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INTENSIVE DIFFERENT STOCKING DENSITIES OF NILE TILAPIA, *Oreochromis niloticus* AND SILVER CARP, *Hypophthalmichthys molitrix* UNDER MONO-OR POLYCULTURE SYSTEMS IN FLOATING NET CAGES REARING IN MANZALA LAKE, Egypt

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ABSTRACT

This experiment was designed in order to study the effect of intensive rearing of mono-sex Nile tilapia and Silver carp under mono-or polyculture systems at different stocking densities in floating net cages. Fish were male mono-sex Nile tilapia with an average initial body weight (19.30 g) and Silver carp with an average initial body weight (73.6 g). The experimental fish were adapted for one week in floating net-cages and then distributed randomly into five experimental cages. The first cage was stocked with Nile tilapia, at a rate of 30 fish / m^3, while the 2^{nd}, the 3^{rd} and 4^{th} cages were stocked with different densities of Nile tilapia with Silver carp, at a rate of 30 fish / m^3 and the fifth cage was stocked with Silver carp only at a rate of 6 fish / m^3. All fish groups were feed the same artificial pelleted diet (except 5^{th} group fed natural water food). The diets were contained of 26.58% crude protein and gross energy 410.35 Kcal/100g DM, and offered twice daily (at 8.30 a.m. and 15.00 p.m.). The feeding rate represented 4% of mass body weight during all experimental periods.

The main results showed that the best treatment was the monoculture of mono-sex Nile tilapia (30 fish / m^3), then followed by the polyculture (88% Nile tilapia) and (12% Silver carp) in most of the examined traits as well as in the economic efficiency. The obtained results showed also that the intensive monoculture systems of silver carp had the lowest economic efficiency related to the only natural food in water only.

The present obtained results lead to the importance using the balanced pelleted complete diet for feeding tilapia fish especially under intensive cultured (monoculture); as well as, depending of green water for fed Silver carp in intensive monoculture. Also, showed the superiority of stocking densities in polyculture system were 88% and 12% for Nile tilapia and Silver carp, respectively As well as from environmentally point of view, it could be concluded that the controlling on different source of water pollution in Manazala Lake are very important to get high quality and safety fish production.

INTRODUCTION

Egypt has various inland resources, include the Nile River with many irrigation canals, six northern coastal lagoons (Mariut, Edku, Borollus, Manzala, Port Fouad and Bardawil). All of these lakes, with the exception of Lake Mariut, are directly connected to the Mediterranean Sea (El-Ganainy, 2006).

In Egypt, most of the aquaculture production derived from tilapia either from semi-intensive fish farms in earthen ponds or integrated intensive fish farms and cages (GAFRD, 2006). Thus, tilapia production in Egypt now takes the 2nd position after China in the world production, as well as, the 1st in Africa and Middle East. On the other hand, Silver carp is plentiful and a nutritious source of protein, the potential value of this fish has not been fully utilized in the Egyptian market. It is well known that the native of Silver carp were China, is filter feeding omnivores. The fish has been widely introduced throughout the old for aquaculture and it is contributing 22% (>3 million tons) of world carp aquaculture production (FAO, 2005).

El-Sayed (2013) now a day's reported that semi-intensive tilapia culture has been adopted in various parts of the world, either in monoculture or polyculture systems. In the same time, semi-intensive tilapia culture with other herbivorous / omnivorous fish such, as (common carp, Silver carp and grass carp) were found. It is important to know the role of the floating cages in the total Egyptian fish production since improving and out spreading of aquaculture among private sector which led to developing and intensification the fish culture supply in the market and reduced its price (Aldwaney, 2002 & GAFRD, 2008). In addition a lot of results, Ellis *et al.,* (2002) and El-Sayed (2006) shown that stocking density is a key factor in determining the productivity and profitability of commercial fish farms.

Therefore, the aim of this study was to investigate the effects of both polyculture and monoculture between tilapia and carp fish at different stocking density under rearing cages system at Manzala Lake, Egypt, on productive performance and economic efficiency.

MATERIALS AND METHODS

The present study was carried out as a part of the project of fish cages culture of young farmers in Manzala Lake (Raswah Lisa Al-Gamaliah), Dakahlia Governorate, Egypt. Five floating net cages (10 m length X 10 m Width X 2 m Depth) = (200 m^3). This study was extended 124 days (four months) from 15 July till 15 November, 2013.

Fish species were male mono-sex Nile tilapia, *Oreochromis niloticus* with an average initial body weight (19.30 ± 0.5 g) and Silver carp, *Hypophthalmichthys molitrix* with an average initial body weight (73.67 ± 0.5 g) were used in this experiment. Mono-sex of Nile tilapia was purchased from a private Manzala hatchery, Egypt. While, Silver carp were purchased from a private Fish Farm of Yoseph Asal at the same district (Raswah Lisa Al-Gamaliah, Egypt).

The experimental fish were adapted for one week in floating net-cages. The fish were weighed and then distributed randomly into five experimental groups as illustrated and design in Table (1). The first cage was stocked with Nile tilapia, only, at a rate of 30 fish / m^3, the second, the third and fourth cages were stocked with different densities of Nile tilapia with Silver carp, at a rate of 30 fish / m^3 and the fifth cage was stocked with Silver carp only at a rate of 6 fish / m^3.

Table (1): Illustrated the design of experimental fishes:

Cage Number	Number of Nile tilapia	Initial weight (g)	Biomass (kg)	Number of Silver carp	Initial weight (g)	Biomass (kg)	Total biomass of cage (kg)
1	6000	19.30± 0.5 g	115.80	____	____	____	115.80
2	5760	19.30± 0.5 g	111.10	240 (4%)	73.67± 0.5 g	17.70	128.80
3	5520	19.30± 0.5 g	106.50	480 (8%)	73.67± 0.5 g	35.40	141.90
4	5280	19.30± 0.5 g	102.00	720 (12%)	73.67± 0.5 g	53.00	155.00
5	____	____	____	1200	73.67± 0.5 g	88.40	88.40

All fish groups were fed the same artificial pelleted diet contains 26.58% crude protein and gross energy 410.35 Kcal/100g DM, (purchased from Abu Abbas Feed Factory belonging to, the industrial zone El- Asafra, Al-Matariah, Dakahliah governorate, Egypt), except group number five fed natural feed. The diet was offered twice daily at 8.30 a.m. and 15.00 p.m. The diets were adjusted biweekly on the basis of the actual average biomass of the fish in each cage at 4% rate (from the beginning to the end during all experimental periods). The Chemical analysis of experimental diet was given in Table (2).

Table (2): The Chemical analysis of experimental diet:

Nutrient Composition	Average
Total moisture %	9.50
Dry matter (DM %)	90.50
Nutrient composition (% on dry matter basis)	
Crude protein (CP)	26.58
Ether extract (EE)	6.14
Crude fiber	8.33
Ash	9.67
Total carbohydrates	49.28
*Gross energy (GE)	410.35
**Protein/energy (P/E) ratio	64.76

***GE (Kcal/100g DM) = CP x 5.64 + EE x 9.44 + Carbohydrates x 4.11 calculated according to (Macdonald *et al.,* 1973).**

****P/E ratio (mg protein/Kcal gross energy) = CP/GE x 1000.**

Water quality parameters were measured in all experimental cages at the start and during the experiment biweekly as, water temperature by using a thermometer, dissolved oxygen concentration was determined by using the Winkler method (APHA, 1971). Total ammonia and pH values of water was measured by direct Nesslerization methods using a CHEMETS® test kits (CHEMETRICS, INC, USA) according to APHA (1992).

Body weight of individual fish sample from each species was weighed biweekly to determine feed quantity and to calculate growth performance and feed utilization according to Abdelhamid (2003) as the following: average weight gain (g / fish) (AWG), average daily gain, (g / fish / day) (ADG), relative growth rate (RGR %), specific growth rate (SGR, % / day), feed conversion ratio (FCR), protein efficiency ratio (PER), protein productive value (PPV %) and energy utilization (EU %) were determine as well calculated.

At the end of the experiment, fish samples from each cage were taken and kept in frozen until chemical analysis. The chemical analysis of the experimental diet and the whole body fish was carried out according to the AOAC (2000), at the start and the end of the experimental period. The chemical analysis carried out at the Department of Animal Production, fish laboratory, Faculty of Agriculture, Mansoura University, Egypt.

At the end of the present study economic efficiency parameters (total outputs, total costs, net return and economic efficiency) of each experimental site cage were calculated as shown in Table (8).

The obtained data were statistically analyzed by one way using, but water quality SAS (2006) procedures for personal computer. When F-test was positive, least significant difference by Duncan (1955) was calculated for the comparison among means for all cages in the experiments.

RESULTS AND DISCUSSION

On the basis of the characteristics of Manzala area, Egypt, in evaluating and regulating their suitability for fish rearing, it was found that all parameters revealed to be within the permissible levels for optimum fish growth. Therefore the mean values of water quality parameters in cages were recorded as shown in (Table 3). The recorded ranges were 21.5-28 °C water temperature, 2.15-3.45 mg / L dissolved oxygen (DO), 7-8 pH and low total ammonia (NH_3) 0.001- 0.03 mg / L during all experimental periods. It could be noticed that the dissolved oxygen was very low may be because of the proliferation of aquatic plants, the lack of speed of the water renewal and increase the number of cages in Manzala Lake.

From the data in Table (3), it could be noticed that the differences in the means of temperature, dissolved oxygen, pH and NH_3 were not significantly different among the cages or months ($P > 0.05$). The present results are in agreement with those of Degefu *et al.,* (2011). They found that physical parameters showed no significantly different between the cages. The exceptions were DO and NH_3, which were lower and higher in the cages, respectively.

Growth performances of Nile tilapia in the different experimental groups were given in (Table 4). Means of initial fish weights were the same among stocking density treatments (19.30 g). In the other side, the Nile tilapia growth represented by the averages final weight, weight gain, ADG, RGR and SGR (Table 4) were significantly affected by stocking density ($P \leq 0.05$). The results showed that growth was positively affected by stocking density.

Similarly different experiment results on the effect of stocking density conducted on different tilapia fish sizes including fry and juveniles (khattab *et al.,* 2004 and Abdelhamid *et al.,* 2007), sub- adults (Bakeer *et al.,* 2007) and large tilapia (Diana *et al.,* 2004). Furthermore, Ellis *et al.,* (2002) reported that stocking density is a key factor in determining the productivity and profitability of the commercial fish farms were obtained.

(Table 3) Mean of water samples parameters in cage's site during of the experimental periods:

Treatment/ Measurement	Temperature °C	DO mg／L	pH mg／L $CaCo_3$	NH_3 mg／L
Cages				
T1	25.5	2.497	7.200	0.0018
T2	25.5	2.808	7.200	0.0018
T3	25.5	2.408	7.200	0.0018
T4	25.5	2.741	7.200	0.0016
T5	25.5	2.785	7.200	0.0020
±SEM	0.264	0.138	0.0020	0.001
P-value	1.00	0.155	1.00	0.746
The experiential months				
Jule	25.00	2.59	7.00	0.0010
August	28.00	2.34	7.00	0.0010
September	27.00	2.15	8.00	0.0018
October	26.00	2.69	7.00	0.0023
November	21.50	3.45	7.00	0.0030
±SEM	0.264	0.135	0.0002	0.0001
P-value	0.0001	0.0001	0.0001	0.0001

The maximum growth rate (Table, 4) was obtained with the Nile tilapia groups (T1, T2, T3 and T4) fed on a diet containing 26.58% CP, as well as with fish groups reared with deferent levels of Silver carp (T2, T3 and T4). The means of growth performance traits (Table, 4) indicated that group 2 (96% tilapia and 4% Silver carp) was higher significantly ($P \leq 0.05$) than those of group 1 (100% tilapia), group 3 (92% tilapia and 8% Silver carp) and group 4 (88% tilapia and 12% Silver carp), respectively. The mean final body weight ranged between 84.13 g to 100.58 g among all treatments (Table 4). Significantly ($P \leq 0.05$) the maximum average final body weight for both male Nile tilapia (100.58 g) and Silver carp(153.8 g) were recorded in T2 (96% tilapia and 4% Silver carp). The growth performance for male Nile tilapia over the 124 experimental days, expressed as range means of ADG, RGR and SGR were significantly ($P \leq 0.05$) increased, from a minimum to maximum to be 0.523g - 0.655g, 335.9 - 421.1 and 1.187% - 1.331% day, respectively.

Jobling, (1993) reported that fluctuation food consumption and growth performance for fish may be related to many environmental factors (temperature, fish size, stocking density, access to acceptable quality of food, water exchange and salinity). The present results (Table, 4) confirmed with the previous explanations. Schmittom (2006) reported that the full utilization of little space from water using, may be give maximum fish production and improve the profitability of the fish farm, from through intensive culture. Thus, in the same direction Abdelhamid (2011) recommended on experiment basis carried out for 6 months in Manzala Lake on rearing Nile tilapia and Silver carp, whether under monoculture or polyculture at different stocking densities four floating net cages (10×10×3m) were used.

Growth performance of Silver carp is shown in (Table 4). Mean initial body weights for Silver carp in all stocking density treatments were 73.67g. The growth performance for fish represented by the averages of final weight, average weight gain, ADG (g), RGR and SGR were significantly affected by stocking density (P ≤ 0.05), (Table 4). The growth performance for fish was reflected in positively increased of T2 compared to T3, T4 and T5

Table (4): Growth performance of Nile tilapia and Silver carp in floating net cages under different mono-and polyculture rearing and stocking rates systems:

Cage	Average initial weight (g)	Average final weight (g)	Average weight gain (g)	ADG (g)	RGR (%)	SGR (%/day)
Growth performance parameters of Nile tilapia						
T 1	19.30	84.13[b]	64.83[b]	0.523[b]	335.9[b]	1.187[b]
T 2	19.30	100.58[a]	81.28[a]	0.655[a]	421.1[a]	1.331[a]
T 3	19.30	96.67[a]	77.36[a]	0.624[a]	400.8[a]	1.298[a]
T 4	19.30	97.46[a]	78.16[a]	0.630[a]	405.0[a]	1.305[a]
±SEM	0.000	1.236	1.232	0.0100	6.382	0.010
P-value	1.00	0.0001	0.0001	0.0001	0.0001	0.0001
Growth performance parameters of Silver carp						
T 2	73.67	227.5[a]	153.8[a]	1.240[a]	208.8[a]	0.90[a]
T 3	73.67	219.2[ab]	145.5[ab]	1.173[ab]	197.6[ab]	0.87[ab]
T 4	73.67	179.5[c]	105.8[c]	0.853[c]	143.7[c]	0.71[c]
T 5	73.67	196.7[bc]	123.0[bc]	0.992[bc]	167.0[bc]	0.78[bc]
±SEM	0.000	9.44	9.44	0.076	12.81	0.037
P-value	1.00	0.014	0.014	0.014	0.014	0.123

Means in the same column having different letters significantly different (P ≤ 0.05).

The growth rates for Silver carp, over the 124 experimental days, expressed as means of ADG, RGR and SGR, were significantly (P ≤ 0.05) ranged, from 1.240g - 0.853g, 208.8% - 143.7% and 0.90% / - 0.71% /day, respectively, Table (4).

Table (5) the compression between Nile tilapia and Silver carp for growth performance. Nile tilapia was better than Silver carp in relative growth rate and specific growth rate. The differences between two species were highly significant (P ≤ 0.05). The same results was recorded by Abuo-sief *et al.,* (2012) that growth performance of different fish species, mean individual growth rate was highest for lower density and it was lowest for the higher density of each species with significant difference (P ≤ 0.05).

Table (5): Comparison of growth performance between Nile tilapia and Silver carp in monoculture system:

Cage	Average Final weight (g)	Average weight gain (g)	ADG (g)	RGR (g)	SGR (g)
Nile tilapia	84.13[a]	64.83[a]	0.523[a]	335.9[a]	1.187[a]
Silver carp	196.7[b]	123.0[b]	0.992[b]	167.0[b]	0.78[b]
±SEM	10.59	10.59	0.085	14.98	0.042
P-value	0.0002	0.0039	0.0039	0.0003	0.001

Means in the same column having different letters significantly different (P ≤ 0.05).

These values are non–agreement with those reported by Bakeer (2001) who found that final body weight of Silver crap increased significantly ($P \le 0.05$) with lower stocking density, daily gain (g) was between 2.49 and 3.629, specific growth rate (SGR) between 2.67 to 2.82 and total fish yields of Silver crap were 1277.95 and 2482.44 kg / cage when the their stocking rate was 2500 and 5000 fish /cage under the some condition and the site of cages.

Table (6) shows that feed conversion ratio and feed utilization were highly significant affected by stocking density ($P \le 0.05$). Feed intake and protein productive value was the high significantly ($P \le 0.05$) in T3 and T2 than that recorded in T1 and T4. The feed conversion ratio was significantly ($P \le 0.05$) differed between groups. The values 2.61 in T1 group were decreased in T2, T3 and T4 by addition Silver carp fish in the cages.

Feed intake (FI), protein efficiency ratio (PER), protein productive value (PPV) and energy utilization (EU) were increased significantly ($P \le 0.05$) in the cages containing Silver carp, also protein efficiency ratio improved significantly ($P \le 0.05$) in T2 compared with T1, T3 and T4 and energy utilization was the high significantly ($P \le 0.05$) in T2, T3 and T4 than that recorded in T1 (Table 6).

Nearly similar results were found by Asase (2013) who found that the FCR of Nile tilapia fingerlings (2.12) were significantly affected by stocking densities ($P \le 0.05$).

Table (6): The effects of different stocking density on feed intake and nutrients utilization of treatments at the end of the experiment:

Treatment	FI	FCR	PER	PPV	EU
T1	168.9^{c}	2.61^{a}	1.59^{c}	21.48^{c}	11.97^{b}
T2	174.1^{ab}	2.14^{c}	1.94^{a}	24.06^{ab}	15.70^{a}
T3	177.2^{a}	2.29^{b}	1.81^{b}	25.83^{a}	15.83^{a}
T4	172.3^{bc}	2.20^{bc}	1.88^{ab}	23.91^{b}	15.32^{a}
±SEM	1.405	0.040	0.030	0.576	0.346
P-value	0.009	0.0001	0.0001	0.0016	0.0001

Means in the same column having different letters significantly different ($P \le 0.05$).

Table (7) shows that carcass composition of Nile tilapia in cages 1, 2, 3 and 4. The values of dry matter (DM), crude protein (CP), ether extract (EE), energy content (EC) and ash of the experimental samples of the cages were significantly different ($P \le 0.05$) between treatments. Treat. 2 gave the high values of EE and EC compared with that of Treat 1, 3 and 4, respectively. The CP and ash of Nile tilapia at the start the experiment was higher than other traits at the end of the experiment.

Table (7): Carcass chemical composition of Nile tilapia and Silver carp groups at the start and at the end of the experiment.

Treatment /Variables.	DM	CP	EE	EC	Ash
Nile tilapia:					
At the start:	20.86	59.47	13.61	463.88	26.92
At the end:					
T1	22.72[b]	58.19[a]	21.54[d]	531.6[c]	20.26[a]
T2	22.27[b]	55.64[c]	28.55[a]	583.4[a]	15.80[b]
T3	24.30[a]	57.04[b]	26.19[c]	569.0[b]	16.76[b]
T4	22.74[b]	55.50[c]	27.49[b]	572.6[b]	17.00[b]
±SEM	0.405	0.306	0.188	2.483	0.358
P-value	0.033	0.0008	0.0001	0.0001	0.0001
Silver carp:					
At the start:	19.49	68.20	9.75	476.68	22.05
At the end:					
T2	16.09ab	70.33a	7.730b	469.6a	21.94c
T3	17.23a	67.31c	7.403b	449.5c	25.28a
T4	15.64b	68.47bc	7.450b	456.5b	24.08b
T5	17.01a	69.65ab	8.733a	476.68	22.05
±SEM	0.365	0.434	0.231	0.334	1.951
P-value	0.0451	0.0054	0.0117	0.0001	<.0001

Means in the same column having different letters significantly different ($P \leq 0.05$).

Table (7) shows that carcass chemical composition of Silver carp in Treat 2, 3, 4 and 5. The mean values of dry matter, crude protein, ether extract, energy content and ash of the examined samples were significantly different ($P \leq 0.05$). The carcass samples of Treat. 2 at the end experiment showed high values of CP, EE and EC, but it was less in DM and ash compared to the treatments 3 and 4, respectively. Carcass traits of Silver carp were highest in DM, EE and EC at the start of the experiment than at the end experiment.

The carcass composition of Nile tilapia was the center point in several studies from different side of views. In this respect, it was found from the proximate chemical analysis of Nile tilapia whole body including total lipids and total ash was significantly influenced by dietary protein level only (Abdel-Tawwab, 2012). On the other hand, changes in protein rate in their synthesis, deposition rate in muscle and ⁄ or different growth rate (Abdel-tawwab et al., 2006). In additionally, khalil et al., (2012) suggested that fish carcass composition in both male and female of Nile tilapia were took unclear trends between adult males and female within all treatments. Generally, there is a negative relationship between CP and crude fats in the chemical composition of Nile tilapia carcass. As well as, khalil et al., (2011) shows that carcass composition of tilapia species in cages site, whose DM, CP, EE and EC were significantly different ($P \leq 0.01$). while, ash increased significant in Nile tilapia among other tilapia species, as well as, khalil et al., (2015) reported that fish reared at high stocking density had significantly ($P \leq 0.05$) increased DM, EE and EC, while ash and CP were significantly decreased comported to the low stocking density rate. The previous results are in more or less help in explaining the present obtained finding.

Economic efficiency and conclusions

Table (8) shows the economic efficiency of Nile tilapia and Silver carp rearing of mono and polyculture under different stocking rates in floating net cages in Manzala Lake, Egypt. The results indicated that the total output, net return and economic efficiency as percentage were gradually increased with the increasing levels of Silver carp in cages 2, 3 and 4, respectively. Whereas, the economical efficiency EF% was less in cage 1 of tilapia (39.59%) than in cage 5 of Silver carp (200%) for monoculture system. It is important to monition that Silver carp in cage 5 fed on natural food in water only. This mean that no cost of feeding. Therefore, the total profit shows the best value in cage 5 in relation to all other cages. In the same time, the cages 2, 3 and 4 shows the same trend of total profit related to the stocking rates of Silver carp in the cages. The results indicated that the best stocking rate between tilapia and Silver carp of economic efficiency was 88% tilapia and 12% Silver carp.

Table (8): Illustrates input, output and economic efficiency per cage on the basis of the footnote equations:

Cage	Total input of cage (LE)	Total output of cage (LE)	Total profit of cage (LE)	Economic efficiency* %
T1	4450	6210	1760	39.59
T2	4600	7310	2710	58.98
T3	4715	7680	2965	60.95
T4	4680	7980	3300	70.47
T5	1200	3600	2400	200

Total feed costs per treatment (cage) (LE / Kg diet) = feed costs per one kg diet X feed intake.**
Total outputs per treatment (cage) (LE / Kg) = fish price X total fish production*.**
Net return per cage (LE) = total outputs – total inputs.
Economic efficiency per cage (%) = (net return / total feed costs) X 100.
***Economic efficiency (return x 100 / total input ⁄ cage), feed cost ⁄ Kg diet according to the local prices year 2013 for fish and feed, where 1 US dollar = 7.50 L.E.**
****The price of 1kg diet used in the present study was (3.20) LE at Egypt (2013).**
***** Total fish production per treatment (cage) = final number of fish X fish weight gain.**

The same results were recorded by many researches, such as Asase (2013) they recommended that Nile tilapia fingerlings stocked in cages at densities of 50 fish 1m^3, 100 fish 1m^3 and 150 fish 1m^3, The economic feasibility, profit index were not significant ($p \leq 0.05$) between the 100 fish 1m^3 and 150 fish 1m^3 treatment. The production, net yield and gross profits showed significant ($p \leq 0.05$) increase with higher stocking densities. Meanwhile, Beveridge (2004) reported that feed cost is usually the highest variable cost averaging around 50 to 60% of total cost. The second highest variable cost is usually seed or fingerlings costs and can range from 10to 40% of variable cost. While, watanabe *et al.,* (1990) reported appositive relationship between stocking density have also been reported be Alemu (2003) and Gibtan *et al.,* (2008) for Nile tilapia.

In the same trend, Abdelhamid (2011) recommended that as experiment was carried on rearing Nile tilapia and Silver carp, whether under monoculture or polyculture at different stocking densities, four flouting net cages. Feed cost 1kg body weight gain (7.78 & 5.89 L.E.) and economic efficiency (144.5 & 77.9%), respectively. Moreover, the monoculture of all males mono-sex Nile tilapia was also the best treatment in return followed by polyculture treatment. Whereas, Abuo-sief *et al.,* (2012) found that the best species combination (crop composition) ratios in polyculture system was (60% tilapia + 10% common carp + 10% silver carp + 20 catfish) which recorded the highest fish production and net profit. Also, Mandel *et al.,* (2012) found cage-pond integration system of and Nile tilapia with carps is the best technology to increase production, where as integration of tilapia and carp for profitability.

The present obtained results lead to the importance using the balanced pelleted complete diet for feeding tilapia fish especially under intensive cultured (monoculture); as well as, depending of green water for fed Silver carp in intensive monoculture. Also, showed the superiority of stocking densities in polyculture system were 88% and 12% for Nile tilapia and Silver carp, respectively under Manazala Lake environment.

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تأثير مستويات تخزين مختلفة لأسماك للبلطى النيلى والمبروك الفضى المستزرع بنظام أحادي أو مختلط فى أقفاص عائمة في بحيرة المنزلة، مصر.

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صممت هذه التجربة لدراسة تأثير نظم الأستزراع المكثف لأسماك البلطى النيلى والمبروك الفضى بمستويات تخزين مختلفة في أقفاص عائمة. وكان الوزن الأبتدائى عند التسكين للبلطى النيلى (وحيد الجنس)١٩.٣٠ جرام والمبروك الفضى ٧٣.٦ جرام. تم أقلمة الأسماك لمدة أسبوع واحد في أقفاص عائمة, ثم توزيعها عشوئيا علي خمس أقفاص. تم تسكين القفص الأول بالبلطى النيلى فقط بمعدل ٣٠ سمكة / متر٣، بينما القفص الثانى والثالث والرابع تم تسكينهم بالبلطى النيلى والمبروك الفضى بمستويات مختلفة بمعدل ٣٠ سمكة / متر٣. في حين أن القفص الخامس تم تسكينه فقط بالمبروك الفضى بمعدل ٦ أسماك / متر٣. غذيت كل الأقفاص بعليقة صناعية (بينما أسماك المعاملة الخامسة تركت بدون تغذية صناعية مضافة لأنها تعتمد في تغذيتها على الغذاء الطبيعى من المياة)، وكانت العليقة تحتوى على ٢٦.٥٨% بروتين خام و طاقة كلية (٤١٠.٣٥ كيلو كالورى لكل ١٠٠ جرام مادة جافة)، وتمت التغذية مرتين يوميا (٨.٣٠ صباحا , ٣ مساء)، وكان معدل التغذية ٤% فى بداية التجربة وخلال فترة اجراء التجربة حتى نهايتها.

وتشير النتائج إلى أن أفضل معاملة كانت الأستزراع الأحادى للبلطى النيلى وحيد الجنس (٣٠سمكة / متر٣) ثم يليها الأستزراع المختلط بمعدل بلطى نيلى (٨٨%) ومبروك فضى (١٢%) من الكتلة الحية / قفص وذلك لتفوقها في الكفاءة الأقتصادية. بالأضافة إلي أن الأستزراع المكثف للمبروك الفضى (الأحادى) سجل أقل كفاءة أقتصادية لإعتماده على الغذاء الطبيعى للمياة فقط.

لذا توصى الدراسة بإستخدام عليقة متوازنة محببة في تغذية أسماك البلطى المستزرعة بنظام مكثف (أحادى الأستزراع السمكى) والأعتماد علي المياه الخضراء فقط في تغذية المبروك الفضى بنفس النظام. وأفضل معدل تسكين في نظام الأستزراع المكثف المختلط كان ٨٨% بلطى نيلى, ١٢% مبروك فضى. ومن الناحية البيئية يفضل عمل كنترول علي مصادر التلوث ببحيرة المنزلة للحصول على أنتاج عالى وأمن صحيا من الاسماك .