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EFFECT OF STOCKING DENSITY ON GROWTH RATE, FEED UTILIZATION AND PROFITABILITY OF EUROPEAN SEABASS DICENTRARCHUS LABRAX REARED IN FLOATING CAGES

By

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ABSTRACT

The effect of stocking density on growth rates, feed utilization efficiency and profitability of European seabass, ***Dicentrarchus labrax*** *reared in floating cages was investigated. Fingerling fish (2.9 g) were stocked in 120 m^3 floating cages (10x10x1.2 m) placed in brackishwater canal near Damietta, Egypt. Each cage was assigned to one of five stocking densities; 30, 35, 40, 45, and 50 fish/m^3. The fish were fed minced trash fish* (***Tilapia zillii***) *at a rate of 5-10% of their body weights per day, divided into two feedings, for 16 months. Water temperature (C), oxygen content (mg/l), salinity, ammonia, and alkalinity were measured weekly throughout the study. Growth and survival rates as well as feed conversion efficiency were depressed with increasing stocking density. Final weight (g/fish) recorded was 234, 221, 206, 187 and 166 g at stocking density of 30, 35, 40, 45 and 50 fish/m^3, respectively. The best economic fish performance, survival and profit index were achieved at a density of 35 fish/m^3. The cost/earning analyses of the results indicated that cage culture of European seabass in brackishwater in Egypt is highly profitable.*

INTRODUCTION

European seabass, ***Dicentrarchus labrax*** is among the most esteemed and demanded fishes in European and Mediterranean countries. The increased demand, concomitant with a shortage in sea bass commercial production has resulted in a sharp increase in their market prices. Therefore, the culture of sea bass has been extensively practiced in many European and Mediterranean coasts (Barnabe, 1974, 1983; Barahona-Fernandes and Girin, 1976; Metailler ***et al.***, 1980, 1981; Barnabe and Billard, 1984; Tsevis ***et al.***, 1992; Barnabe and Guissi, 1993). However, only recently, a great attention has been given to sea bass artificial breeding and larval culture (Barnabe and Billard, 1984, Barnabe and Guissi, 1993).

The present study was conducted to evaluate the effect of stocking density on the performance and profitability of ***D. labrax*** reared in floating cages placed in Shatta brackishwater canal, near Damietta, Egypt.

MATERIALS AND METHODS

Fish and culture facility

Fingerlings of ***D. labrax*** used in this study were collected from the Mediterranean coastal waters, near Damietta branch of the Nile River during the month of May 1995. The fish are usually aggregated in great numbers in shallow, coastal waters during spring months. Fish were collected by dragging a small net (2 mm mesh size) alongside the coast. Fingerlings of approximately similar weight (2.9 g) were stocked into 5 120 m^3 floating net-cages of equal dimensions (10 m x 10 m x 1.2 m) at 5 densities; 30, 35, 40, 45 and 50 fish/m^3. The cages were placed in Shatta brackishwater canal, near Damietta, Egypt. The fish were acclimated in the cages for 2 weeks to adapt them to culture conditions and feeding regime in captivity. At the end of conditioning period, about 20-30 fish were netted from each cage, weighed to the nearest 0.1 g and their average initial weight was recorded.

The fish were hand fed minced trash fish (***Tilapia zillii***) at a rate of 5-10% of their body weight, divided into 2 feedings (early morning and late afternoon) for 16 months (from June, 1995 to September, 1996). A monthly sample of about 50 fish was netted from each cage and weighed (collectively) to the nearest g, and the daily ration was readjusted accordingly. Mortality rate was also monthly recorded for each cage throughout the study period.

Hydrological analyses

Regular water samples were collected weekly from the cage sites for water quality analyses, during the course of the study. Water salinity (ppt), pH, oxygen contents (mg/l), NH_4-N (mg/l), alkalinity, and nitrite (NO_2) were analyzed according to APHA (1989) (Table 1), while surface water temperature was measured by a mercury thermometer at 14 hr.

Statistical analyses

A one-way analysis of variance (ANOVA) was used to test for the effects of stocking density on fish performance. Comparison between means was conducted when F-values were significant as described by Gill (1981). The appropriate regression analyses were also performed.

Table (1): Average monthly hydrological parameters tested during the course of the study.

Parameter	Jun' 95	July	Aug	Sep.	Oct.	Nov	Dec.	Jan' 96	Feb	Mar	Aprl	May	Jun	July	Aug	Sept
Temperatur (C)	29	31	33	28	23	19	17	10	9	17	23	26	31	35	33	27
Salinity (ppt)	10.6	6.3	5.4	4.8	4.9	5.1	6.6	6.5	6.3	7.2	9.3	10.5	10.2	6.6	5.8	5.4
Oxygen (mg/l)	3.2	2.1	3.2	3.3	5.2	6.7	6.8	7.3	8.5	8.3	6.7	6.2	3.1	2.5	2.6	3.5
pH	8.8	8.1	8.1	8.2	7.9	8.0	7.6	7.8	7.6	7.4	7.4	7.5	7.6	7.8	7.9	8.0

RESULTS AND DISCUSSION

The effects of stocking density of seabass on fish performance in the present study are shown in Table 2. The results demonstrated that fish growth rates, feed utilization efficiency and profit indices were inversely correlated ($P<0.05$) with stocking density (Fig. 1), as shown from the regression analyses (Table 3). At the lowest density (30 fish/m^3), the average final weight was 234 g, while the fish reached only 166 g at the highest density (50 fish/m^3). The same trend was observed for weight gain (%), average daily gain (ADG), feed conversion (FC), Incidence cost (IC) and profit index (PI). On the other hand, specific growth rates (SGR) was not significantly affected by stocking density. The growth

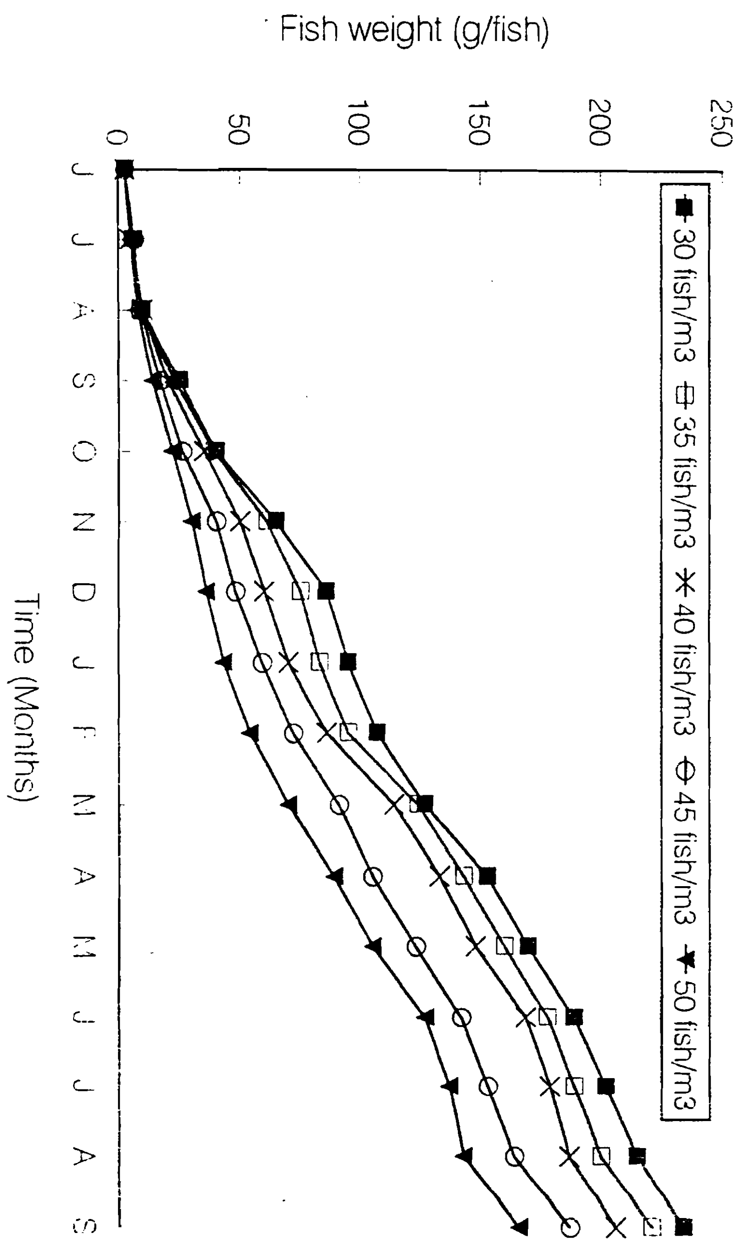

Fig. (1): Growth rates of *D. labrax* during the cource of the study.

Table (2): Performance of ***Dicentrarchus labrax*** reared in floating cages at 5 stocking densities. Figures in the same column with different superscripts are significantly different($P<0.05$).

Debsity fish/m^3	IW	FW	ADG[1]	SGR[2]	FC[3]	IC[4]	PI[5]	S[6]	Yield Kg/m^3
30	2.9	234± 51^a	0.48^a	0.91^a	3.81^a	8.08^a	3.71^a	84^a	3.78^a
35	2.9	211± 64^a	0.45^a	0.90^a	3.85^a	8.17^a	3.67^a	82^a	4.33^b
40	2.7	206± 52^b	0.42^{ba}	0.90^a	4.48^b	9.51^b	2.63^b	75^a	3.73^a
45	2.9	187± 43^c	0.38^b	0.87^a	4.34^b	9.22^b	2.17^c	66^c	4.10^b
50	2.8	166± 36^d	0.34^c	0.85^a	4.96^c	10.16^c	1.90^d	60^c	3.35^c

IW = Average initial weight (g/fish).
FW = average final weight (g/fish).
[1]average daily gain (g/fish/day).
[2]Specific growth rate = 100 (ln FW -ln IW)/ time (days).
[3]Feed conversion = g dry feed given/ g fish weight gain.
[4]Incidence cost = cost of kg wet feed/ kg of fish produced.
[5]Profit index = Value of fish yield/cost of feed. Values in Egyptian pounds, one pound = 0.29 US$ (1996).
[6]Survival (%).

Table (3): Regression analyses between stocking density (X) and fish performance (Y).

Parameter	***Regression equation***	***r***
Final weight	Y = 338.80 - 3.400 X	-0.995
ADG	Y = 0.694 - 0.007 X	-0.997
FC	Y = 2.056 + 0.056 X	0.920
IC	Y = 4.860 + 0.104 X	0.923
PI	Y = 7.012 - 0.104 X	-0.953
Survival	Y = 124.60 - 1.280 X	-0.984

obtained at low densities in the present study (30-35 fish/m^3) is acceptable. Similar growth rates were reported on ***D. labrax*** reared in polyculture system for 16 months (El-Ghobashy ***et al.***, 1993). However, fish performance obtained in the present study was lower than that previously reported (Rene, 1984; Pillay, 1990). It has been reported that ***D. labrax*** reared in floating cages in temperate areas at densities below 20 kg/m^3 takes about 2 years to reach a marketable size of about 250g (Pillay. 1990). When the fish were fed a balanced diet, they grew up to 300 g in 18 months. Furthermore, the fish reached 250-350 g in 14-15 months at a loading density of 1-6 kg/m^3 (Rene (1984). The difference in fish performance among researchers may be due to the differences in stocking densities, initial fish sizes, water quality, diets composition, feeding regimes and other prevailing culture conditions.

It was noticed that fish performance was reduced during coldest months (January and February) and hottest months (July and August) (Fig. 1). Mortality rates were also increased during these months. Similar effects of low water temperature on fish performance have been reported for golden gray mullet ***Liza aurata*** (Chervinski, 1982) and European eel, ***Anguilla anguilla*** (Degani ***et al.***, 1988). Meanwhile, the poor fish performance and increased mortality rates noticed in the present study at high water temperature (in summer) were probably due to the sharp depletion of oxygen content of the water. Therefore, supplemental aeration should be provided during these months. It has been reported that the optimum temperature for ***D. labrax*** was 22-25 °C and a temperature lower than 14°C has adversely affected fish growth (Pillay, 1990). Aeration, optimum pH (7.9-8.2) and regular water renewal significantly improved the growth and reduced mortality of the fish (Pillay, 1990).

At higher densities, the stress caused by crowding and extremely low or high water temperatures may have increased mortality rates (see Table 1). Cannibalism was also another important factor that may have affected the survival of seabass in the present study. Cannibalism was proven to be a major problem in mass culture of many fish species (Smith and Reay, 1991), including European seabass (Katavic ***et al.***, 1989) and Asian seabass, ***Lates calcarifer*** (Parazo ***et al.***, 1991). Therefore, A great attention should be given to size selection to avoid cannibalism among cultured seabass.

The cost/earning analyses of the present data indicated that cage culture of sea bass under the weather conditions prevailing in Egypt was cost-effective. The break-even (BE) price of the fish was 15 pounds, while the average retail price is about 25 pounds (see Table 4). Therefore, cage culture of sea bass in brackishwater in Egypt appears very profitable. However, improving the culture conditions will further increase the profitability of seabass culture. Blakstad ***et al*** (1996)

Table (4): Cost-earning analyses of the results obtained from the present study. Price in Egyptian pound (one US s = 3.39 pounds in 1996).

Income:			
cage	**Yield (kg)**	**Unit price**	**Total price**
1	453	33	14949
2	520	33	17160
3	447	25	11175
4	493	20	9860
5	402	20	8040
Total	2315		61184
Costs:	**Quantity**	**Unit price**	**Total cost**
Cage construction	5	2000	10000
(10000 x 25% depreciation/year			2500
Seeds	24000 fish	60/1000 fiish	1440
Feed	20 mt	800	16000
Salary	32 man/month	300	9600
Miscellaneous			3000
Total costs			30740
Net income	61184 - 30740 = 30444 LE.		
Net income/cost (%0	30444/30740 = 99%.		
Break-even price	30740/2315 = 13.28 LE.		
Break-even production	3040/25 = 1229.6 kg.		

demonstrated that cage culture of seabass was more profitable than land based installations (concrete tanks).

In conclusion, the present study indicated that 35 fish/m^3 was the optimum stocking density of ***D. labrax*** reared in floating cages. The cost/earning analyses indicated that cage culture of these fish is highly profitable in Egypt.

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