Egypt. J. Aquat. Biol. & Fish., Vol. 10, No.3: 55 - 67 (2006) ISSN 1110 – 6131

EVALUATION OF GROWTH PERFORMANCE, PRODUCTION AND NUTRITIVE VALUE OF THE AFRICAN CATFISH, *CLARIAS GARIEPINUS*. CULTURED IN EARTHEN PONDS.

Abdalla A. El-Shebly
National Institute of Oceanography and Fisheries, Alexandria, Egypt.

Keywords: African catfish, growth performance, production, nutritive value, economic evaluation.

ABSTRACT

Small African catfish, *Clarias gariepinus* collected from the neighbouring harvested farms with 21.67 cm and 88.24g average individual length and weight respectively. Fish were stocked in a freshwater earthen pond, with an area of 2 feddans and a bout 2 meters, at a rate of 22600 fish/ feddan (2000 kg/ feddan). Growth performance, production, nutritive value and net return were evaluated for 8 months. The fish attained an average final length of 47.4 cm/fish and an average final weight of 846 g/fish. The final total biomass was 18500 kg/feddan. The biochemical analysis of *Clarias gariepinus* flesh revealed high nutritive value, where total protein was 15.65 % and total lipid was 3.13 % on wet weight basis. The economic evaluation revealed high net return of 68500 L. E. /feddan during the rearing period (8 months) with investmental return of 3.85 L. E. / 1 L. E. Cost.

INTRODUCTION

Fish farming for global food security is gaining popularity in recent years. It has the same objective as agricultural production and live stock breeding mainly to increase by all possible means the production of food in a level which would be above that produced naturally. It is also a form of land and water usage. Fish culture can flourish in boggy and badly drained land which is poorly suitable for agriculture, or which needs great capital expenditure to be reclaimed. It can flourish in saline and brackish waters unsuitable for agriculture.

The African catfish (*Clarias gariepinus*) are freshwater fish. They are of great importance as they grow quickly, attain a large size, and are

edible fish with few spines in their flesh. They can withstand wide range of environmental conditions, including severe temperatures, as well as low oxygen.

Clarias gariepinus has recently attracted the attention of fish culturists. Many trials for introducing this prolific fish to different regions have been done; El-Bolock and Koura (1960b) in Barrage experimental ponds, Bishai (1976 and 1979) in Manzala fish farm, Borham (1978) in Abassa pond, Hengsawat *et al.* (1997) in cages, Zaghloul, (2000) in three water qualities (Ismailiya canal, agricultural drainage and waste municipal water) and Abdel-Hakim & Abdel-Nasser (2001) in concrete tanks. The African catfish, *Clarias gariepinus* are piscivorous fish. They have a great economic importance firstly as they reach a large size and secondly being piscivorous, they affect other fish. They affect fish culture as they attack the fry, fingerlings or even adult transplanted fish. Eisawy *et al.*(1974) showed that one of the factors responsible for high mortality among transplanted mullet in ponds is due to the presence of carnivorous fish (*Clarias. gariepinus*) that may consume large numbers of the transplanted fish. El-Bolock and Koura (1960b) and Borham (1978) pointed out that a remarkable relationship is observed between the total production of carnivorous fish (*Clarias garieoinus*), mortality and vice versa the production, and that high mortality in ponds within different cultivated fish is parallel with a high production of carnivorous fish. On the other hand, *Clarias gariepinus* fish serve to control natural propagation of tilapia species that cause over-crowding in the ponds. They eat young tilapia species thus decreasing their numbers, hence allowing more space for better growth of tilapia and other fish in the pond. At the same time they transfer trash fish into protein of high class. Fielding (1966) found that the percentage of usable tilapia was increased by introduction of predaceous fish. Lemasson and Bard (1966) found that predatory fish control the excessive production of tilapia.

The major objective of this work was to study the growth performance and production of reared African catfish (*Clarias gariepinus*). Other related objectives were to determine the nutritive values and the economic feasibility of *Clarias gariepinus* culture.

MATERIALS AND METHODS

The present work was carried out in a private fish farm with an area of 2 feddans and a water depth of about 2 meters. The pond was dried, cattle manure was spread on its surface and filtered water was let

in. The farm was connected with a running fresh water source. The experimental pond was filled with water by gravity. After two weeks, African catfish, *Clarias gariepinus* fingerlings obtained from the neighboring farms at Lake Manzala were stocked in the pond at mid April 2005, at a density of 2260 (number) (2000 kg) fingerlings /feddan. A random sample of 100 fish was measured for initial weights. The fish has an individual lengths ranging from 16 to 26 cm, with an average of 21.67 cm/ fish and an individual weights ranging from 40 to 150 g, with an average of 88.24 g/fish. The fish were fed on supplementary food of small freshwater shrimp and trash fish, at a rate of 5 % of their body weight. Water quality and growth performance parameters were monitored for 8 months (up to mid December, 2005).

Water samples were collected monthly and analyzed for temperature, pH, dissolved oxygen, total alkalinity, hardness, total phosphorus and total nitrogen according to the methods described by the American Public Health Association (APHA, 1985).

For growth performance parameters, a total number of 50 fish were randomly sampled monthly, to determine increment in length and weight and readjust the food quantities. Body lengths and weights were measured to the nearest 0.1cm and 0.1g respectively.

Length-weight relationship were measured by applying the equation $W= aL^b$ (Beckman, 1948; and Le-Cren, 1951), where W = total weight in grams, L= total length in centimeter, a and b are constants.

The condition factor (K) was calculated for each individual sampled fish from the formula $K= 100\ W/L^3$ recommended by Schreck and Moyle (1990).

At the end of the experiment, the pond was drained and the fish were harvested and weighed. The cost-benefit analysis was carried according to current local market prices of *Clarias gariepinus* expressed in Egyptian L. E.

Some biochemical parameters were determined, where muscle water content was determined according to Sidwell *et al.*, (1970). Total muscle protein was determined using Kjeldahl method as reported by Josylin (1950). Total lipids of muscle were determined by the standard method reported in A. O. A. C. (1970). Muscle ash was determined by burning the samples in a muffle furnace for 16 hours at 550 °C (Sidwell *et al.*, 1970).

RESULTS

Water quality during the present work was within the suitable ranges for *Clarias gariepinus* culture (Table 1). Water temperature ranged from 14.8 to 33.9 °C with an average of 28.56 °C. Water pH ranged from 6.8 to 8.5, with an average of 7.52. Dissolved oxygen ranged from 5.2 to 9.7 mg/l, with an average of 7.18 mg/l. Total alkalinity ranged from 179 to 335 mg/l, with an average of 241 mg/l. Total hardness ranged from 151 to 214 mg/l, with an average of 172 mg/l. Total phosphorus ranged from 0.23 to 1.17 mg/l, with an average of 0.87 mg/l. Ammonia concentration ranged from 0.03 to 0.41 mg/l, with an average of 0.12 mg/l. Total nitrogen ranged from 1 to 6 mg/l, with an average of 2.44 mg/l.

The growth parameters are presented in Tables (2, 3 & 4) and Figures (1 & 2) where the fish attained an average final length of 47.4 cm/fish and an average final weight of 846 g/fish at the end of rearing period. The fish acquired an increment of 757.76 g/fish, with an average daily gain of 3.16 g/fish.

The total fish production was 18500 kg/feddan, and the net total gain was 16500 kg/feddan, after subtraction of the initial weight (2000 kg/feddan).

The length-weight relationship was illustrated by the following equation (log W = -1.87 + 2.851 log L). From Table 3 and Figure 2, it is evident that generally the empirical weights are slightly lower than the calculated weights for fish less than 36 cm long and higher than the calculated weights for larger fishes. The condition factor measures the degree of well being of fish. Its average value is 0.79 (Table 4).

Regarding the muscle biochemical composition of *Clarias gariepinus* (Table 5), the results revealed that it contains 78.76% water, 15.65% protein (wet weight), 3.13% lipid (wet weight) and 2.46% ash.

The production costs are the main aspects of economical evaluation. The economical evaluation of *Clarias gariepinus* cultured in earthen ponds (Table 6) showed that the costs of culturing/ feddan was 7000 L. E. for seed price (3.5 L. E. /kg), 15000 L. E. for food and 2000 L. E. for labor and other costs. The total costs were 24000 L. E./feddan. The present total production is 18500 kg/feddan, with total sale price of 92500 L. E. (5 L. E./kg fish). The net return is 68500 L. E./feddan with investmental return of 3.85 L. E. for each 1 L. E. cost.

DISCUSSION

The water quality of the pond under study was within the recommended limits for the culture of this type of fish (*Clarias gariepinus*). African catfish (*Clarias gariepinus*) feed on vegetable eating fish (*Tilapia* sp. and trash fish). Hickling (1962) stated that ecologically herbivorous fish are valuable as primary producers of animal protein.

The results of final length and weight are in accordance with those found by El-Bolock and Koura (1960b) in Barrage ponds, El- Bolock (1972) in Serow experimental farm and Bishai (1976) in Manzala fish farm. Hengsawat *et al.*(1997) recorded final mean weight of 385.7g/fish for *Clarias gariepinus* cultured in cages for 56 days. Various studies on African catfish reported differences according to the type of culture. Viveen *et al.* (1984) reported that growing catfish in tanks required 24-28 weeks to reach a size of 300-500g. In ponds where the fish were fed for the same time, catfish grew to a weight of 200g. However, Hogendorn and Koops (1983) found that the fish under field conditions reached 300g in only 22 weeks. During the same period, but in fertilized ponds and without supplemental food, catfish reached a maximum weight of 135g (Bok and Jongbloed, 1984).

Results of the present study, showed that African catfish, *Clarias gariepinus* reached weights ranging from 433 to 950 g, with an average of 846 g in 8 months.

The daily gain in weight of fish in the present study was 3.16 g/fish, which is higher than that recorded for other freshwater fishes.

An important relationship in the growth parameters includes length and weight at which the fish grows most rapidly. The value of the exponent b is 2.851, which means high growth rate and good length-weight relationship.

The condition factor (k) reflects the well-being and configeration of the fish as well as their body protein and lipid contents (Weatherly and Gill, 1983). The average condition factor (k) of the present study is 0.79, which is higher than that recorded in Barrage ponds i.e. 0.67 (El-Bolock, 1972) and that in Manzala fish farm i.e. 0.75 (Bishai, 1976).

The high protein and lipid levels in muscle of fish may be attributed to the good water quality and food.

Results of the present work revealed high production of African catfish, *Clarias gariepinus* and accordingly, the high return, which means that investment in this field of production is profitable and feasible.

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Table (1): Water quality parameters of *Clarias gariepinus* fish rearing pond.

Items	**Range**	**Average**
Temperature C^0	14.8 – 33.9	28.57
PH	6.8 – 8.5	7.52
Dissolved oxygen (mg/l)	5.2 – 9.7	7.18
Total alkalinity (mg/l)	179 –335	241
Total hardness (mg/l)	151 – 214	172
Total phosphorus (mg/l)	0.23 – 1.17	0.87
Ammonia (mg/l)	0.03 – 0.41	0.12
Total nitrogen (mg/l)	1 – 6	2.44

Table (2): Monthly variations in length and weight of cultured *Clarias gariepinus*.

Time	Av. Length (cm/fish)	Av. Weight (g/fish)
mid April	21.67	88.24
mid June	29.00	204.15
mid August	34.50	325.50
mid October	43.50	678.67
mid December	47.40	846.00

Table (3): length-weight relationship of cultured *Clarias gariepinus;* Calculated weights are obtained by applying the equation: Log W= -1.89 + 2.851 log L.

Length (cm).	No.	Av. Empir weight (g)	Calc weight(g)	Diffe rence	Length (cm).	No.	Av. Empir weight(g)	Calc weight(g)	Differen ce
16	3	40	36.55	-3.45	33	13	282	287.93	5.93
17	3	43	43.45	0.45	34	15	304	313.51	9.51
18	4	50	51.14	1.14	35	12	335	340.52	5.52
19	7	56	59.67	3.67	36	14	372	368.99	-3.01
20	11	63	69.06	6.06	37	8	399	398.97	-0.3
21	16	74	79.37	5.37	38	7	443	430.49	-12.51
22	23	88	90.62	2.62	39	11	471	463.58	-7.42
23	19	101	102.87	1.87	40	9	498	498.29	0.28
24	15	116	116.14	0.14	41	12	537	534.62	-2.38
25	27	131	130.47	-0.53	42	6	573	572.64	-0.36
26	28	150	145.91	-4.09	43	6	622	612.38	-9.62
27	22	164	162.49	-1.51	44	5	685	653.86	-31.14
28	27	177	180.24	3.24	45	5	770	697.12	-72.88
29	20	192	199.2	7.2	46	6	817	742.2	-74.8
30	31	205	219.42	14.42	47	5	866	789.13	-76.87
31	17	236	240.92	4.92	48	1	912	837.95	-74.05
32	17	261	263.74	2.74	49	1	950	888.69	-61.31

Table (4): Growth, production and condition factor of cultured *Clarias gariepinus.*

Items	Rate
Average initial length (cm/fish).	21.67
-------- final ------- -------	47.4
-------- initial weight (g/fish).	88.24
-------- final ------- ------	846
Increment in weight (g/fish).	757.76
% Increment in weight.	858.75
Stocking density/feddan (2kg fingerlings)	22665
Rearing period/day.	240
Daily gain in weight (g/fish).	3.16
Final total biomass (kg/feddan).	18500
Average condition factor (k).	0.79

Table (5): Some biochemical parameters of muscles of *Clarias gariepinus* reared in earthen pond.

Items	Rate
Water content %.	78.67
Total protein % (wet weight).	15.65
Total lipid % (wet weight).	3.13
Ash %.	2.46

Table (6): Cost-benefit analysis and net return (L. E./feddan) of *Clarias gariepinus* reared in earthen pond.

Items	**Rate**
Costs/feddan	
Seed cost (3.5 L. E./kg seed).	7000
Food cost.	15000
Labor and other costs.	2000
Total cost	24000
Income/feddan.	
Total production (kg/feddan).	18500
Price (L. E.) of one kg fish.	5
Total income/L. E.	92500
Net return/L. E.	68500
Investmental return (return/L. E. cost).	3.85

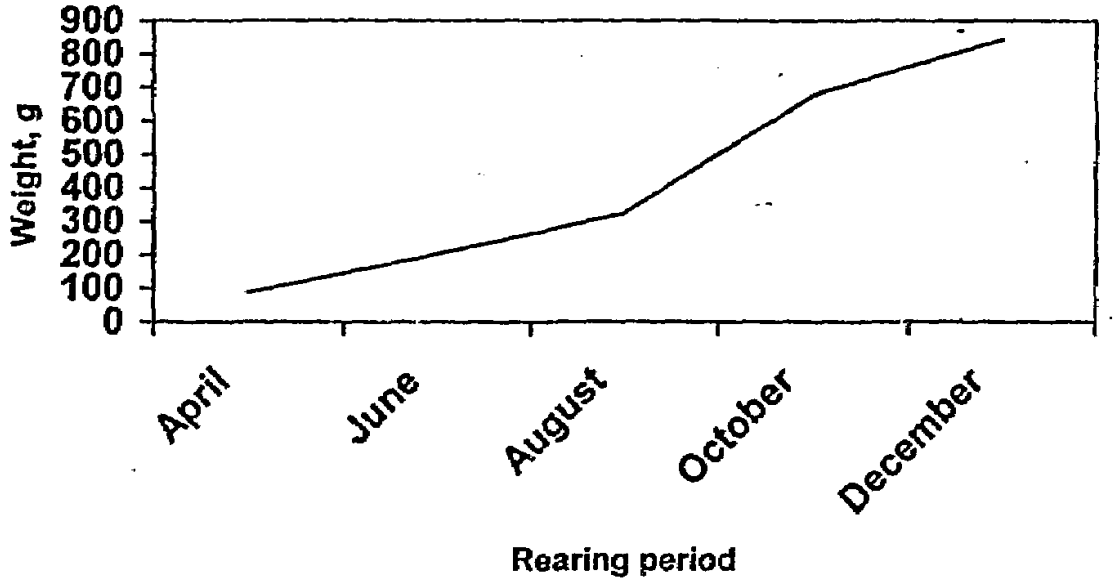

Fig (1): Average weights of *Clarias gariepinus* reared in earthen ponds during the experimental periods.

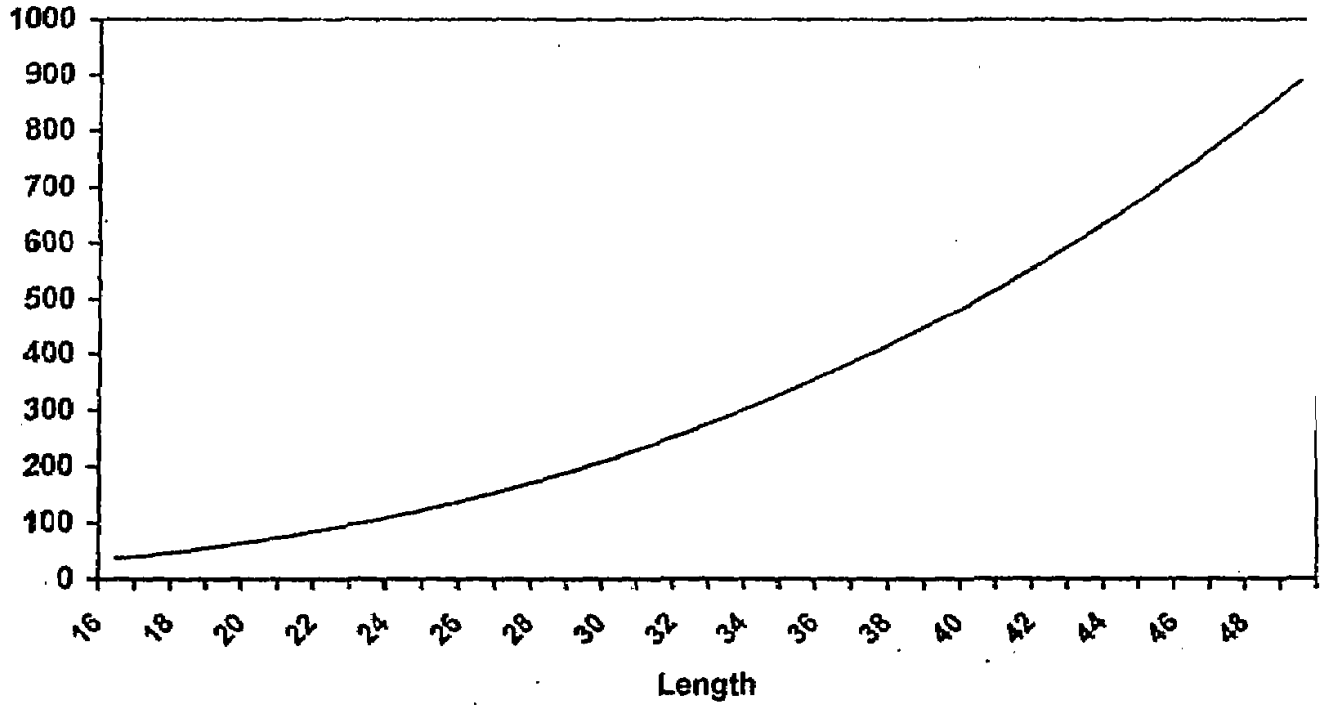

Fig (2): Length-weight relationship of cultured *Clarias gariepinus*, calculate weights are obtained by applying the equation: Log W= -1.98 + 2.851 Log L.