhujel, R. C. (2000). A review of strategies for the management of Nile tilapia (*Oreochromis niloticus*) brood fish in seed production systems, especially hapa-based systems. Aquaculture, 181, 37-59.

Bhujel, R.C.; Little, D.C.; Hossain, A. (2007).Reproductive performance and the growth of pre-stunted and normal Nile tilapia (*Oreochromis niloticus*) brood fishat varying feeding rates. Aquaculture, 273, 71-79,.

Bombata, F. H. and Megbowon, I. (2012). Proximate composition and breeding description of an unidentified Cichlid of Epe Lagoon, Lagos, Southwest, Nigeria commonly called 'Wesafu'. International Journal of Nutrition and Metabolism, 4, 57-63.

Borgeson, T. L.; Racz, V.; Wilkie, D. C.; White, L. J. and Drew, M. D. (2006). Effect of replacing fishmeal and oil with simple or complex mixtures of vegetable ingredients in diets fed to Nile Tilapia (*Oreochromis niloticus*). Aquaculture Nutrition, 12, 141–149.

Bucur, C.; Costache, M.; Oprea, D. and Marica, N. (2012). Studies and Observations on the Spawning of *Oreochromis niloticus* Species Reared at SCDP Nucet– Dambovita. Scientific Papers: Animal Science and Biotechnologies, 45 (2): 113-120.

Castell, J. D. and K. Tiews (1980).Report of the EIFAC, IUNS and ICES Working Group on the Standardization of Methodology in Fish Research. Hamburg, FRG, Germany, IFAC Tech. Pap, 24 (3): 21–23.

Duncan, D.B. (1955). Multiple range and multiple F test. Biometrics, 11:1-42.

Duponchelle, F. and Legendre, M. (2000).*Oreochromis niloticus* (Cichlidae) in Lake Ayame, Côte d'Ivoire: life history traits of a strongly diminished population. Cybium.,24, 61–172.

El-Saidy, D. M. S. and M. M. A. Gaber.(2005). Effect of dietary protein levels and feeding rates on growth performance, production traits and body composition of Nile Tilapia, (*Oreochromis niloticus*) (L.) cultured in concrete tanks. Aquac. Res., 36 (2):163-171.

El-Sayed, A. Y. (1996). Biological and Ecological studies on purse-seine fisheries in the Gulf of Suez . Ph.D. Thesis, Zool. Dep., Fac. Sci., Suez Canal Univ. , Ismailia, Egypt.

FAO (2008).The year book of fishery and aquaculture statistics, fisheries and aquaculture department.Food and Agriculture Organization of the United Nations, Rome, Italy, 176.

FAO (2011). FAO Factsheet -Global Importance of a Growing Sector: Fisheries and Aquaculture. FAO, Rome, 128.

FAO (2012).The year book of fishery and aquaculture statistics, fisheries and aquaculture department.Food and Agriculture Organization of the United Nations, Rome, Italy, 239.

Farag, M. S. (2003). Reproductive performance of *Oreochromisniloticus* through three seasons on earthen ponds. Egypt. J. Aquat. Biol. &fish., 7(4): 263 – 282.

Fasakin, E. A.; R. D. Serwata and S. J. Davies.(2005). Comparative utilization of rendered animal derived products with or without composite mixture of soybeanmeal in hybrid Tilapia (*Oreochromis niloticus X Oreochromis mossambicus*) diets. Aquac., 249 (1-4): 329-338.

Fath El-Bab, A. F., M. E. Farag A. A. Ramadan, and A. S. Hassan (2011).Effect of temperature and female weight on reproductive performance of two Nile tilapia (*Oreochromis niloticus*) populations Egypt. J. Aquat. Biol. & Fish., 15 (2):179-193.

Fitzsimmons, K. (2010). Potential to Increase Global Tilapia Production.Global Outlook for Aquaculture Leadership. Kuala Lumpur. The Global Aquac. Alliance., 13, 21-28.

Gómez-Márquez, J. L.; B. Peña-Mendoza; I. H. Salgado-Ugarte and M. Guzmán-Arroyo.(2003). Reproductive aspects of *Oreochromis niloticus* (Perciformes: Cichlidae) at Coatetelco lake, Morelos, Mexico. Rev. Biol. Trop., 51, 221-228.

Hashem, M. T. and El-Agamy, A. (1977).Effect of fishing and maturation on the *barbusbynni* population of the NozhaHydrome. Bull Inst. Ocean and fish A. R. E., 7:137-151.

Hughes, D. G. and Behrends, L. L. (1983).Mass production of *Tilapia nilotica* seed in suspended net enclosures. In: Fishelson, L., Yaron, Z. _Eds.., International Symposium of Tilapia in Aquaculture, Tel Aviv University, Israel, pp. 394–401.

Hussein, A.E. and Farag,M, El (2002). Evaluation of growth performances crosses for different populations of Nile tilapia (*Oreochromis niloticus*). 1st Scientific Conference of the Egyptian Agriculture Society Faculty of Environmental Agricultural Sciences El-Arish, North Sinai, Egypt. 5 (2): 13-15.

Jaspe, C. J. and Caipang, C. M. A. (2011).Increasing salinity tolerance in tilapias: selective breeding using locally available strains. AACL Bioflux, 4(4):437- 441.

Macintosh, D. J. (1985). Tilapia culture: Hatchery Methods for *Oreochromis mossambicus* and *O. niloticus*, with special reference to all-male fry production, Institute of Aquaculture, University of Sterling, Stirling, 3 (3): 10-19.

Marshall, B. E. (1979). Observations on the breeding biology of *Sarotherodon macrochir (Boulenger)* in Lake McIlwaine, Rhodesia. J. Fish. Bioi.,14, 419 -24.

Mohamed, A. H.; R. Ferdinand; M. Traifalgar and Augusto E. S. (2013). Maternal size affects fecundity of saline-tolerant tilapia*Oreochromis* *mossambicus*(Peters) in freshwater tanks. Scholars Research Library Annals of Biol. Res., 4 (3):138-142.

Nandlal, S. and Pickering, T. (2004). Tilapia fish farming in Pacific Island countries. Tilapia hatchery operation. Noumea, New Caledonia: Secretariat of the Pacific Community, 10 (2):190-203.

Njiru, M.; J. E. Ojuok; J. B. Okeyo-Owuor; M. Muchiri; M. J. Ntiba and Cowx.I.G. (2006). Some biological aspects and life history strategies of Nile tilapia *Oreochromis niloticus* (L.) in Lake Victoria, Kenya. Afr. J. Ecol., 44, 30-37.

NRC (1993).National Research Council.Nutrient Requirements of Fish.National Academy Press, Washington, DC, 114 pp.

Payne, A. I. and Collinson, R. I. (1983).A comparison of the biological characteristics of *Sarotherodon aureus* (Steindachner) with those of S. *niloticus*(L.) and other tilapia of the delta and lower Nile. Aquac., (30): 335-51.

Rana, K. J. (1986). Parental influences on egg quality, fry production and fry performance in *Oreochromis niloticus* Linnaeus and *O. mossambicus* Peters .PhD Thesis, Institute of Aquaculture, University of Stirling, UK, 295 pp.

Rana, K. (1988). Reproductive biology and the hatchery rearing of tilapia eggs and fry, In: Muir,. J.F., Roberts, R.J. Eds. , Recent advances in aquaculture, Croom Helm, London and Sydney and Timber press, Portland, OR, USA. 3, 343 – 406.

Ricker, W. E. (1975).Computation and interpretation of biological statistics of fish populations.Fish. Res. Board Can. Bull., 191: 1-382.

SAS (2002).SAS Institute Inc., Cary, NC, USA. NOTE: SAS Proprietary Software Version 9.00 (TS M0).

Shalloof, K. A. S. and Salama H. M. M. (2008).Investigations on some aspects of reproductive biology in *Oreochromis niloticus* (Linnaeus, 1757) inhabited Abu-Zabal Lake, Egypt. Global Vet., 2: 351-359.

Shamsuddin, B.; Hossain, M. Rahman; Asadujjaman, N. and Y. Ali (2012).Performance of Monosex Fry Production of two Nile Tilapia Strains GIFT and New GIPU. World J of Fish and Marine Sci., 4 (1): 68-72.

Shelton, W. L. and Popma, T. J. (2006).Biology.Culture and Nutrition. Food Products Press, an imprint of The Haworth Press, Inc, NY 13904- 1580, USA. 645p.

Tsadik, G. G. and Bar. A. N. (2007). Effects of feeding, stocking density and water-flow rate on fecundity, spawning frequency and egg quality of Nile Tilapia, *Oreochromis niloticus* (L.). Aquac., 272, 380-388.

Watanabe, T. (1985).Importance of the study of broodstock nutrition for further development of aquaculture. In: Cowey, C.B., Mackie, A.M. and Bell, J.G. (eds) Nutrition and Feeding in Fish. Academic Press, London, pp. 395–414.

"تأثير حجم الاناث علي معدلات الكفاءة التناسلية لآمهات أسماك البلطي النيلي"

وحيد علوان محمد[1]،صبرى محمد على شحاته[2]، جمال عثمان النجار [1]، احمد مصطفى محمد خاطر[3]، محمود خيرى محمود[2] .

١ – المركز الدولى للأسماك بالعباسة–ابوحماد–الشرقيه

٢ –شعبة علوم البحار و الأسماك ، قسم علم.الحيوان ، كلية العلوم (بنين) ، جامعة الأزهر، القاهرة.

٣ – المعمل المركزى لبحوث الثروة السمكيه بالعباسة–ابوحماد–الشرقيه

أجريت هذه التجربة بالمركز الدولى للأسماك–العباسة– أبوحماد –محافظه الشرقيه وقد أجريت هذه التجربة بهدف دراسة تأثير حجم الأمهات على الكفاءة التناسليةلأسماك البلطي النيلي وتحديد إستراتيجيات إدارة الأمهات المحتملة التي قد تعتمدها المفرخات لتحسين إنتاج الزريعه. تم استخدام 360 انثى و120 ذكر فى هذه التجربة. تم تصنيف الأمهات إلى ثلاثة مجموعات من الأحجام. المجموعة الأولى: أحجام صغيرة وهى (85- 105جرام)، المجموعة الثانية أحجام متوسطه وهى (150- 180 جرام)، المجموعة الثالثة أحجام كبيرة وهى (250-280جرام) حيث سمح ليحدث إقتران بين الذكوروالأناث بنسبة 3 إناث لكل ذكر وقد أظهرت النتائج أن عدد الزريعة، عدد البيض وقطر البيض قد تأثرت بشكل ملحوظ مع حجم الإناث في بداية فترة الفقس بينما لم يتأثر حجم الزريعه مع الزيادة فى وزن الإناث .وقد إزداد عدد الزريعه 200،03، 122،5% على التوالي فى مجموعات الإناث الكبيرة والمتوسطة بالمقارنة مع مجموعة الإناث الصغيرة. وقد تم تسجيل أكبر عدد من البيض في الوزن الكبير من الإناث.

أظهرت النتائج أن زياده الوزن ا لإبتدائى من الزريعه 71.43و71.35%على التوالى فى الزريعه الناتجه من مجموعات ا لإناث الكبيرة والمتوسطه عن الزريعه الناتجه من المجموعة الصغيرة من الإناث.

كما أحدثت النتائج أن طول الجسم النهائي للزريعه بعد 60 يوم اقد ازداد مع زيادة حجم المخزون من الأمهات، كما تأثر معنويا نسبه معامل الحاله (condition factor) مع وزن الزريعه .

وقد أدى ذلك إلى أن معامل الحاله للزريعه قد إزداد بنسبة 13.16، 7.89 % فى مجموعات الزريعه الناتجه من ا لإناث الكبيرة والمتوسطه على التوالى عن مجموعه الإناث الصغيرة.

أظهرت النتائج أن معدل الزيادة اليوميه لوزن الزريع ة خلال فترة التجربه قد تأثر معنويا عند ($P<0.001$) مع حجم الزريعه. وقد أدى ذلك الى زياد ة معدلات الإعاشه خلال التجربه ($P<0.001$) مع الزريعه محل الدراسة.

أوضحت النتائج أن أعلى قيمه فى معدل زيادة المناسل و وزن المبيض سجلت في الحجم الكبير بينما إنخفضت فى الأحجام المتوسطة والصغيرة على التوالى. كما تأثرت قيمه الخصوبة المطلقة والنسبية تأثراً معنويا عند($P<0.001$) وكانت أعلى قيمه للخصوبة المطلقة والنسبية وجدت فى الحجم الكبير بينما إنخفضت فى الحجم المتوسط والصغير على التوالى.

دللت النتائج على أن أعلى قيمه فى معدل زيادة المناسل ، وزن المبيض، الخصوبة المطلقة و الخصوبة النسبية سجلت فى شهر مايو بينما تناقصت فى شهر أبريل ومارس على التوالى ووصلت الى اقل قيم ة فى شهر فبراير.