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Production of the European Seabass and the Gilthead Seabream Reared in Earthen Ponds

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ABSTRACT

The investigation's primary goal was to determine whether it is possible to raise the gilthead seabream *(Sparus aurata*) and European seabass in private earthen ponds. In this study, 22,000 gilthead seabream and European seabass, each weighing an average of 10g, were raised for a full year in the Fish Farm's one-feddan pond, which has a water depth of approximately 1.50 meters. The fish were fed an artificial diet consisting of 45 percent protein, and their final body weight was 200 ± 6.14g with a weight rise of 190g, while the gilthead seabream reached 230 ± 8.24, with a weight gain of 220g. For the seabass and seabream, the daily weight gain was 0.52 and 0.60, respectively. Moreover, the SGR was 0.63 and 0.83g/ day, respectively. Seabass and seabream had respective production costs of 146,192 and 159,180 LE/feddan, total production of 2.200 and 3.036 tons/feddan, total income of 330.000 and 485.760 LE/feddan, net return of 183,808 and 326,580 LE/feddan, and investment return of 1.26 and 2.05 LE/feddan. Compared to the seabass raised in clay ponds during this experimental investigation, the seabream demonstrated superior growth performance, feed consumption, and profit.

INTRODUCTION

The production of aquaculture is increasing globally, which is essential for both economic growth and food security **(FAO, 2017)**. Egypt produced 1.5 million tons of fish in total in 2015, of which 1.2 million tons (78%) came from aquaculture and the remaining 22% from inland and marine fisheries capture according to the FAO.

The gilthead seabream (*Sparus aurata*) and European seabass *(Dicentrarchus labrax)* are the two most significant aquaculture species in the Mediterranean, and they are the second most valuable species in the EU aquaculture industry **(Eid *et al.*, 2022)**. Seabass and intense seabream production started in the late 1980s and expanded rapidly in the 1990s. The market price has been declining steadily as a result of the industry's current problems with the increasing supply and failing to increase demand.

Eid *et al.* (2022) showed that the seabream had a greater market value and could be farmed with an investment return of 8.80 LE/return and a higher net return of 146,250

LE/ feddan. Seabream is a great option for pond cultivation according to the study's findings.

The European seabass are completely carnivorous and found throughout the Mediterranean region. *Dicentrarchus Labrax* L. is a highly prized table fish and is regarded as a delicacy in restaurants **(Kousoulaki *et al.*, 2015)**. Seabass can be fed artificial feed or inexpensive food, and their rapid growth is one benefit of producing them. Customers can also get flavor-infused white meat from it **(Singh, 2000)**. Seabass output is influenced by a number of parameters, including growth performance and survival rate. Improving the diet's quality can significantly boost agricultural output **(Gigorakis *et al.*, 2009)**.

In fish farms that use leftover fish as feed, the feed conversion ratio (FCR) typically ranges from 10 to 12kg of feed per kilogram of fish. However, based on **Haggag (2017)**, the FCR of 2.5 to 3kg of feed per kilogram of fish is frequently much greater in farms that use artificial feed. According to research, the European seabass can be raised in clay ponds with good growth performance, feed consumption, and net profit **(El-Dahrawy *et al.*, 2025)**.

Assessing the growth performance, feed utilization, survival, and economic evaluation of the seabass (*Dicentrarchus labrax*) and seabream raised in earthen ponds was the goal of the current study.

MATERIALS AND METHODS

Fish farm and environmental conditions

For a complete year, this investigation was done in clay ponds at a private fish farm in the Ismailia Governorate. A third of the water in each of the six clay ponds was switched every three days. Every day, a mercury thermometer and oxygen meter were used to monitor the water's temperature (°C), dissolved oxygen (DO) (mg^{-1}), salinity (ppt), and pH. Every two days, pH was measured on-site using digital electronic meters (Model YSI-58, USA, and Jenway Model-3).

Fish stocking and sampling

Twelve random samples of seabass and seabream fingerlings were collected during the study period, and fish were added to the pond at a rate of 22,000 per feddan. Upon completion of the experiment and pond emptying, a thorough census of all seabass and seabream was carried out, including weighing and numbering. The fingerlings were bought from a private fish hatchery in the Damietta Governorate, and at birth, they weighed an average of 10g $fish^{-1}$.

First, netting was used to catch the seabass and seabream in order to guarantee a complete harvest. The clay ponds were subsequently completely drained, and any fish that remained were hand removed.

Feeding fish

The fish was fed a commercial diet with 45% protein for the whole study period, which lasted 365 days. The gilthead seabream and European seabass were fed the same diet using pellets no. 4-5, which were made by a private fish feed company. Table (2) displays the nutritional makeup of the feed. Every fish was hand-fed three times a day at 8:30, 12:00, and 16:30.

Table 1. Chemical analysis and approximate composition of the experimental food fed to seabass and seabream raised in earthen ponds for a whole year

Ingredient	**%**
Fish meal (70% p)	35
Corn gluten meal (60% p)	15
Soybean meal (44% P)	30
Yellow corn	8
Fish oil	5
Vegetable oil	5
Vit&Min.Mix[1]	2
Chemical analysis (%)	
Moisture	8.90
Crude protein	44.9
Crude lipid	12.3
Crude fiber	4.0
Crude ash	9.5
NFE[2]	29.3
*Gross energy (GE Kcal / 100 g diet)[3]	489.44

1- Vitamin and mineral mixture/kg premix: vitamin A, 4.8 million IU; D 3, 0.8 million IU; E 4g; K, 0.8g; B1 0.4g; riboflavin, 1.6g; B6, 0.6g; B12, 4mg; pantothinic acid, 4g; nicotinic acid, 8g; folic acid, 0.4g; biotin, 20 mg; choline chloride, 200 g; Cu, 4g; I, 0.4g; Iron, 12g; Mn, 22g; Zn, 22 g; selenium, 0.4g.
2- NFE is nitrogen free extract = 100 (Cp + Cl + Cf +Ash).3- * Gross Energy (GE) content was calculated by using the factors 5.65, 9.4 and 4.1 kcal/g for protein, ether extract and carbohydrate, respectively **(Jobling & Wandsvik, 1983)**.

Growth performance parameters

Fish growth, expressed as daily increment in weight (g $fish^{-1}$) or the increase in body weight per day (% day^{-1}) were calculated using the following equations according to **Carlos (1988)**:

$$WG = W_2 - W_1$$

$DWG = (W_2 - W_1)/t$

: The time in days.

The mean fish weight (g) was determined in terms of gain in weight:

$GW\ \% = (W_2 - W_1)/W_1 x100$

Where,

W_1 = The initial live body weight (g),

W_2 = The final live body weight (g).

SGR in weight % = (ln FBW - ln IBW) /t ×100; where: FBW is final body weight (g); IBW is initial body weight (g); ln= natural logarithmic; t = time in days

SR % =(initial No- final No)X100

Feed utilization

Feed Intake (FI):-Amount of consumed feed per period

FCR = Feed intake (g) / weight gain (g)

FE= Weight gain (g) / Feed intake

Protein Efficiency Ratio (PER)= weight gain, g/ .crude protein intake, g

Survival rates (%)

Survival rates (%) were estimated as: No. of fish harvested/ No. of fish stocked x100.

Economical evaluation

Seabream and seabass were raised in a single feddan with water depth of about 1.50 meters. Details about the production of fish:

a. Fingerlings source, costs and quantities.
b. Feeding source, costs and quantities.
c. Pond aeration.
d. Labor
e. Fish production
f. Fingerlings cost= No. fish X price of each
g. Feed cost= amount of feed X price per /kg

Total production (kg /feddan) = No. of fish at Harvest X average body weight

Total income L.E/ feddan = Total production (kg /feddan X price of Kg)

Net return L.E/ feddan = Total income L.E/ feddan - Total cost.

The experiment's profitability was estimated using a basic economic analysis. Net revenue was estimated by deducting gross income from total investment expenses after total investment costs were computed. Seabass and seabream farm gate prices as well as actual local market prices, expressed in Egyptian LE, served as the foundation for this study.

Statistical analysis

The analysis was conducted using **Statistical Package for Social Science (2007)** (SPSS for Windows; v19.0, USA) and differences were considered statistically by using T test to examine differences in feed consumption and growth performance.

RESULTS

Physico-chemical parameters

Table (2) provides an overview of the seabass and seabream cultured under earthen pond conditions during the trial period on the private fish farm, Ismailia Governorate, based on the mean values of many water quality indicators, including salinity, pH, temperature, and dissolved oxygen. Depending on environmental changes, the water temperature in the seabass and seabream ponds ranged from 17.0 to 29.80°C, with an average of 23.4°C, and 17.35 to 28.50°C, with an average of 22.93°C, respectively, during the study. Temperature variations were observed during the study's months. The current study's water salinity ranged from 23.90 to 26 and 24 to 27.5ppt, with an average of 25.75 and 24.95ppt. The average dissolved oxygen in the seabass and seabream ponds was 4.5, with a range of 4 to 5. Additionally, the average pH for the seabass and seabream was 7.8 and 7.85, respectively, with variations between 7.40 and 8.20 and 7.47 and 8.23. Every value was ideal for raising the seabass and seabream.

Table 2. Water quality criteria for Suez Canal farm throughout the experimental period (365 days)

Month	DO mg/L		Salinity (ppt)		Temperature ºC		pH	
	Sea bass	Seabream	Sea bass	Seabream	Seabass	Seabream	Seabass	Seabream
June 2020	5.00	4.98	25.00	25.09	27.20	28.00	8.00	7.50
July	4.90	5.00	25.00	24.78	28.00	27.90	7.90	7.47
August	4.50	4.52	25.00	25.07	29.80	28.50	7.40	8.00
September	4.00	4.05	24.00	24.50	28.10	27.50	7.50	7.80
October	4.00	4.02	24.20	25.00	25.20	25.00	8.00	7.90
November	4.20	4.00	24.50	23.90	22.20	21.50	8.10	8.00
December	4.90	4.86	25.20	25.00	17.00	17.35	8.20	8.10
January 2021	4.90	5.00	25.20	25.10	18.50	19.00	8.90	8.30
February	4.20	4.14	25.50	25.30	20.00	21.00	8.00	7.54
March	4.10	4.10	25.00	25.93	23.80	22.90	8.20	8.02
April	4.20	4.23	26.50	26.00	21.70	22.00	8.10	8.00
May	4.10	4.00	26.00	25.80	25.00	26.10	8.10	8.23

Growth performance and feed utilization of seabass and seabream

The most frequently utilized feed items in seabass diets are listed in Table (1). Yellow maize, soy bean meal, full-fat soy, fish meal, fish oil, and corn gluten are usually the main ingredients used to feed fish. With a dietary crude protein (DCP) percentage of 44.9% and a total of 12.40 percent, the meal's chemical analysis indicated that feed consumption is controlled according to fish relative. Crude fiber and nitrogen-free extract levels in the diets were 4 and 29.3%, respectively. The findings in Table (3) demonstrated the growth performance and feed utilization of the gilthead seabream and European seabass raised on private fish farms in the Suez Canal region over the 365-day experimental period.

According to the findings, the average ultimate weight of seabass and gilthead seabream was 200 and 230g, respectively. Although the average initial weights of the two species were identical (10.00g), with little changes in standard deviation, the end body weight of the seabream was substantially higher ($P \geq 0.05$) than that of the European seabass. The gilthead seabream gained greater weight (220 and 0.6g) than the European seabass (190 and 0.52g), following the same pattern in weight gain and weight gain per day.

The gilthead seabream had an SGR rating of 1.49 and the European seabass had an SGR rating of 0.82. The survival rate of the European seabream was 60%, while that of the seabass was 50%. Both feed efficiency and PER showed the same pattern, with seabream having a considerably higher PER than seabass. For the seabass and seabream, feed efficiency and PER followed the same pattern, measuring 0.63 and 1.39 and 0.71 and 1.59, respectively. These findings revealed that during the trial, seabream outpaced seabass in terms of growth rate and feed utilization. But at 1.4 and 1.6, the FCR for the seabass and seabream was considerably lower ($P \geq 0.05$).

Table 3. Growth performance and feed utilization of the seabass and seabream reared on fish farms belonging to Suez Canal region throughout the experimental period 365 days

Parameter	**European seabass**	**Gilthead seabream**
Average initial weight (g)	10.00 ± 0.24	10.00 ± 0.09
Average final weight (g)	200^{b} ± 6.14	230^{a} ± 8.24
Weight gain (g)	190^{b} ± 4.22	220^{a} ± 11.02
Weight gain/day	0.52^{b} ± 0.002	0.60^{a} ± 0.001
SGR in weight	0.63^{b} ± 0.003	0.86^{a} ± 001
Survival rate (%)	50^{b} ± 2.01	60^{a} ± 1.09
Food intake (g / fish)	304	308
Food conversion ratio	1.6^{a} ± 0.001	1.4^{b} ± 0.001
Feed efficiency	0.63 ^{b}± 0.002	0.71^{a} ± 0.001
Protein efficiency ratio (PER)	1.39^{b}± 0.001	1.59^{a}± 0.000

Means in the same column not sharing the same letter are significantly different $P < 0.05$.

Economical evaluations

For the seabass and seabream raised in earthen ponds, Table (4) displays the economic evaluation. Seabass and seabream were found to have fingerlings cost (LE) of 37.62 and 34.55 percent, respectively. This clearly showed that the feed cost for seabream and seabass was 45.97 and 41.17%, respectively.

A total of 2,200 and 3,036 tons were produced per feddan, and 330,000 and 385,760 LE/feddan were earned. Furthermore, for the seabass and seabream, the investment mental return rate was 1.26 and 2.05%, and the net return per feddan was 183,808 and 326,580 LE. However, oil, rent, and other expenses accounted for 10.94 and 10.5% of the costs of seabass and seabream, respectively.

To ascertain the economic value of the seabass and seabream culture, several factors have been considered:

1) The creation,
2) The price of culturing
3) The size and quality of the fish that will be sold.
Table (4) provides a summary of the economic evaluation data.

The research's objective was to ascertain how profitable seabass and seabream production is in the study area. The study included estimating the costs and earnings associated with fish farming. By examining the yield, output data, and input costs, a thorough cost and return analysis was carried out. Table (4) provides a detailed breakdown of these economic elements, including cost inputs, total production, money gained, and net returns.

This demonstrates unequivocally how much money is spent by major fish growers in the study area to buy feed.

Table 4. Average cost and return of seabass and seabream in Suez Canal region

	Seabass		Seabream	
Items	**Rate**	**%**	**Rate**	**%**
Costs/ feddan:				
Fingerlings costs LE	55,000	37.62	55,000	34.55
Feed cost LE*	60,192	41.17	73,180	45.97
Labor and other costs LE	16,000	10.94	16,000	10.05
Oil+ rent + other	15, 000	10.26	15,000	9.42
Total costs LE feddan	146,192	100	159,180	100
Income feddan LE				
Total production (ton / feddan)	2.200		3,036	
Price (LE) of one kg fish	150		160	
Total income LE / feddan	330,000		485,760	
Net return LE / feddan	183,808		326,580	
Investmental return rate	1.26		2.05	

Price of food (18,000EGP/ ton)

DISCUSSION

Salinity, age, gender, dissolved oxygen levels, water temperature, and other water quality indicators that are classified as external effects are some of the fundamental factors that affect fish growth (**Laiz-Carrion *et al*., 2005)**.

According to **Hossain *et al.* (2006**), the ideal temperature range for breeding tropical pond fish is 17.0 to 29.80°C, with an average of 23.4°C, and 17.35 to 28.50°C, with an average of 22.93°C, for the seabass and seabream ponds at the experimental fish farm. The ideal temperature range for the gilthead and seabass growth is between 17 and 21°C, for example, and temperatures below 13°C significantly reduce their ability to feed **(FAO, 2002)**.

However, according to **Boyd (1992)**, the optimal temperature range for fish culture is between 26 and 31 degrees Celsius. It should be noted that temperature alone might not fully account for variations in plankton and fish production. The organic formation is also influenced by nutrients, alkalinity, high pH, and carbon dioxide **(Begum *et al.*, 2007)**. The pH and dissolved oxygen variations were within the proper productive range and were comparable (P>0.05) **(El-Shebly *et al*., 2007)**.

At the conclusion of the rearing period (365 days), the average ultimate weight of seabass and seabream was 200.00 and 230g fish-1, respectively. While seabream had a weight increase of 220g fish^{-1} with a daily gain of 0.60g fish^{-1}, seabass saw a weight increase of 190g fish^{-1} with a daily gain of 0.52g fish^{-1}. The findings showed that seabass had a considerably lower growth performance than seabream (P≥0.05). The seabream *(Sparus aurata)* had a larger maximum daily gain than seabass, which is consistent with the findings of **ElShebly and Siliem (2003)** and **El-Shebly (2005)**. In the current investigation, the SGR for the seabass and seabream was substantially greater (P≥0.05) than that recorded for the seabass (0,86g fish-1 and 0.63). Different fish species or environmental factors could be to blame for this. Red seabream's higher weight increase and SGR compared to seabass are consistent with the findings of **Eid *et al*. (2022)** and **El- Dahrawy *et al*. (2025)**.

Seabass and seabream had feed conversion ratios (FCRs) of 1.6 and 1.4, respectively, according to findings in Table (3). These findings concur with those of other research. **Campos *et al.* (2017)** and **El- Dahrawy *et al.* (2025)** discovered that the FCR values were lower than those of the gilthead seabream and European seabass that were grown in tanks and net cages in the ocean. **Eid *et al.* (2022)** found that the FCR value was 3.21 for the seabream. **Sleem *et al.* (2022)** showed that feeding diets with between 42 and 40 percent protein and 17 percent fat gave very exceptional growth performance measures in growing fish. However, fish species such as the seabass and seabream sometimes need a higher protein diet than other fish species. Marine fish growth rates, feed intake, and feed efficiency are all impacted when the amount of protein in their diet is reduced **(Oliva, 2000)**.

According to Table (3), the survival rates for seabass and seabream were 50 and 60%, respectively, in accordance with **El-Shebly *et al.* (2007)**, who recorded comparable outcomes. This study's outcome is consistent with research on the financial viability of fish farming, including those conducted by **Ashaolu *et al.* (2006)**. On the other hand, **Eid *et al.* (2022)** discovered that the seabream culture in the Suez Canal region had a 73% survival rate. In addition to the finest management, the high survival rate numbers can be ascribed to the quality of the feed and water. This agrees with **Berillis *et al.* (2016)**, who discovered that the seabream culture in the Suez Canal region had a 73% survival rate. In addition to the finest management, the high survival rate numbers can be ascribed to the quality of the feed and water.

The ratio of profit to total production costs is known as the rate of return per capital invested, or RORCI. It shows how much money the company makes from capital expenditures **(Awotide & Adejobi, 2007)**. The current study's findings indicate that the seabream output is higher than seabass production, and as a result, there is a corresponding increase in income. Ultimately, the current study concluded that the seabream would be a good option for marine water pond aquaculture in Egypt and other countries.

The outcome aligns with the findings of **Ashaolu *et al.* (2006)**, **Eid *et al.* (2022)** and **El-Dahrawy *et al.* (2025)** based on their fish farming profitability research. In Egypt and other places, it implies that the production of the seabass and seabream is a lucrative industry with the potential to become a prosperous aquaculture enterprise.

CONCLOUSION AND RECOMMENDATION

Based on this experimental investigation, it can be concluded that the seabream (*Sparus aurata*) demonstrated superior growth performance, feed consumption, and profit than the seabass *(Dicentrarchus labrax*) reared in earthen ponds.

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