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Breeding of Shrimps *Metapenaeus affinis* (H. Milne Edwards, 1837) in Cages

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Abstract Breeding of shrimp *Metapenaeus affinis* in submersible cages (SC) and floating cages (FC). Grown were with an average initial weight of 2.350 ±0.636 and 2.383 ±0.400, which were fed on the industrial diet prepared for 45 days. Some growth measures as follows (FC and SC): weight increase (g) 1.880 ±0.170 and 0.884 ±0.011. Daily growth rate (% g/day) 0.042 ±0.004 and 0.020 ± 0.001. Feed conversion rate 2.476 ±0.487 and 1.462 ±0.350, relative growth rate (%) 82.031 ±14.993 and 38.008 ±6.858. While its survival rate (%) was 90 ±7.071 and 75 ±7.071, all this respectively. Some environmental conditions measures were temperature (℃)= 27.667 ±3.055, salinity (mg/l)=1.603 ±0.329, pH=7.783 ±0.226, dissolved oxygen (mg/l)= 6.863 ± 0.228. The results of the statistical analysis showed significant ($P < 0.05$) differences in FCR and in RGR between the shrimp cultured in the SC and FC, while there were no significant differences in the rates of daily growth and increase in weight and survival rates and weekly weight.

Keywords *Metapenaes affinis*; Cages; Breading of shrimps

Background

Shrimps are cultured mainly in ponds, cages, pens, and raceways, the growth rate of penaeid shrimps in cages is greater than ponds (Sivanandavel and Soundarapandian, 2010).

Most respondents were keen to get involved with prawn cage culture, because prawns are high-value fish. It is reported that the current local market price for prawns (U.S. $4-6/kg) is four to five times higher than those for Indian major carp or tilapia. Moreover, fishers reported that their income from fishing has fallen due to declined catch because of overfishing, use of destructive fishing gear, environmental degradation, siltation and human encroachment. On the other hand, fishers suggested that cage culture may require relatively modest investment, as cages can be made locally with available bamboo and netting (Ahmed, 2010).

Shrimp culture in floating cages has been studied as an alternative to the traditional shrimp breeding by many researchers (Li and Chen, 1987; Walford and Lam, 1987; Martinez-Cordova, 1988; Srikrishnadhas and Sundararaj, 1990). Krishnan et al. (1983) compared the growth of penaeide shrimps in floating cages and another fixed in the waters of its inhabitants. Li and Chen (1987) studied his experience in the culture of Chinese shrimp in cages. Martinez-Cordova (1988) studied the cultivation of blue shrimp *Penaeus stylirostris* in floating cages. While Srikrishnadhas and Sundararaj (1993) reported studies on the growth of marine shrimp in floating cages.

Paquotte et al. (1998) studied the intensive cultivation of *Penaeus vannamei* shrimp in floating cages. Sivanandavel and Soundarapandian (2010) studied the effect of density on the growth and survival of Indian *Penaeus indicus* shrimp in floating cages in the water. Post-larvae of shrimp *Penaeus monodon* were kept in floating cages (0.5 m^3) and were kept in ponds for 30 days, he survival rate was between 65 – 78% with a stocking density of 100-400 PL/$m^2$from 1. 5 g to 17.8 g at a density of 22 juvenile/m^2in cages with dimensions of (5 × 4 × 1) m^3(Maheswarudu et al., 2016). The current study aims to give a picture of the possibility of using shrimps by booking and raising them in cages in Iraqi waters.

1 Materials and Methods

Sample of shrimps, brought from the Shatt Kerma Ali, Basrah city - Iraq, were caught using cinnamon nets, where shrimps were isolated and placed in a flask box and transported to laboratory. The experiment was designed on the

basis of four cages - tubs fixed near the muddy mud shelf to be bottom connected to the bottom. The other two pellets were fixed three meters from the shelf in a floating way, which is not connected to the muddy floor. In each basin, 20 young shrimps were then transferred to submersible cages (SC) and floating cages (FC), each has two cage dimensions 75 × 75 × 75 cm^3 made from a metal frame with a 1 mm slotted mesh, which was set in one side of a pond belonging to the aquaculture Station of the Center for Marine Sciences. Feeding rate of once daily, while feeding levels were depending on Van Wyk et al. (1999). The experiment lasted 45 days, during which some environmental conditions were measured of temperature, salinity, pH and oxygen content. The weights were calculated by an electric scale and measurements were made every week after the maximum amount of moisture of the shrimp body was eliminated.

The estimate of daily food intake was based on New (1987):
Amount of daily food= (number of adolescents × average weight × nutrition ratio) / 100.

The following growth measures were based on Jobling (1993):
Total weight gain (g)= Final weight (g) - Primary weight (g).
Daily growth rate (% g/day)= final weight (g) - primary weight (g) / duration of experiment (days).
Relative growth rate (RGR)= Increase Weight (g) / primary weight (g) × 100**.**

Survival rate was also calculated based on Teng et al. (1985):
Survival rate% = (final number at the end of the experiment / total number at the beginning of the experiment) × 100.

The utilization rates of food were based on Hepher (1988):
Feed conversion rate (FCR)= amount of food intake (g) / weight increase (g).

1.1 Statistical analysis

The results were statistically analyzed using the Statistical Pakage Social Science (SPSS) version 17 of 2007, and the studied factors were tested using the least significant difference (L.S.D) and below the level of significance 0.05.

2 Results

2.1 Environmental conditions

Table 1 shows some environmental conditions in submersible cages (SC) and floating cages (FC), temperature ranged between 25-30 ℃, salinity (mg/l) 1.3-1.9, pH 7.5-7.8, while the dissolved oxygen (mg/l) was between 6.6-7.0.

Table 1 Some environmental conditions in cages

Parameter	Mean ± SD
Temperature (℃)	27.667 ± 3.055
Salinity (mg/l)	1.603 ± 0.329
pH	7.783 ± 0.226
Dissolved oxygen (mg/l)	6.863 ± 0.228

2.2 Growth rates

It showed the statistical analysis significant ($P < 0.05$) differences in FCR and in RGR between the shrimp *M. affinis* cultured in the SC and FC, while there were no significant differences in the rates of daily growth and increase in weight and survival rates and weekly weight (Table 2).

There were no significant differences in Figure 1 between the weekly weights of shrimp *M. affinis* grown in floating cages and that in submersible cages.

Table 2 Growth performance of *M. affinis* in submersible cages (SC) and floating cages (FC) for 45 days (mean ± standard deviation)

Parameters	FC	SC
Mean initial body weight (g)	2.383 ± 0.400	2.350 ± 0.636
Mean final body weight (g)	3.275 ± 0.389	4.230 ± 0.806
Total weight gain (%)	0.884 ± 0.011	1.880 ± 0.170
Mean daily growth rate (g/day)	0.020 ± 0.001	0.042 ± 0.004
Feed conversion rate (FCR)	2.476 ± 0.487	1.462 ± 0.350
Relative growth rate (%)	38.008 ± 6.858	82.031 ± 14.993
Shrimp survival (%)	76 ± 5.659	92 ± 5.657

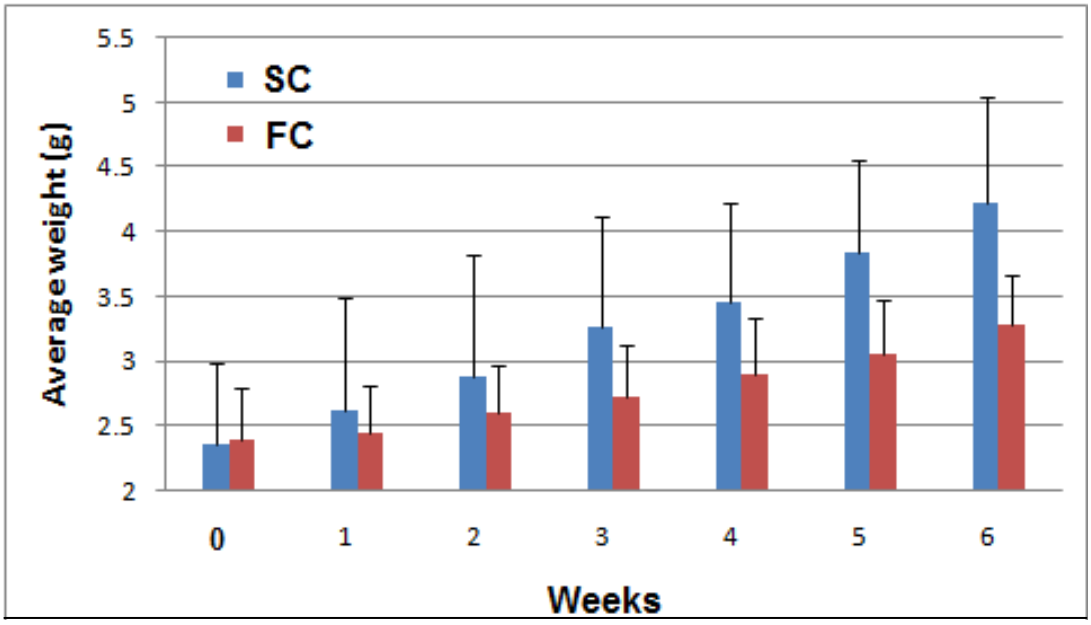

Figure 1 Breeding of shrimp *M. affinis* in submersible cages (SC) and floating cages (FC), fed on diet for six weeks

3 Discussion

Cage culture are a reliable method of pool representation and are more economical and are more representative of the environmental conditions of the laboratory and are a compromise for shrimp research applications (Castex et al., 2008).

In present study, it showed feed conversion rate, weight increase, daily growth and relative growth when shrimp culture in submerged cages gave or were better than in shrimp culture at floating cages, due to the following reasons. At the bottom through the pores and capture lack of loss of food given to the shrimp during the submersible cages while getting in a part of the food in the shrimp in the floating cages through the descent of part to the bottom one way or another, because of the nature of the living shrimp and the border with the bottom and lack of movement by immersing his body in the bottom during the submersible cages compared with floating cages, which consume large energy through the large movement to maintain its balance and adaptation. And the results of the present study have high survival rates.

And they are consistent with several studies, including. Cuvin-Ararlar et al. (2009) which mentioned that the daily growth rates range between 0.11-0.24 g/day and feed conversion rate range 1.53-165 in cage culture of *Litopenaeus vannanei*. While Maheswarudu et al. (2016) showed that the rate of culture 1179 per m^3 and the number of feeding times variable, FCR was 3.9, and the weight increases from 0.030 to 0.590 g and the survival rate 88.9% farmed of shrimp *P. monodon* in floating cages during 45 days. Siddharaju and Menon (1982) observed in the lower survival rate of 97%, but in the higher stocking density of 20/m^2 for the culture of *P. monodon* in the cages. In the present study the survival rate recorded in SC was better than FC of previous works. Krishnan et al. (1983) observed the survival rates of 56-59% in the higher stocking density of 25/m^2 in floating

cages and fixed cages for *Penaeus indicus*. Environmental conditions were more favorable for shrimp farming and were consistent with many studies. Ahmed (2010) refers to temperature (℃) 29-30, pH 8.3-8.6, dissolved oxygen (mg/l) 4.5-5.1 and high salinity (mg/l) during rearing of prawn *Macrobrachium rosenbergii* in cages. Maheswarudu et al. (2016) showed that the temperature ranged between 26-32, dissolved oxygen between 3.9 to 4.5 and pH between 8.1 to 8.3.

Although there has been a good increase in the amount of shrimp cultivated in cages, the increase in weight may be higher due to several factors, such as the inability of shrimp to benefit from benthic nutrition, the use of a diet with a protein content not exceeding 30%, shortening the duration of the culture, and other shrimp larvae go to breeding ponds, especially larvae and sprigs of shrimp, which led to competition for food, as well as there may be another reason that affects the growth of shrimp, but due to environmental factors, including the absence of fans to flop water for the work of waves and currents of continuous water favored farmed shrimp, especially that cages placed in the basins originally static.

Ghosh et al. (2016) had a feeding ratio of one to four times daily, feeding and harvesting after 68 days, prawns *L. vannamei* were grown at a weight of 0.86 g and with a density of 1060 m^2 in Floating Cages, monoculture and mixed farming, the final weight was 13.3-13.5 g, 64.7 to 76.8% and feed conversion rates between 2-1.6 and 0.18 to 0.19 g respectively, referring to temperature (℃) 29-30, pH 7.4-8.2, dissolved oxygen (mg/l) 3.6-4.2 and salinity (mg/l) 17-28.

From Figure 1, weekly weights of shrimp cultured in submersible cages and floating cages were observed that weights at submersible cages were the best in 45 days, although there were no significant differences between them. This is a good indicator of freshwater cage culture in freshwater and these studies suggest that the quality of pond water, particularly lake basins, should be maintained to obtain an increase in production of submersible cage culture which is more successful for raising shrimp with other habitats and benefiting from fish ponds in shrimp culture with submersible cages and obtaining high production and multiple, while floating cages are the best in running water, especially deep water at sea coasts.

Authors' contributions

I have done all the research requirements and become this final form.

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