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The effect of farming density on the growth of common carp *Cyprinus carpio* L.1758 raised in floating cages in the Thi-Qar province of the Euphrates River using Iranian feed.

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Abstract:

From 18/10/2021 to 18/3/2022, samples were collected from private farms to cultivate fish in floating cages on the Euphrates River. Finally, different densities were studied to obtain the best farming density, in which three densities were used (63-43-23 fish/m3) by several 500 fish for the first process, 1000 fish for the second process, and 1500 fish for the third process, with a weighted rate of 100-120 gm, as a result, an originally Iranian feed was used for all three processes. The results of statistical analysis revealed that there are abstract differences (p0.05) in total weight gain, with the first process outperforming the rest of the process (130.0 gm/fish), followed by the second process (90.0 gm/fish).

As well as the third process (75.0 gm/fish). Furthermore, the relative growth rate recorded when performing the statistical analysis that there are abstract differences (p0.05), in that the first process outperformed the second and third processes, with the first process outperforming the second (2.67 percent), the second (2.09 percent), and the third process outperforming the first (2.67 percent) (1.81 percent). Because of the existence of abstract differences in the relative growth rate between the experiment months, the first process outperformed both the second and third processes. The first process has the highest relative growth rate (130.0 gm/fish), the second process has the highest relative growth rate (90.0 gm/fish), and the third process has the highest relative growth rate (75.0 gm/fish). Statistical analysis of the food conversion rate and food conversion efficiency revealed that there are abstract differences (p0.05) during the experiment months. So the food conversion rate recorded in the first process outperformed the second and third processes, and the highest food conversion rate was recorded for the first process (32.7 feed/gm), followed by the second process (22.5 feed/gm), and finally the third process (15.0 feed/gm). However, the food conversion efficiency demonstrated that the third process outperformed the first and second processes, while the second process outperformed the first. Furthermore, the food conversion efficiency values for the third process (12.5 percent), the second process (10.0 percent), and the first process (10.0 percent) are shown (7.22 percent).

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I. Introduction

Fish farming in floating cages is considered one of the techniques that are privileged with a gain of production proportion through the area unit, as well as administration facilitation and the possibility of disease surveillance and control (2009 Olubunmi). So the significance of fish is not solely based on its food value, but it is also used as a fish powder made from fish leftovers that are unfit for human consumption, which is also mixed with feed and can access into the food of poultry and other animals, so good food is important for both the human and the consumer as the fish protein is described as high quality and easily digestible (2012, Ouda). Thus, carp fish has an advantage in Iraqi farms because it is matured with high growth weights, it is simple to provide its food requirements, and it is resistant to environmental circumstances. It also has consumer acceptance, adaptation to a polluted environment, tolerance to a wide temperature range, and the ability to adapt to agricultural systems (2013 Tang and others, 2009, Al-Faer and others).

One of the things that should be observed inside the floating cages in the farming density, which should be studied and have the necessary fish number acknowledged for farming, as well as the type of feed given to them, because density is considered one of the influential factors on fish growth and production gain. So the current speed, cage size, type of farmed fish, and length of growth duration are all factors in farming density (2014, Dhahir).

II. Materials & work methods

The experiment was carried out in one of the areas related to Thi-Qar province – Al-Nasiriyah city, in one of the private farms in Al-Shamamrah south of Al-Nasiriyah city, which is approximately 5-6 kilometers from the Al-Nasiriyah center according to coordinates (31.01168°N, 46.30371°E). as samples were collected monthly and for 6 months from the study station beginning on October 18, 2021, and ending on March 18, 2022, the growth standards, are total weight gain, relative growth rate, specific growth rate, food conversion rate, and food conversion efficiency, were measured as follows:

total weight gain (gm)= final weight (gm)- primary weight gm (2013,Philpose)

relative weight rate (gm/day) = normal algorithm for final weight – normal algorithm for primary weight / time period between the two weights X 100 (1957, Brown) .

relative growth rate % = final weight – primary weight /primary weight X 100 (1978, Utne) .

Food conversion rate = quantity of eaten feed (gm) / weight gain (gm) (1957, Brown).

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Food conversion efficiency = (weight gain gm/ feed weight gm) X 100 (1978, Uten).

III. Discussion and results

Table (1) shows the total weight gain, which recorded a high weight gain (130.0 gm/fish) in October, while the second process recorded (90gm/fish) and the third process recorded (75.0 gm/fish), and it is noticeable that the first process outperformed the two remaining processes, as well as abstract differences on the level (p0.05). So the current study results agreed with Abdul Hadi's (2021) findings that the best weight gain occurred when the density was low in number. It also agreed with Abbas (2016), who stated that the best weight gain occurred when the density was low. Thus, it agreed with the results obtained by Al-Bahadli (2011), who obtained a weight gain of 241 gm in a density of 40 gm/fish, which is close to the current results. The current study's findings differed from those of previous studies, which found that people with high densities gained more weight. Mordas and Al-Janabi (2012) and Tahir (2014).

As a result, the current study results showed that there are abstract differences in total weight gain between the processes. The first process outperformed the second and third processes, indicating that statistical analysis results show that there are abstract differences on the level (p0.05) between the processes.

Table (1) : shows the total weight gain (gm/fish) for common carp farmed in floating cages at various densities during the experiment months.

Month / transaction	October	November	December	January	February
T1	130.0 a±0.677	120.0 a±0.479	120. a±0.377	110.0 a±0.377	130.0 a±0.377
T2	90.0 b±0.577	80.0 b±0.677	70.0 b±0.577	80.0 b±0.373	100.0 b±0.577
T3	75.0 c±0.500	75.0 c±0.477	70.0 b±0.677	80.0 b±0.677	100.0 b±0.565
morale	*	*	*	*	*

(Arithmetic rate ± measurement error)

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In table (2) the first process was surpassed in the first three months of the relative growth rate, which are October and November, and January, so the relative growth rate (0.96, 1.40, 2.67 gm/fish) respectively. whereas in January and February, the third process outperformed the first and second processes in terms of relative growth rate. As a result, the second process outperformed the first process in the last two months, demonstrating that there are abstract differences between the first, second, and third processes, with the first process outperforming all others. Furthermore, the statistical analysis results revealed that there are insignificant differences between the processes on the level (p0.05).

Table (3) of the relative growth rate shows the outperformance of the first process in the three months combined October, November, and January, so sequentially the relative growth rate recorded (130.0, 52.17, 34.28 gm/fish). As a result, the current study's findings agreed with some of the previous studies' findings (Al-Bahadli, 2011, Abbas and others, 2016, Abdul Hadi, 2021). and the studies revealed that the outperformance was with the lowest density. So there are some studies for densities in closed systems, and the Ghulam Study (2020) found that the relative growth rate and relative growth within the density of medium quantity outperformed the current study. As a result of the statistical analysis results, there are abstract differences between the process over the level (p0.05) between the experiment months.

Table (2): shows the relative growth rate of common carp fish farmed in floating cages at various densities during the experiment months.

Month / Transaction	October	November	December	January	February
T1	2.670 a±0.005	1.400 a±0.057	0.960 a±0.005	0.670 c±0.005	،،0.710 c±0.005
T2	2.090 b±0.005	1.130 b±0.005	0.740 c±0.005	0.710 b±0.005	0.750 b±0.005
T3	1.810 c±0.005	1.200 b±0.057	0.770 b±0.005	0.740 a±0.005	0.780 a±0.005
morale	*	*	*	*	*

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(Arithmetic rate ± measurement error)

Table (3): shows the relative growth rate (gm/fish) of common carp farmed in floating cages at various densities during the experiment months.

Month / transaction	October	November	December	January	February
T1	130.00 a±0.577	52.170 a±0.005	34.280 a±0.005	23.400 b±0.057	22.400 c±0.057
T2	90.00 b±0.577	24.100 c±0.057	25.920 c±0.005	23.520 b±0.005	23.800 b±0.057
T3	75.00 c±0.577	24.850 b±0.005	28.00 b±0.577	25.00 a±0.577	25.00 a±0.577
morale	*	*	*	*	*

(Arithmetic rate ± measurement error)

The food conversion rate is defined as the percentage difference between the presented food weight and the wet weight gain for fish, which is used to calculate food efficiency and feed efficiency.

Table (4) displays the first process's superiority over the second and third processes, as well as the experiment's duration. The first process also demonstrated a higher rate of food conversion (32.3, 32.7 feed/gm) in both January and February. Furthermore, for December and November, the second process demonstrated a higher rate of food conversion (22.5, 21.4 feed/gm). In January and February, the third process had a higher rate of food conversion (14.3, 15.0 feed/gm). As a result, the statistical analysis revealed that there are abstract differences in the level (p0.05) between the processes throughout the experiment. Some studies had similar results to the current ones, and the conversion rate outperformed the lower number densities, as shown by the study results (Al-Bahadli, 2011, Taher and others, 2018, Abdul Hadi, 2021, Shuhaib, 2021).

The food conversion efficiency, on the other hand, is the inverse of the food conversion rate but expressed as a percentage, which is standard for determining the usefulness range of eatable food. Table (5) shows how

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the third process outperformed the first and second processes throughout the experiment. Furthermore, it demonstrated a higher food conversion efficiency (9.3%, 12.5%) for December and November, whereas the second process demonstrated food conversion efficiency (6.6, 10%) for October and November sequentially. In addition, the first process has a higher food efficiency (7.2, 5%) in October and November. As a result, the statistical analysis results revealed that there are abstract differences in the level (p0.05) between the processes over the study months.

So the current study results differed from some previous studies on food conversion efficiency, such as those (Abdul Hadi, 2021, Shuhaib, 2021), in which the food conversion efficiency decreased as farming density increased, whereas, in the current study, farming density increased as farming density decreased.

Table (4): Food conversion rate (feed/gm) for common carp fish farmed in floting cages at various densities.

Month / transaction	October	November	December	January	February
T1	13.843 a±0.003	20.00 a±0.577	25.00 a±0.577	32.700 a±0.057	32.300 a±0.057
T2	10.00 b±0.577	15.00 b±0.577	21.420 b±0.005	22.500 b±0.057	21.000 b±0.577
T3	8.00 c±0.577	٨٥،10.660 c±0.005	14.280 c±0.005	15.00 c±0.577	14.333 c±0.881
morale	*	*	*	*	*

(Arithmetic rate ± measurement error)

Table (5) Food conversion efficiency (feed/gm) for common carp fish farmed in floating cages at various densities.

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Month / transaction	October	November	December	January	February
T1	7.220 C±0.005	5.00 c±0.577	4.00 b±0.577	3.050 c±0.005	0.005 c±3.090
T2	10.00 b±0.577	6.660 b±0.005	4.6600 b±0.005	4.440 b±0.005	0.005 b±4.760
T3	12.500 a±0.057	٨٥9.370 a±0.005	7.00 a±0.577	6.660 a±0.005	7.1400 a±0.005
morale	*	*	*	*	*

IV . Conclusions

1- The farming density of few quantities is higher on rate for weight gains.

2- High output in cages with a higher farming density

3- Investigating various types of feed and comparing them to local and imported feed.

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