# An Economical Evaluation of the Production of Seabream (*Sparus aurata*) in Suez Canal Region

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**Abstract:** The present study investigated the effect of rearing the seabream in pond aquaculture with using artificial feeding in ponds throughout June, 2017 to June, 2018, Fingerlings of 1 g weight was stocked in pond with an area of 1 feddan and 1.25 m depth at a rate of 20000 fish/feddan in a monoculture system. Temperature ranged between 21.0 and 30.8°C; pH ranged between, 7.4 and 8.9; DO ranged between 4.0 and 5.0 mg/L and salinity, ranged between 16.0-18.8 ppt during the study. Seabream attained average final average final weight 250g/fish at harvest with an increment of 249g/fish and a daily gain of 0.46g/fish. Average survival rate was 77% and total production 3.8 ton and net production was 3.78 ton/feddan. The results revealed that the cost of feeds accounted for the largest proportion (30.03%) of the total cost of fish production, then fingerlings (1.66%), rent and other (0.09%) and labor (30.0%). This experiment demonstrated the possibility of cultivation of Seabream as well as the higher commercial value where better net return (146250 LE /feddan) was recorded with investment return of 8.80 LE / return LE cost. The results of the study revealed that Seabream is a promising candidate for cultivating in ponds.

## INTRODUCTION

Aquaculture is currently the largest single source of fish supply in Egypt accounting for more than 70% of the total fish production of the country, where 98% of such production is from the private sector. In Egypt the fish culture industry has a great potential in Egypt. This is due to the presence of the following natural resources: a) the big length of the eastern and northern seashores of the country, b) the big length of the River Nile from the high to the Mediterranean sea, c) the huge network of irrigation and drainage canals and d) some big lakes with brackish water scattered all over the country (Campos *et al.,* 2017). There is a need for developing and managing the fisher activity as a cheap source of protein. Fish may compensate the present deficiency of other expensive sources. Aquaculture is the science and technology of producing aquatic plants and animals (Lawson, 1995). Aquaculture has been practiced in order to increase the yield of fish from ponds in Egypt since thousands of years (Green, 1995). “Aquacultural systems” mean the commercial production systems of aquatic animals either in controlled or in uncontrolled environment (Bala and Satter, 1989). Aquaculture plays an important role in universal fish production. It has been the world’s fastest growing food production system for the past decade. The world fish production of aquaculture increased about more than three times from 7.5 million tons to 22.0 million tons during the period 1988 to 2000. This increase is a result of intensification of production from the existing fish farms and the expansion of areas under cultivation (El-Ebiary 2002). Fish culture systems are increasingly intensive, largely due to the shortage of water and land and labor resources. There is also a need in Egypt for quick production of market-size fish to meet the demand of an increasing population (Sadek *et al*., 1993). Intensification in aquaculture is defined as management in which more fish are produced per area unit, by complementing of substituting the natural food web in culture environments with external inputs such as feeds and Marine fish farming in Egypt began in 1976 with the culture of gilthead sea bream, (*Sparus aurata*) as this fish was notably adaptable to brackish and marine pond conditions. The development of sea bream culture in Egypt is now severely inhibited by the shortage of seeds and adequate feeds both sea bream and sea bass were exported as an average of 1300 tons/year during 1994-1996 (Sadek, 2000).

Gilthead seabream (*Sparus aurata*) and European seabass (*Dicentrarchus labrax*) are the most important aquaculture species in the Mediterranean and rank second in the European Union (EU) aquaculture sector in value terms, after Atlantic salmon (STECF, 2018). Intensive production of seabream and seabass began in the late 1980s, and grew exponentially during the 1990s .Currently, the industry suffered from the consequences of a high growth in supply without being able to expand the market demand, which led to successive drops in the market price.

This present study was carried out to assess the potential of the cultivating Seabream (*Sparus aurata*) in earthen pond systems in Suez Canal region.

## MATERIALS AND METHODS

### Water quality

In this study half of the water volumes were exchanged every four days. Water samples were collected to be analyzed to determine the physico-chemical parameters once per week between 09.00 and 12:00 h from specific points distributed in the pond at a depth of 20-30 cm below the water surface.

The water temperature (°C), Water salinity (ppt). (Model Dissolved Oxygen (DO) ($mg^{-1}$) and pH were measured in the field according to APHA (1992).

**Fish Stocking and Sampling**

The fingerlings of Seabream (*Sparus aurata*) were obtained from the coastal area of Mediterranean Sea and Northern shores of Lake Manzala, during June, 2017 to December 2018 with an average initial body weight of 1 g fish. In Suez Canal ponds stocked with 20000 fry of Seabream were stocked with average initial 1 g during June, 2017 to December, 2018.

Two reperments, eighteen random samples of the fish were taken during the study period (18 samples $year^{-1}$). At the end of experiment, the pond was harvested and a complete census of all Seabream was done, where all the harvested individuals were counted; and weighted.

**Feeding Fish**

The fish were fed with artificial diets (40% crude protein) from Alar Aqua Company which contains a high content of protein. Throughout the experimental period of 540 days.

**Growth Performance Parameters**

Fish growth, expressed as daily increment in weight (g $fish^{-1}$) or the increase in body weight per day (% $day^{-1}$) was calculated based the following formula:

$DGR = (W_2 - W_1)/t$

***Where,***

ww = The initial live body weight (g),

$W_2$ = The final live body weight (g),

T = The time in days.

Total weight at stocking Kg/feddan = No of fish stocked X Average weight at stocked

Total harvested weight Kg/feddan= No of harvested fish X Average harvested weight.

Net Production=Total harvested weight Kg/feddan- Total stocked weight Kg/feddan

The feed conversion ratio (FCR) was expressed as the proportion of dry food fed required per unit live weight gain of fish.

FCR = Food intake (g) / weighted gain (g)

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

**Survival rates (%)**

Survival rates (%) were estimated as: No. of harvested fish /No. of stocked fish x100. Net production (kg feddan-1) was calculated by deducting the stocked biomass from the harvested biomass.

The mean weight of fish (g) was determined as follow:

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

***Where,***

$W_1$ = The initial weight of live body (g),

$W_2$ = The final weight of live body (g).

The condition factor (CF) is determined from to the equation:

$CF = (W/L^3) \times 100$

***Where,***

W = The weight of the body (g),

L = The length of the fish (cm).

**Economical Analysis Methodology**

Information on the studied private farm located at Damietta Governorate with an area of 1feddans and a water depth of about 12.5 m was collected during June, 2017 to December, 2018. Fish Production Information:

a. Fingerlings source, quantities and costs.
b. Feeding source, quantities and costs.
c. Pond aeration.
d. Labors
e. Fish production
f. Fingerlings cost= No of fingerlings x price of each
g. Food cost= amount of food (kg) x price of kg

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

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

Net return LE feddan= Total income LE feddan- Total cost.

A simple economic analysis was performed to estimate the profitability from this experiment. Total investment costs were calculated and the net revenue was determined by the difference between the gross revenue and the total investment costs. This analysis was based on farm gate prices of meager and current local market prices expressed in Egyptian LE.

**Statistical Analysis**

Variations in physico-chemical parameters and growth data were tested by using one-way ANOVA and any difference at 5% level of significance using the Tukey test was considered.

## RESULTS AND DISCUSSION

Mean values of some water quality parameters such as temperature, pH, dissolved oxygen and salinity were calculated to clear the changes in the seabream culture earthen pond throughout the experimental period in Suez Canal fish farm Ismailia Governorate (Table 1). Water temperature ranged between 21.0 to 34.4°C with an average of 24.3°C during the study time depending on the climatic changes. There were significant variations in temperatures among the times of this study ($p<0.05$). The water pH ranged between 7.4 to 8.9 with an average of 8.10. Dissolved Oxygen (DO) content fluctuated between 5.0 and 4.0 mg $L^{-1}$ with an average of 4.50 mg $L^{-1}$. Water salinity ranged from 24 to 27 ppt with an average of 25.50 ppt depending on the seasonal variations. The variations of pH and dissolved oxygen were more or less similar ($p>0.05$) during the different times of the experiment. The variations in salinity were significantly ($p<0.05$) different. The variations of water temperatures may be attributed to weather conditions. The statistical tests showed significantly differences ($p<0.05$) in temperatures among the different times of the study.

The observed average temperatures was within the optimal ranges (14.3-32.4°C) for fish production in tropical ponds (Begum *et al*., 2003; Hossain *et al*., 2006). However, the best temperature for the growth of the gilthead seabream *Sparus* sp is between 17-21°C and feeding activity is substantially reduced when water temperatures drop below 13-15°C (FAO, 2002). Quemener (2002) also recorded the rapid growth of the gilthead seabream *Sparus* between 16 and 20°C. On the other hand, Boyd (1992) recommended optimal temperature for fish culture, in the range of 26.06-31.97°C. It should also be indicated that temperature alone may not account for variations in plankton as well as fish production. There are some other factors such as high pH, alkalinity, carbon dioxide and nutrients also responsible for the organic production (Hossain *et al*., 2007; Begum *et al*., 2007). The variations in pH and dissolved oxygen were similar ($p>0.05$) and they were coincide with the suitable productive range (El-Shebly *et al*., 2007; Hossain *et al*., 2007).

**Table (1):** Water Quality Criteria for Suez Canal Farm throughout the experimental period (540 days)

| Month | DO mg/L | Salinity (ppt) | Temperature °C | pH |
|---|---|---|---|---|
| **June 2017** | 5.00 | 25.00[c] | 33.20[a] | 8.00 |
| **July** | 4.9 | 25.00[c] | 34.00[a] | 7.90 |
| **August** | 4.50 | 25.00[c] | 33.80[a] | 7.40 |
| **September** | 4.0 | 24.00[d] | 30.10[b] | 7.50 |
| **October** | 4.0 | 24.20[d] | 25.20[c] | 8.00 |
| **November** | 4.2 | 24.50[d] | 22.20[d] | 8.10 |
| **December** | 4.90 | 25.20[c] | 22.00[d] | 8.20 |
| **January 2018** | 4.9 | 25.20[c] | 22.00[d] | 8.9 |
| **February** | 4.20 | 25.5[c] | 21.00[e] | 8.00 |
| **March** | 4.10 | 25.00[c] | 21.80[e] | 8.20 |
| **April** | 4.20 | 26.50[b] | 21.70[e] | 8.10 |
| **May** | 4.10 | 26.00[b] | 22.00d | 8.10 |
| **June** | 4.20 | 27.50[a] | 33..20[a] | 8.10 |
| **July** | 4.20 | 27.00[a] | 34.00[a] | 8.30 |
| **August** | 4.20 | 27.00[a] | 33.80[a] | 8.10 |
| **September** | 4.10 | 27.00[a] | 30.10[b] | 8.10 |
| **October** | 4.20 | 27.00[a] | 25.20[c] | 8.10 |
| **November** | 4.10 | 24.00d | 22.20[d] | 8.30 |
| **December 2018** | 4.20 | 24.20[d] | 22.00[d] | 8.00 |

The present study proposed that the sea water may be more appropriate for the culture of the gilthead seabream *Sparus.* This information is relevant to the aquaculture industry as optimizing salinities for those species that could improve their growth rates, resulting an economic advantages. Estuaries are associated with the life history of the gilthead seabream *Sparus* juveniles that mostly found in seawaters (Morales-Nin *et al*., 2012).

**Growth and Production of the gilthead seabream**

The growth performance of the the gilthead seabream in terms of initial weight, final weight, stocking rates, survival rates, daily increment in weight and total production in Suez Canal fish farm Ismailia Governorate are shown in Table (2).

The fish attained an average final weight of 2500.00 g fish-1 at the end of the rearing period (540 days). The fish attained an increment in weight of 250 g fish-1 with daily gain of 0.46 g fish-1 and a percentage gain in weight of 249 fish-1. The highest daily gain of Seabream (*Sparus aurata*) was recorded from the same area where other marine fishes such as Sea bream (*Sparus aura*ta) attained a daily gain of 0.73 g fish-1 (El-Shebly and Siliem, 2003) and Sea bass (*Dicentrarchus labrax*) attained a daily gain of 1.13 g fish-1 (El-Shebly, 2005). The present results were better than the findings recorded by Risk and Hashem (1981).

The daily gain in weight and specific growth rate in the present study was 4.0 g $fish^{-1}$, 1.00. The highest daily gain of seabream was recorded from the same area where other marine wear attained a daily gain of 0.73 g $fish^{-1}$ (El-Shebly and Siliem, 2003) Sea bass (*Dicentrarchus labrax*) attained a daily gain of 1.13 g fish-1 (El-Shebly, 2005). This may be due to different fish species or environmental conditions.

This result is consistent with the finding of (Ashaolu *et al*., 2005) on profitability studies on fish farming. The rate of return per capital invested (RORCI) is the ratio of profit to total cost of production. It indicates what is earned by the business by capital outlay (Awotide and Adejobi, 2007). The result revealed that the average 5.83 % implying that fish farming in the study area is profitable (Table 3). Fish culture gives higher returns in money and food than rising of cattle, sheep and poultry (Hickling, 1962). The result of the present study has been shown the higher production of seabream and accordingly the higher income which means that investment in this field of production is profitable. Finally, the present study concluded that seabream may be a promising candidate for the marine water pond aquaculture in Egypt as well as other parts of the world.

This result is consistent with the finding of Ashaolu *et al*. (2006) from their studies on profitability on fish farming. It indicates what is earned by the business by capital outlay (Awotide and Adejobi, 2007; Eid *et al*., 2020).

**Table (2):** Growth performance of the Seabream (*Sparus aurata*) reared in fish farms belong to Suez Canal Company throughout the experimental period 540 days from June, 2017 to July, 2019

| Parameters | Rate |
|---|---|
| **Average Initial weight (g)** | 1.00 |
| **Average Final weight (g)** | 250.0 |
| **Weight gain (g)** | 249.0 |
| **Weight gain/day** | 0.46 |
| **Weight gain (%)** | 249 |
| **SGR in weight** | 1.02 |
| **Survival rate (%)** | 77 |
| **Rearing period (day)** | 540 |
| **Total weight at stocking ton/feddan** | 20.00 |
| **Total weight at Harvest ton/feddan** | 3.850 |
| **Net production ton /feddan** | 3.830 |
| **Food intake (ton / feddan)** | 8000 |
| **Food Conversion** | 3.21 |

Hickling (1962) found that Fish culture gives higher returns in money and food than rising of cattle, sheep and poultry. The result of the present study agreed with this theory and revealed higher production of seabream and accordingly the higher income which means that investment in this field of production is profitable.

**Table (3):** Average cost and return of Seabream (*Sparus aurata*) production

| Items | Rate | Percent |
|---|---|---|
| **Costs feddan** | | |
| **Fingerlings costs LE** | 20000 | 11.04 |
| **Feed cost LE** | 128000 | 70.7 |
| **Labour and other costs LE** | 3000 | 1.65 |
| **Oil+rent+ other** | 30000 | 16.57 |
| **Total costs LE feddan** | 181000 | |
| **Income feddan LE** | | |
| **Total production (ton /feddan)** | 3.850 | |
| **Price (LE) of one kg fish** | 85 | |
| **Total income LE/feddan** | 327250 | |
| **Net return LE/feddan** | 146250 | |
| **Investmental return LE/ return LE cost** | 8.8 | |

## REFERENCES


APHA (1992). Standard Methods for the Examinations of Water and Wastewater. 18th Edition, American Public Health Association (APHA), American Water Works Association (AWWA) and Water Pollution Control Federation (WPCF), Washington DC.

Ashaolu, O. F., A. A. Akinyemi and L. S. Nzekwe (2006). Economic viability of homestead fish production in Abeokuta Metropolis of Ogun state, Nigeria. Asset Series A, 6(2): 209-220. Central Bank of Nigeria 2004. Statistical Bulletin, 264-267.

Awotide, D. O. and A. O. Adejobi (2007). Technical efficiency and cost of production among plantain farmers in Oyo State Nigeria, Moor Journal of Agricultural Science, 7(2): 107-113.

Bala, B. K. and M. A. Satter (1989). System dynamics simulation and optimization of aquaculture systems. Aquacultural Engineering, 8: 381-391.

Begum, M., M. Y., Hossain, M. A. Wahab, Z. F. Ahmed, M. J. Alam, M. M. Shah and S. Jasmine (2007). Effects of iso-nutrient fertilization on plankton production in earthen ponds of Bangladesh. Pak. J. Biol. Sci., 10: 1221-1228.

Boyd, C. E. (1992). Water Quality Management of Pond Fish Culture. Elsevier Sci. Publ. Co. Amsterdam-Oxford, New York, pp: 318.

Campos, I., E. Matos, A. Marques and L. M. P. Valente (2017). Hydrolyzed feather meal as a partial fishmeal replacement in diets for European seabass (*Dicentrarchus labrax*) Juveniles. Aquaculture, 476: 152-159.

Cremer, M. C. and Z. Jian (1999). Pompano (*Trachinotus ovatus*) Growth Performance in 1.5 m 3 Cages with Soybean Meal and Fish Meal Based Feed Rations. Results of ASA/China, Feeding Trial, 35, 99-73.

Eid, A. E., Ali B. A., Elfeky, A, Bazina, W. K. and H. Saleh (2020). Production of Meagre In Earthen Ponds. Egyptian J. Nutrition and Feeds, 23(1): 161-169

El-Ebiary, E. H. (2002). Modern technology for intensification of fish culture and its environmental impact. Report of a workshop held in Ismailia, Suez Canal University, 1-2 July.

El-Shebly, A. A. and N. A. Siliem (2003). Studies on growth and production of seabream (*Sparus aurata*) in brackish water fish farms. Bull. Nat. Instit. Oceanography Fish. A.R.E., 29: 267-279.

El-Shebly, A. A. (2005). Studies on growth and production of sea bass (*Dicentrarchus labrax*) reared in brackish water fish farms. J. Egypt. Acad. Soc. Environ. Develop. (B-Aquaculture), 6: 19-30.

El-Shebly, A. A., A. H. M. El-Kady, B. H. Abdalla and M. Y. Hossain (2007). Preliminary Observations on the Pond Culture of Meagre, *Argyrosomus regius* (Asso, 1801) (Sciaenidae) in Egypt. Journal of Fisheries and Aquatic Science, 2: 345-352.

FAO. (2002). Cultured aquatic species information *programme Argyrosomus regius*. Fish Physiology and Biochemistry 22: 171–178, 2000.

Gracia, F., A. Jofer, E. Pascual, Y. Sanchez and S. Rey (2002). Preliminary studies on growth of meagre, (*Argyrosomus regius*) (Asso, 1810) in sea cages and indoor tanks. Aquaculture Europe, 2002, Sea Farming Today and Tomorrow, 32: 422-423.

Green, B. W. (1995). Evaluation of Nile tilapia production systems in Egypt.PD/A CRSP Research Report, 95-91.

Hickling, C. F. (1962). Fish Culture. Faber and Faber, London. 295p

Hossain, M. Y., S. Jasmine, A. H. M. Ibrahim, Z. F. Ahmed and J. Ohtomi (2007). A preliminary observation on water quality and plankton of an earthen fish pond in Bangladesh: Recommendations for future studies. Pak. J. Biol. Sci., 10: 868-873.

Lan, H. P., M. C. Cremer, J. Chappell, J. Hawke and T. O. Keefe (2008). Growth performance of Pompano (*Trachinotus blochii*) Fed Fishmeal and Soy Based Diets in Offshore OCAT Ocean Cages. Results of the 2007 OCAT Cage Feeding Trial in Hainan, China.

Lawson, T. B. (1995). Fundamental of Aquacultural Engineering. Elsevier Scientific Publishers, Amsterdam.

Manomaitis, L. and C. M. Cremer (2007). Performance of Pompano Fed Soy-Optimized, Extruded Feed Using ASA-IM Low Volume High Density Cages in Vung Tau Province, Vietnam. Results of ASA-IM/Soy-in-Aquaculture 2007, Feeding Demonstration Project. American Soybean International Marketing (ASA-IM).

McMaster, M. F., T. C. Kloth, J. F. Coburn and N. E. Stolpe (2008). Florida Pompano (*Trachinotus carolinus*) Is an Alternative Species for Low Salinity Shrimp Pond Farming. *In*: Aquaculture America 2006. Mariculture Technologies International Inc.

Morales-Nin, B., A. J. Geffen, S. Perez-Mayol, M. Palmer, R. Gonzalez-Quiros and A. Grau (2012). Seasonal and ontogenic migrations of meagre (*Argyrosomus regius*) determined by otolith geochemical signatures. Fish. Res., 127–128, 154–165

Osman, M. F. and S. Sadek (2002). Meagre (*Argyrosomus regius* Asso, 1801) A new candidate in Aquaculture (short notes). Proceedings of the 1st Scientific Conference of the Egyptian Aquaculture Society, Faculty of Environmental Agricultural Sciences, December 13-15, 2002, El-Arish, North Sinai, Egypt, pp: 7-.

Peres, H. and T. A. Oliva (2003). The effect of dietary ribonucleic acid incorporation in performance of European sea bass (*Dicentrarchus labrax*) juvenile. Aquaculture, 215: 245-253.

Quemener, L. (2002). Meagre (*Argyrosomus regius*): Biology, Fisheries, Market and Rearing Potential. Resources-de-La-mer-IfremerPlouzane-France, France, pp: 31.

Risk, M. H. and M. T. Hashem (1981). Some biological aspects of *Sciacna aquilla* Risso in Abu-Kir Bay. Bull. Instit. Oceanography Fish. A.R.E., 7: 505-516.

Sadek, S. and A. Baraneya (1993). Evaluation of Egyptian trial in aquaculture. Proceedings of the Fish Culture Workshop, April 11-14, 1993, Riyadh, Saudi Arabia, pp: 27-.

Sadek, S. (2000). Sea bream culture in Egypt; status, constraints and potential Scientific. Fish Physiology and Biochemistry, 22(2): 171.

STECF, (2018). Scientific, Technical and Economic Committee for Fisheries (STECF) – Economic Report of the EU Aquaculture sector (STECF-18-19). Publications Office of the European Union, Luxembourg, 2018, ISBN 978-92-79-79402-5, doi: 10.2760/45076, JRC114801.

# تقييم اقتصادي لإنتاج سمك الدنيس بمنطقة قناة السويس

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تناولت الدراسة الحالية تأثير تربية الدنيس في الاستزراع المائي في الأحواض الترابية باستخدام العلف الصناعي خلال الفترة من يونيو ٢٠١٧ إلى يونيو ٢٠١٨ ، حيث تم وضع إصبعيات يبلغ وزنها ١ جرام في أحواض مساحتها ١ فدان وعمق ١.٢٥ م بمعدل ٢٠٠٠٠. سمك / فدان في نظام الزراعة الأحادية. تراوحت درجة الحرارة من ٢١.٠ - ٣٠.٨ درجة مئوية ؛ الرقم الهيدروجيني ، ٧.٤ - ٨.٩ ؛ الأكسجين المذاب ٤.٠ - ٥.٠ ملجم / لتر والملوحة ، ١٦.٠ - ١٨.٨ جزء في المليون أثناء الدراسة. بلغ متوسط الوزن النهائي للدنيس ٢٥٠ جم / سمكة عند الحصاد بزيادة ٢٤٩ جم / سمكة ومكاسب يومية ٠.٤٦ جم / سمكة. بلغ متوسط معدل البقاء ٧٧٪ وإجمالي الإنتاج ٣.٨ طن وصافي الإنتاج ٣.٧٨ طن / فدان. أظهرت النتائج أن تكلفة الأعلاف شكلت النسبة الأكبر (٣٠.٠٣٪) من إجمالي تكلفة إنتاج الأسماك ، ثم الإصبعيات (١.٦٦٪) والإيجارات وغيرها (٠.٠٩٪) والعمالة (٣٠.٠٪). أظهرت هذه التجربة إمكانية استزراع الدنيس وكذلك ارتفاع القيمة التجارية حيث سجل صافي عائد أفضل (١٤٦٢٥٠ جنيه/ فدان) بعائد استثماري ٨.٨٠ جنيه / عائد. أشارت نتائج الدراسة إلى أن الدنيس كمرشح واعد للزراعة في الأحواض.