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Effect of aeration systems under desert conditions on growth, survival and yield of Nile tilapia *Oreochromis niloticus*

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ABSTRACT

The experiment was conducted to determine the effects of aeration systems for ponds cultured with Nile tilapia *Oreochromis niloticus* in the period from April 1st to the end of June, 2020.Three treatments were used T_1 (non-aerated ponds), T_2 and T_3 (aerated ponds). Growth performance of tilapia *O. niloticus* in terms of length, weight, weight gain, specific growth rate and production were estimated to be significantly (*$p<0.05$*) higher in the ponds of T_2 and T_3 compared to T_1. The average final length of Tilapia was 15.7±2.1 , 17.9±2.4 and 17.8±2.6 cm in T_1, T_2 and T_3, respectively. The mean final weight at the end of 90 days was 75.3, 127.1 and 127.8g for fish of treatments T_1, T_2 and T_3, respectively. The length-weight relationship equation was $W = 0.0153*L^{3.0646}$ ، $W = 0.0093*L^{3.2817}$ and $W = 0.0013*L^{3.1877}$ for T_1, T_2 and T_3, respectively. The respective condition factor values were 1.94, 2.22 and 2.26. There was a significant difference ($P < 0.05$) in survival rates of non-aerated and aerated.

***Keywords*:** Water quality, Nile tilapia, *Oreochromis niloticus*, aeration systems, Growth performance, Fish production, Length-weight relationship, condition factor.

INTRODUCTION

Fish aquaculture is one of the major sectors capable of ending food shortages in the world and contributing to poverty mitigation, and it has a major role in providing relatively inexpensive animal protein, although its practice in desert and dry areas faces significant obstacles, especially with regard to water supplies and the nature of the desert (Crespi and Lovatelli, 2011; Soliman and Yacout, 2016; Wally, 2016; Kaleem and Abudou-Fadel, 2020).

Dissolved oxygen may be the most important component of water quality in aquaculture because all aquatic organisms need dissolved oxygen to grow and survive (USDA, 2011). Aeration improves the aspects of aquaculture pond environmental quality (Boyd 1998). It is the process of bringing water and air into close contact by exposing drops or thin sheets of water to the air or by introducing small bubbles of air and letting them rise through the water. Aeration can remove certain dissolved gasses and minerals through oxidation (Igib *et al.*, 2013). Boyd (2018) mentioned that, the mechanical aeration is applied to avoid night-time dissolved oxygen concentrations from falling below the critical level (3 mg/L) for catfish. Aeration is important to increase stock density, growth, and fish farming productivity and is widely used in fish farming systems (Hatem, *et al.*, 2017). Rajts and Shelley (2020) mentioned that the pond aeration improves the survival of cultured fish, produces better pond soil by accelerating the mineralization of organic sediment, increases fish stocking and feeding rates, provides good fish health, better feed conversion, better growth rate and higher profit.

The current study aims to determine the effects of aeration systems in concrete ponds on the growth and production of Nile tilapia (*Oreochromis niloticus*) to identify the best aeration method under desert conditions.

MATEREAL AND METHODS

1. Study area:

This study was carried out in privet small farm in Bir Al-Abed city, North Sinai, Egypt during the period from April 1^{st} to end of June 2020**.**

2. Experimental design:

Eight square concrete ponds were prepared for this experiment, the dimensions of each pond as 1.5 x 1.5 m in depth of one meter, with three aeration systems to assess their effects on the growth and production of the monosex tilapia *Oreochromis niloticus*. Fries in each pond were counted and group-weighed after the acclimation period to begin the study.

The fish were exposed to three treatments with three replications (T_1, T_2 and T_3). Treatment T_1 is the non-aerated, T_2 is the discharged aerated as the water flows from the central pump through PVC pipe. Using it in the experimental pond for aeration daily for ten hours from 3 AM to 1 PM. T_3 is the blower aerated using an air compressor using it in the experimental pond for aeration daily for five hours from 3 to 8 AM.

All treatments have similar stocking density (15 fish/m^3) of fry (0.3 to 5 g initial weight). Fish were fed by hand twice a day on prepared floating commercial pelleted fish feed (30% crude proteins) by the ratio of 3% of total biomass.

3. Water Quality Measurement

Physical-chemical parameters of pond water as dissolved oxygen (DO), temperature, pH, turbidity, ammonia and salinity were monitored in situ every day morning and evening. Field test instruments were in use to analyze water quality as a follow:

- Salinity (ppt) was determined using a portable Salinity meter (Milwaukee, USA) EC 60.
- pH was determined using a portable pH meter (pH 55 Pocket-size, Milwaukee, USA).
- Ammonia was determined using a Portable Ammonia Nitrogen Meter Ln-N11 (HangZhou Lohand biological Co. Ltd.).

4. Growth performance

4.1 Fish weight and growth

All fish were bimonthly weighed; the growth of fish was recorded every 15 days .The final weight and other calculated indices of fish growth were done.

4.2 Daily Growth rate

Daily growth rate (DGR) (g/day):

$$\textbf{Daily Growth rate} = \frac{\mathbf{W2 - W1}}{\mathbf{t2 - t1}}$$

Where: W_1 = initial weight (g)

W_2 = final weight (g)

t_2-t_1 = duration between W_2 and W_1 (days).

4.3 Mean Weight Gain (MWG)

The MWG was estimated after **Effiong *et al* (2009)**:

$$\mathbf{WG\ (g) = FMW - IMW}\ \left(\frac{\mathbf{g}}{\mathbf{fish}}\right)$$

Where: FMW= the final mean weight (g) of fish,

IMW= the initial mean weight (g) of fish.

4.4. Specific growth rate (SGR, %/day)

Estimated by **Effiong *et al*. (2009)** equation as a follow:

$$\mathbf{SGR}\ (\%) = \frac{\mathbf{100} \times [(\mathbf{ln\ final\ fish\ weight}) - (\mathbf{ln\ initial\ fish\ weight})]}{\mathbf{experimental\ days}}$$

4.5.Survival rate and mortalities

Mortalities for fishes were recorded every 15 days and the survival rate was calculated.

$$\mathbf{Survival\ rate}\ (\%) = \frac{\mathbf{fish\ stocked\_mortality}}{\mathbf{fish\ stocked}} \times \mathbf{100}$$

5. Length-weight relationship:

At the end of the study, 100% of the stock was caught and the total length (TL) of each individual was measured to the nearest 0.1 cm using a simple fish ruler board and the total body weight to the nearest 0.1 g by using electronic balance. These data were used to calculate the length weight relationships according to equation of **Sparre *et al.* (1989)**:

$$\mathbf{W = aL^b}$$

Where: W=total body weight (g).

L= total fish length (cm).

a=constant.

b= relative growth coefficient of weight and length.

6. Condition factor:

The Fulton’s Condition factor (K_F) was calculated employing **Fulton (1904)** equation:

$$\mathbf{K_F = \left(W/_{L^3}\right) * 100}$$

Where: KF: The Fulton’s Condition factor

W: weight of fish (g).

L: Total length of fish (cm).

7. Statistical analysis

The obtained data were subjected to two-way ANOVA to test the effects of DO concentration on growth. Statistical analysis was performed using Microsoft® Excel-2010. In addition, Different mean values were analysed using Minitab software version 17.0, Tukey's test was used to compare between samples. All statistical analysis were considered significant at 5% ($p<0.05$).

RESULTS

1. Physical and chemical measurements of water

Different chemical and physical parameters of ponds such as water temperature, dissolve oxygen, salinity, pH, ammonia and dissolved oxygen were illustrated in Table (1).

No significant differences (ANOVA, $P > 0.05$) among treatments unless dissolved oxygen and ammonia concentration (ANOVA, $P < 0.05$). There was a significant (ANOVA, $P < 0.05$) differences between aerated systems.

Table (1): Water quality parameters recorded during study of *O. niloticus* cultured for 90 days in different pond aeration system

Item/Treatments	T1	T2	T3
Salinity (‰)	3.25±0.007	3.26±0.018	3.25±0.007
pH	7.17±0.020	7.59±0.108	7.66±0.007
Temperature (C◦)	22-28.1	22-28.8	22-28.7
Dissolved Oxygen (DO) (mg/l)	3.91^{a} ±0.038	4.96^{b} ±0.066	5.23^{c} ±0.014
Ammonia concentration (mg/l)	0.072^{a}±0.0006	0.067^{b}±0.0010	0.064^{c} ±0.0043

The average temperature ranged between 22.3 to 28.8°C, salinity ~ 3.25ppt, DO 3.91 to 5.23 mg/L, and pH from 7.17 to 7.66. All these parameters remained within safely range throughout the experiment (Table 1).

Dissolved oxygen measurements confirmed that the oxygen concentration was maintained near 3.91, 4.96, and 5.23 mg liter^{-1} in T_1 (non-aerated), T_2 (discharged aerated) and T_3 (blower aerated), respectively. DO was significantly variable between treatments ($P < 0.05$).

On the other hand, ammonia concentration of the non-aerated system was significantly higher than in discharged aerated and blower aerated systems ($P < 0.05$). Also, ammonia concentration was significantly higher in discharged aerated compared with blower aerated systems ($P < 0.05$). Ammonia concentration was significantly variable between the three treatments ($p < 0.05$).

2. Growth performance

2.1 Fish weight and growth

Growth performance of Nile tilapia, *O. niloticus* at 90 culture days in various aerated system is illustrated in Table (2). The final weight, weight gain, specific growth rate and production were found to be significantly higher ($P<0.05$) in the ponds of T_2 and T_3 (aerated ponds) compared to T_1 (non-aerated ponds).

Table (2): Growth performance of *O. niloticus* cultured for 90 days at concrete pond with various aerated system

Item/Treatments	T1	T2	T3
Initial weight	0.56	0.57	0.55
Final weight	75.3^{b}	127.1^{a}	127.8^{a}
Daily Growth rate	0.83^{b}	1.41^{a}	1.41^{a}
(g) weight gain	74.73^{b}	126.49^{a}	127.27^{a}
Specific growth rate (SGR, %/day)	5.45^{b}	6.01^{a}	6.05^{a}

a,b,c…. etc: means within the same row with different superscripts are significantly different (P<0.05).

The average final length of Tilapia was 15.7±2.1, 17.9±2.4 and 17.8±2.6 cm in T_1, T_2 and T_3, respectively (Fig. 1).

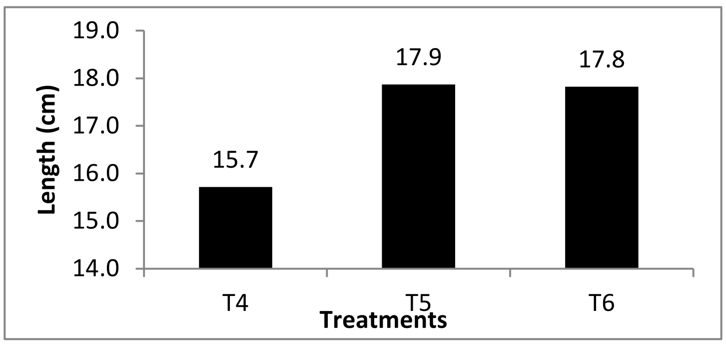

Fig. (1): Average final lengths of *O. niloticus* cultured for 90 days at different pond aeration system

The mean final body weight of Nile tilapiaat the end of 90 days of treatments; T_1, T_2 and T_3 was 75.3, 127.1 and 127.8g, respectively (Fig. 2).

The mean of final weight of Nile tilapia, *O. niloticus* were found to be significantly (p<0.05) higher in the ponds of T_2 and T_3 (aerated ponds) compared to T_1 (non-aerated ponds). Final weight was significantly variable between treatments (p<0.05).

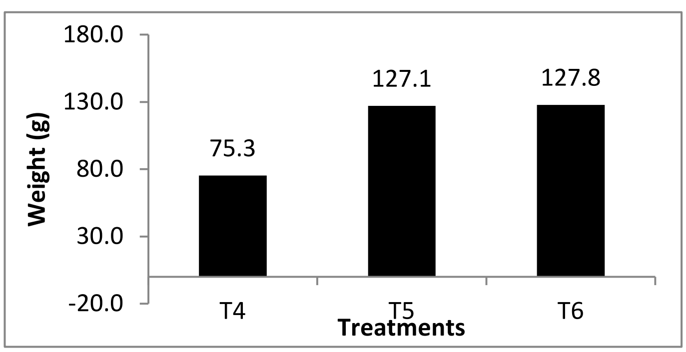

Fig. (2): Average final weight of *O. niloticus* cultured for 90 days at different pond aeration system

2.2 The daily growth rate

It was observed that the daily growth rate the highest in T_2 and T_3 (1.41g/day) aerated with air blower and the lowest was observed in non-aerated (0.31 ± 0.03). There was no significant difference between the treatments T_2 and T_3 ($P>0.05$).

2.3 Specific Growth Rate (SGR)

SGR of *O. niloticus* was 5.45 ± 0.03 %, 6.01± 0.013 % and 6.05± 0.017 % which was not significantly different ($p>0.05$) of treatments 2 and 3. There was significant difference between the treatments T_2 and T_3 compared with treatment 1($P<0.05$).

2.4 Survival rate

There was a significant difference ($P < 0.05$) in survival rates of the fish cultured in the aerated and non-aerated treatments (Table 3 & Fig. 3). Survival rates were significantly variable between treatments ($P < 0.05$). The difference observed was not significant between discharged aerated and blower aerated.

Table (3): Survival rate of *O. niloticus* cultured for 90 days at different treatments.

Treatments	Survival rate (%)
T1 (non-aerated)	79.17b ±3.82
T2 (discharged aerated)	93.33a ±1.44
T3 (blower aerated)	94.17a ±3.82

a,b,c…. etc: means within the same row with different superscripts are significantly different ($P<0.05$).

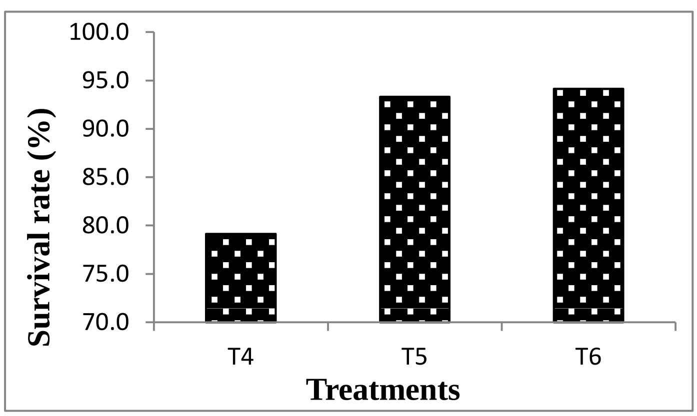

Fig. (3): Survival rate of *O. niloticus* cultured for 90 days at different pond aeration systems.

3. Length-weight relationship and condition factors

The results of the values of the regression coefficients (a & b) obtained from the LWR for treatments and condition factors are presented in Table (4).

The length-weight relationship of *O. niloticus* representing trial 1, trial 2 and trial 3 are presented in Figure (4).

Table (3): Length-weight relationship and condition factors of *O. niloticus* cultured for 90 days at aeration system.

Item/Treatments	T1	T2	T3
Mean length	15.7	17.9	17.8
Value of "a" in LWR	0.0153	0.0121	0.013
Value of "b" in LWR	3.0646	3.2817	3.1877
Condition factors	1.94	2.22	2.26

The equations of length-weight relationship are as the following:

Trial 1: $W = 0.0153*L^{3.0646}$ $r = 0.95$
Trial 2: $W = 0.0093*L^{3.2817}$ $r = 0.96$
Trial 3: $W = 0.0013*L^{3.1877}$ $r = 0.94$

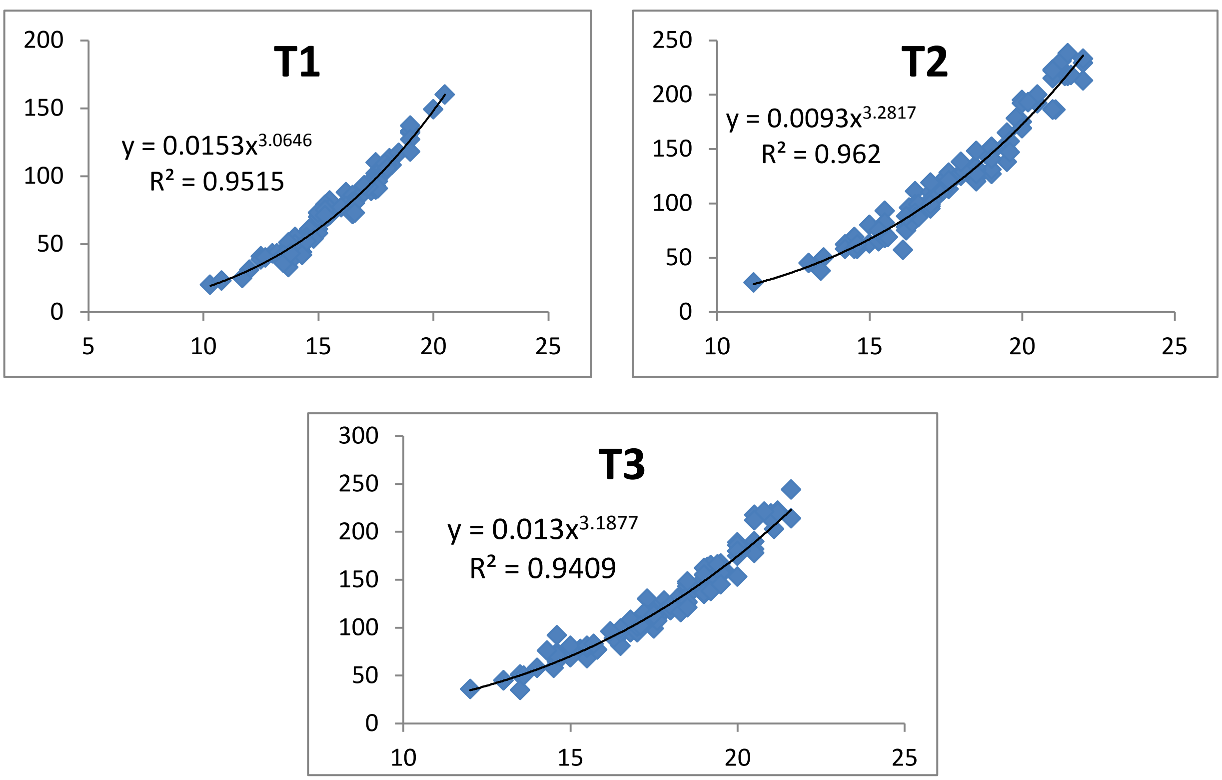

Fig. (4): Relationship between total length (cm) and weight (g) of *O. niloticus* in treatments (T1, T2 & T3) after the experimental period.

The Index of well-being or mean condition factor obtained was different for treatments 2 and 3 compared with T_1. The condition factor values of trial 1, 2 and 3 were 1.94, 2.22 and 2.26 respectively.

4. Yield

After 90 days of experimental culture, the total fish yield was 1.05 kg/m^3 in T1, 2.1 kg/m^3 in T2 and 2.11 kg/m^3 in T3 (Table 4). From results indicate that, there was a significant difference ($P<0.05$) in the yield as weight of the fish cultured in the aerated and non-aerated treatments. There were no significantly in yield between discharged aerated and blower aerated. Yield was significantly variable between treatments ($P<0.05$) concerning gross yield/m^3 (Table 4 & Fig. 5).

Table (4): Yield of pond, yield of cubic meters of *O. niloticus* cultured for 90 days at different treatments.

Treatments	Gross Yield (kg/m^3)
T1 (non-aerated)	1.05b ±0.07
T2 (discharged aerated)	2.11a ±0.13
T3 (blower aerated)	2.10a ±0.13

a,b,c…. etc: means within the same row with different superscripts are significantly different (P<0.05).

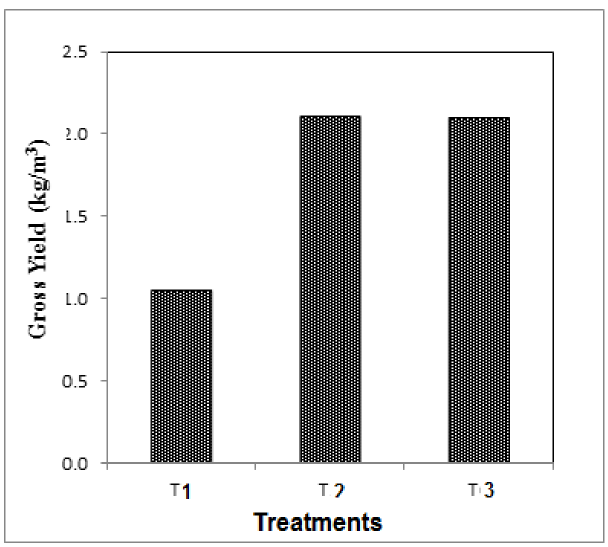

Fig. (5): yield of cubic meters of *O. niloticus* cultured for 90 days at different pond aeration systems.

DISCUSSION

In the present study, the level of DO in the ponds of T_1, T_2 and T_3 was 3.91, 4.96 and 5.23 mg/l, respectively which was more or less similar to the result of Qayyum *et al*. (2005) who recorded DO ranging from 4-9 mg/l and 2-8 mg/l in aerated and non-aerated ponds, respectively. The higher DO content in the aerated ponds in present study is due to use of aeration facilities.

Oxygen is important in respiration and metabolism processes in any animal. In fish, the metabolic rate is highly affected by the concentration of oxygen in the rearing environment. From the current results oxygen level has a positive effect on the growth of fish.

The increase in mean weight of individual fish *O. niloticus* during the course of the growth tests in the three treatments with high, medium and low levels of DO, the fastest rate of growth was at high DO and the slowest growth was in the presence of low DO. The growth rate is higher when the oxygen level is between 4.96, and 5.23 mg liter^{-1}. The growth for *O. niloticus* was lower at 3.91 mg liter^{-1} dissolved oxygen. As the dissolved oxygen concentration decreases, respiration and feeding activities also decrease. As a result, the growth rate is reduced and the possibility of a disease attack is increased. However, fish is not able to assimilate the food consumed when DO is low (Tom, 1998).

Hussain (2004) reported that water quality parameters for optimal survival and growth of *O. niloticus* were temperature ranging from 25.0 to 30.0°C, dissolved oxygen 4.0 - 8.0 mg/l and pH 6.5 - 9.0 which are in conformity with the present records. Release points in the diffused-air system allow more contact time for the bubbles to diffuse oxygen into the water column as they rise to the surface (Tucker, 2005).

Vijayan and Varghese (1986) found that the total fish production and the average survival rate were significantly higher in the aerated tanks than in the control ones. The DO concentration that leads to negative effects as mortality can be dependent on many factors, such as increasing feed loads and stocking density (Clark and Helfrich, 2006). The results of Mallya (2007) showed that oxygen saturation level had a positive effect on the growth and feed conversion ratio of fish.

Sultana *et al*. (2017) found that aeration can be a potential mechanism of aqua-farming to enhance the growth and production of tilapia and DO content in pond water synchronizing other water quality parameters in ponds. Welker *et al*. (2019) observed significant negative effects on growth and survival of rainbow trout corresponded with declining DO levels.

The positive effects of aeration were apparent in the decreases in the ammonia concentration and the growth performance in the treatments as the higher length and weight gain, specific growth rate, survival rate, and yield found to be significantly ($P<0.05$) higher in the aerated ponds of the present study compared to non-aerated ponds. This might be due to proper controlled conditions, differences in DO content due to aeration facilities since fish growth always showed good feed efficiency at required DO in water (Bergheim *et al*., 2006; Duan *et al*., 2011).

It is clear that the poorest condition factor was that of fish reared in non-aerated water, while fish reared in discharged aerated and blower aerated showed the best condition factor of tilapia as Episodes of low concentrations of dissolved oxygen and high concentrations of ammonia are major causes of fish stress, which in turn, reduces growth and increases mortality rates in aquaculture ponds (Sriyasak *et al*., 2015).

The negative changes in growth and survival were similar in the current result to previous study of Zhu *et al.* (2020) who reported the Dissolved oxygen is an important factor for improving water quality and boosting fish growth in aquaculture ponds, and plays an important role in the conversion of ammonium-nitrogen ($NH4^+$-N) to nitrite-nitrogen (NO_2^--N) and eventually nitrate-nitrogen (NO_3^--N). Moreover, they found that aeration interval or no aeration resulted in high concentrations of NH_4^+-N in the water column.

Mixing by aeration can minimize organic matter accumulation that may increase BOD, reduce the density of algal blooms that can lead to oxygen depletion and fish health issues, and shift the composition of algae blooms that may lead to flavor issues in finfish (Hargreaves, 2003).

Hossain *et al*. (2017) indicated that the highest value of condition factor (1.73 ± 0.02) was recorded in tilapia fed on *Chlorella vulgaris* and the lowest value (1.56 ± 0.02) of fish fed with commercial feed (control). In the current investigation the estimated condition factor for *O. niloticus* was high in aerated ponds which increase conversion ratio of this fish.

Conclusion:

Oxygen level has an effect on the growth of fish, and in the case of *O. niloticus*, the growth rate is higher when the oxygen level is between 4.96, and 5.23 mg $liter^{-1}$. The growth for *O. niloticus* was lower at 3.91 mg $liter^{-1}$ oxygen dissolved.

Recommendation:

The Nile tilapia (*Oreochromis niloticus*) can be reared in aerated ponds in desert area using either discharged or blower aeration and gave high yield.

REFERENCES

Bergheim, A.; Gausen, M.; Naess, A.; Holland, P.M.; Krogedal, P. and Crampton, V. (2006). A newly developed oxygen injection system for cage farms. Aquacult. Engineering, 34(1): 40–46.

Boyd, C.E. (2018). Dissolved oxygen and aeration in ictalurid catfish aquaculture. J. World Aquacult. Soci., 49(1): 7-70.

Boyd, C.E. (1998). Pond Water Aeration Systems. Aquacult. Engineering,18(1998):9-40.

Clark, M.L. and Helfrich, L.A. (2006). Comparison of water quality and rainbow trout production in oxygenated and aerated raceways. N. Am. J. Aquac. 68, 41–45.

Crespi, V. and Lovatelli, A. (2011). Aquaculture in desert and arid lands: development constraints and opportunities. FAO Technical Workshop. 6–9 July 2010, Hermosillo, Mexico. FAO Proceedings No. 20. Rome, FAO. pp. 25–37.

Duan, Y.; Dong, X.; Zhang, X. and Miao, Z. (2011). Effects of dissolved oxygen concentration and stocking density on the growth, energy budget and body composition of juvenile Japanese flounder, *Paralichthys olivaceus* (Temminck et Schlegel). Aquacult. Res., 42: 407–416.

Effiong, B.N.; Sanni, A. and Fakunle, J. O. (2009). Effect of partial replacement of fishmeal with duckweed (*Lemna paucicostata*) meal on the growth performance of *Heterobranchus longifilis* fingerlings. Report Opin., 1: 76-81.

Fulton, T.W. (1904). The rate of growth of fishes. Twenty-second Annual Report, Part III, Fisheries Board of Scotland, Edinburgh.

Hargreaves, J.A. (2003). Pond Mixing. Southern Regional Aquaculture Center, SRAC Publication No. 4602, United States Department of Agriculture, Cooperative State Research, Education, and Extension Service. Mississippi State University, Mississippi State, Mississippi.

Hatem, M. H.; Y. B. Abd Elhay; E. M. Okasha and A. E. Awaad. (2017). The effect of air distributor shapes at fish ponds on the dissolved oxygen in water. Agricultural Engineering International: CIGR J., 19(3): 105–111.

Hossain, M.; Sultana, N.; Noor, P.; Khan, S.; Lisa, S. A.; Begum, M. and Rahman, M. S. (2017). Growth performance and fatty acid profile of Nile Tilapia *Oreochromis niloticus* (Linnaeus, 1758) fed with different phytoplankton. Dhaka Univ. J. Biol. Sci., 26: 13-27.

Hussain, M.G. (2004). Farming of Tilapia: Breeding plans, mass seed production and aquaculture techniques. 1st (eds), pp. 149 published by Habiba Akter Hussain, 55 Kristawpur, Mymensingh 2200 Bangladesh.

Igib, P.; S. Agus and A. S. Ahmad (2013). Design optimization of solar powered aeration system for fish pond in Sleman Regency, Yogyakarta by HOMER software. Energy Procedia, 32(1): 90-98.

Kaleem, O. and Abudou-Fadel, S. (202**1**). Overview of aquaculture systems in Egypt and Nigeria, prospects, potentials, and constraints. Aquaculture and Fisheries, 6(6): 535-547.

Mallya, Y.J. (2007). The effects of dissolved oxygen on fish growth in aquaculture, United Nations University, Fisheries Training Programme, UNU-FTP, 30 pp.

Qayyum, A.; Ayub, M. and Tabinda, A. B. (2005). Effect of aeration on water quality, fish growth and survival in aquaculture ponds. Pakistan J. Zool., 37(4):75–80.

Rajts, F. and Shelley, C.C. (2020). Guidelines for managing aeration and water quality in fishponds in Bangladesh. Penang, Malaysia: WorldFish. Guidelines: 2020-36.

Soliman, N. F., and Yacout, D. M. M. (2016). Aquaculture in Egypt: Status, constraints and potentials. Aquacult. Int., 24:1201–1227. DOI: 10.1007/s10499-016-9989-9

Sparre, P.; Ursin, E. and Venema, S. C. (1989). Introduction to tropical fish stock assesment. Part I. Manual FAO Fisheries Technical Paper, 1. Rome FAO, No: 306, 337 pp.

Sriyasak, P.; Chitmanat, C.; Whangchai, N. *et al.* (2015). Effect of water de-stratification on dissolved oxygen and ammonia in tilapia ponds in Northern Thailand. Int. Aquat. Res., 7: 287–299. https://doi.org/10.1007/s40071-015-0113-y

Sultana, T.; Haque, M. M.; Salam, M. A. and Alam, M. M. (2017). Effect of aeration on growth and production of fish in intensive aquaculture system in earthen ponds. J. Bangladesh Agril. Univ. 15(1): 113–122.

Tom, L. (1998). Nutritional and feeding of fish. Kluwer Academic Publishers. Second edition.

Tucker, C.S. (2005). Pond Aeration. Southern Regional Aquaculture Center, SRAC Publication No. 3700. United States Department of Agriculture, Cooperative State Research, Education, and Extension Service. Mississippi State University, Mississippi State, Mississippi.

USDA, United States Department of Agriculture (2011). Aeration of Ponds Used in Aquaculture, Technical Note No. AEN-3, AC-02-SP-2. Washington, DC.

Vijayan, M. M. and Varghese, T. J. (1986). Effect of artificial aeration on the growth and survival of Indian major carps. Proc. Indian Acad. Sci. (Anim. Sci.), 95(4):371-378.

Wally, A. (2016). The State and Development of Aquaculture in Egypt. Global Agricultural Information Network. USDA Foreign Agriculture Service. 1-4.

Welker, T.L.; Overturf, K. and Abernathy, J. (2019). Effect of aeration and oxygenation on growth and survival of rainbow trout in a commercial serial-pass, flow-through raceway system. Aquaculture Reports 14, 100194. (http://creativecommons.org/licenses/BY-NC-ND/4.0/).

Zhu, D.T.; Cheng, X.J.; Sample, D.J. and Yazdi, M.N. (2020). Effect of intermittent aeration mode on nitrogen concentration in the water column and sediment pore water of aquaculture ponds. J. Environ. Sci., 90: 331–342.

تأثير أنظمة التهوية في ظل الظروف الصحراوية على نمو وبقاء وإنتاج البلطي النيلي (*Oreochromis niloticus*)

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٣. كلية الاستزراع المائي والمصايد البحرية - جامعة العريش

المستخلص

تم إجراء تجربة لتحديد تأثيرات أنظمة التهوية لأحواض تربية السمك خلال عام ٢٠٢٠. تم اختيار أسماك البلطي النيلي لأنها من أهم أسماك المياه العذبة ويتم استزراعها على نطاق واسع في العديد من دول العالم. تم استخدام ثلاث معاملات : المعاملة الاولي (الأحواض غير الهوائية)، المعاملة الثانية والثالثة (الأحواض المهواة). وجد أن أداء نمو البلطي (*Oreochromis niloticus*) من حيث الطول والوزن وزيادة الوزن ومعدل النمو النوعي والإنتاج كان أعلى معنويا ($P<0.05$) في أحواض المعاملة الثانية والثالثة مقارنة مع المعاملة الاولي. كان متوسط الأطوال النهائية للبلطي ١٥.٧ ± ٢.١ سم ، ١٧.٩ ± ٢.٤ و ١٧.٨ ± ٢.٦ سم في المعاملة الاولي والثانية والثالثة على التوالي. متوسط الوزن النهائي للبلطي النيلي في نهاية ٩٠ يومًا من المعاملات الثلاثة كان٧٥.٣ ,١٢٧.١ و ١٢٧.٨ جم فى الاولي والثانية والثالثة على التوالي. كانت معادلات علاقة الطول والوزن $W = 0.0153 * L^{3.0646}$ ، $W = 0.0093 * L^{3.2817}$ و $W = 0.0013 * L^{3.1877}$ للمعاملة الاولي والثانية والثالثة على التوالي. كانت قيم عامل الحالة للتجارب الثلاثة على التوالى ١.٩٤ ٣ و ٢.٢٢ و ٢.٢٦ . لم يكن الاختلاف ملحوظ معنوياً ($p> 0.05$) بين المعالجات الثلاثة في معدلات البقاء على قيد الحياة.

الكلمات الارشادية: جودة المياة ، البلطي النيلي ، ***Oreochromis niloticus*** ، أنظمة التهوية ، أداء النمو ، إنتاج الأسماك ، العلاقة بين الطول والوزن ،عامل الحالة