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Experimental grow-out of European Sea bream (*Sparus aurata*) and Gilthead Sea bass (*Dicentrarchus labrax)* in Eastern Libya

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الباحث الثاني: باباتوندي توفيق أديمولا ، قسم الأحياء، جامعة عمر موسى يارادوا، نيجيريا.

Abstract Sea bream and sea bass are highly adaptable to different culture systems, making them well suited for aquaculture. Their delicious flesh has contributed to the growing popularity of the aquaculture industry. This research was conducted to evaluate the grow-out of European Sea bream and Gilthead Sea bass in the eastern Libyan coast of the Mediterranean Sea. Fingerlings of the fish obtained from the natural brackish water of the Eastern Libyan coast and stocked in earthen ponds supplied with brackish water. A 120-day rearing trial was conducted which showed that the growth performance of Seabream and Seabass in this experiment varied significantly, even though both were fed similar levels of dietary proteins. The weight gained, specific growth rates, and protein efficiency ratio were significantly higher ($P<0.05$) in Seabream compared to Seabass. The survival was not significantly different between the two species at the end of the experimental period. The feed conversion ratio was lower in Seabream (1.77) compared with Seabass (1.98). The moisture (68.10 ± 0.72%) and ash contents (3.90 ± 0.04%) were significantly higher in Seabass, while the crude protein (17.39 ± 0.17%) and lipids (11.36 ± 0.24%) were significantly higher in Seabream in this experiment. The Libyan Mediterranean coast is suitable for the grow-out of the two species, and the Seabream showed better growth and higher nutrition quality compared with Seabass.
Keywords: Grow-out, Seabream, Seabass, Brackish water

تربية تجريبية للدنيس الأوروبي (*Sparus aurata*) والقاروص الذهبي (*Dicentrarchus labrax*) في شرق ليبيا

المستخلص: يتكيف الدنيس والقاروص بدرجة كبيرة مع أنظمة الاستزراع المختلفة، مما يجعلها مناسبه تمامًا لتربية الاحياء المائية. وقد ساهمت جودة لحومها في تزايد شعبيتهما في قطاع الاستزراع السمكي. أُجري هذا البحث لتجربة تربية الدنيس الأوروبي والقاروص الذهبي في البحر الأبيض المتوسط بشرق ليبيا، وتم الحصول على الإصبعيات من مياه متوسطة الملوحة الطبيعية شرق ليبيا وتخزينها في أحواض ترابية مزودة بمياه متوسطة الملوحة متوسطة الملوحة، وقد أظهرت التربية في مدة 120 يومًا أن أداء نمو الدنيس والقاروص كان مختلفا بشكل كبير، على الرغم من أن كلاهما تم تغذيتهما بمستويات مماثلة من البروتين، وكان الوزن المكتسب ومعدل النمو النوعي ونسبة كفاءة البروتين أعلى بشكل ملحوظ ($P<0.05$) في الدنيس مقارنة بالقاروص، ولم يكن معدل البقاء مختلفًا بين النوعين في نهاية الفترة التجريبية. كان معدل التحويل الغذائي اقل في الدنيس (1.77) مقارنة بالقاروص (1.98). وكانت نسبة الرطوبة (68.10 ± 0.72%) ومحتوى الرماد (3.90 ± 0.04%) أعلى معنويا وبشكل ملحوظ في اسماك القاروص، بينما كانت نسبة البروتين (17.39 ± 0.17%) والدهون (11.36 ± 0.24%) أعلى بشكل ملحوظ في أسماك الدنيس، ويُعدّ ساحل ليبيا على البحر الأبيض المتوسط مناسبًا لتربية هذين النوعين، وقد أظهر الدنيس نموًا أفضل وجودة أعلى مقارنةً بالقاروص.
الكلمات المفتاحية: تربية، الدنيس، القاروص، مياه متوسطة الملوحة

INTRODUCTION

Seabream and Seabass are fish known for their adaptability to various culture systems and they are accepted in aquaculture for their ability to thrive (Arechavala-Lopez *et al*., 2013). They have delicious flesh which makes them becoming increasingly popular in the world of aquaculture (Regnier and Bayramoglu, 2017). The Seabream, is particularly well-established in aquaculture, especially in the Mediterranean region (Ortega *et al*., 2021). Challenges such as disease outbreaks and fish health concerns remain areas of active improvement (Polovina *et al*., 2020). Sea bream was typically cultured in the marine environment for optimal health and growth. While techniques for low-salinity culture of sea bream appear promising, large-scale freshwater sea bream aquaculture is not yet commercially viable (Boyd *et al*., 2020). Sea bass is a well-prized fish known for its delicate flavor and firm flesh. The rise in popularity is largely driven by the success of sea bass aquaculture, a rapidly growing sector of the global seafood industry (Asche *et al*., 2022). Apart from wild-caught sea bass, farmed sea bass are now popular in aquaculture markets. Grow-out facilities, typically located in coastal areas to raise the fingerlings to market size. Two main methods, namely net pen culture and pond culture are mostly employed (Mohd Aripin, 2020). Both systems rely on formulated feeds purposely intended to meet the nutritional requirements of sea bass for optimal growth. Seabream and Seabass aquaculture boasts several advantages not limited to alleviation of pressure on wild populations, promoting sustainable fishing practices, controlled environments for better monitoring of fish health, and reducing the risk of disease outbreaks. Consistent production throughout the year, meeting consumer demand, and stabilizing market prices will also be achieved. This research will contribute to existing knowledge of Seabream and Seabass aquaculture. Libya is one of the Mediterranean countries where Sea bream and Sea culture are still at their infancy (Cross, 2022). We conducted an experimental grow-out of European Sea bream and Gilthead Sea bass in the Eastern Libyan Mediterranean coast.

MATERIALS AND METHODS

Experimental setup: The experiment was carried out in a private earthen pond farm located at Tamimi village, Eastern Libya. A 120-day rearing trial from April 2023 through July 2023 was conducted for wild fingerlings of Seabream and Seabass obtained from the natural brackish lake of Eastern Libya. The initial average wet weight of the Seabream and Seabass were 8.64±0.10 g and 9.08±0.12 g respectively. Immediately after collecting the fish from the fishermen, they were placed in nursery ponds, sorted and distributed in acclimatization ponds according to type and weight, then finally to the grow-out pond for this experiment.

For this study, four (4) earthen ponds (40m by 80m by 1.2m) used. Water was pumped up from the brackish area using a moto-pump. Two ponds stocked with 2000 fingerling specimens of Seabream (*Sparus aitrata*) and Seabass (*Dicentrarchus labrax*, L.) separately.

At the beginning of the experiment, the fingerlings were transferred to the rearing ponds and fasted for 72 hours to adapt to the rearing conditions. For the entire study period, European seabass and gilthead seabream were fed a commercial diet containing 45% crude protein (Table 1).

Table:(1). Proximate composition (%) of the commercial fish feed used for the experiment**.**

Proximate composition (%)	(%)
Moisture	14
Crude protein	45
Crude lipid	15
Crude ash	12

Rearing trial: The fish were fed twice daily at 9:30 and 16:30 at a rate of 3% of total pond fish biomass from the beginning to the end of the study. The amount of feed consumed by the fish per day was recorded. To estimate the growth of the fish and to obtain the feed conversion ratio, 50 fish were randomly sampled from each pond once a week, and the average wet weight was recorded by using a 0.01 g sensitive scale. Feed also adjusted accordingly.

Water parameters measured weekly. Temperature (°C), pH, and salinity were measured using Hana multimeter. Dissolved oxygen and total ammonia concentration were determined through the Winkler-Azide method and titrimetric method respectively (Apha, 1995). The proximate composition of the fish carcass was determined by the method described by (AOAC, 1997).

At the end of 120-day rearing trial, the following parameters of the fish estimated:

$$\text{Weight gain (g)} = \text{final body weight (g)} - \text{initial body weight (g)}$$

$$\text{Weight gain (\%)} = \frac{\text{final body weight (g)} - \text{initial body weight (g)}}{\text{initial body weight (g)}} \times 100$$

$$\text{SGR (\%)} = \frac{\ln \text{final body weight} - \ln \text{initial body weight}}{\text{number of days}} \times 100$$

$$\text{Feed conversion ratio(FCR)} = \frac{\text{total dry weight of diet fed (g)}}{\text{wet weight gain (g)}}$$

$$\text{Protein efficiency ratio (PER)} = \frac{\text{wet weight gain (g)}}{\text{total protein intake (g)}}$$

Statistical analysis: The independent t-test was used to compare the mean monthly water parameters, proximate and growth parameters between the Seabram and the Seabass ponds. Significant differences were detected at α level of 5% ($P < 0.05$). Statistical analysis was done using SPSS version 23 for Windows.

RESULTS

Water quality of the ponds: The results of the water quality of experimental ponds over the experimental period (Table 2) indicated that the temperature, pH, DO and salinity of the ponds were not significantly different ($p>0.05$) between the two rearing groups on Seabream and Seabass. TAN was also significantly lower in the Seabream ponds (Carminato *et al*., 2020; Mansour *et al*., 2021).

Table: (2). Average water quality parameters of the experimental ponds

Parameters	Seabream	Seabass	P Value
Temperature (°C)	27 ± 3.21[a]	27 ± 2.10[a]	ns
pH	7.8± **1**.20[a]	**7.9**± **1**.40[a]	ns
DO(*mg/l*)	6.9± 1.21[b]	6.8± 0.42[a]	ns
Salinity (*g/l*)	18.1± 0.10[a]	18.0± 0.10[a]	ns
NH_4 (*mg/l*)	0.85± 0.11[a]	0.88± 0.15[b]	s

ns: not significant ($p>0.05$) and s: significant ($p<0.05$).

Growth performance**:** Growth performance of Seabream and Seabass fingerlings reared in brackish water in this experiment varied significantly (Table 3), even though both fed similar levels of dietary proteins (Table 1). The weight gained, specific growth rates, feed conversion ratio, and protein efficiency were significantly higher ($P<0.05$) in Seabream compared to Seabass (Table 3). The survival rate was not significantly different between the two species at the end of the 120-day rearing period.

Table: (3). Growth performance and feeding efficiency of Seabream and Seabass

Parameters	Seabream	Seabass	P Value
Initial weight(g)	8.98 ±0.30[a]	9.06±0.42 [a]	ns
Final weight (g)	70.05 ±1.57[b]	58.90 ±0.26[a]	s
Weight gain (g)	61.07 ± 1.47[b]	49.82 ±0.14[a]	s
Weight gain (%)	679.09±9.10[b]	548±6.13[a]	s
Survival%	76.50± 0.75[a]	77.05± 0.50[a]	ns
SGR[1] (% d^{-1})	3.19±0.01[a]	3.03 ±0.00[a]	ns
FCR	1.77 ±0.08[a]	1.98± 0.02[b]	s
PER	1.25 ±0.06[a]	1.11 ±0.14[b]	s

ns: not significant (p>0.05) and s: significant (p<0.05).

Proximate composition: In this study on cultured sea bream and sea bass, the proximate composition value of the fish carcass (Table 4) showed that there is a significant difference (p<0.05) in moisture, crude protein, crude lipid and crude ash contents of the two species. The highest moisture (68.10 ± 0.72%) and ash content (3.90 ± 0.04%) were found in Seabass while crude protein and lipids were higher in Seabream in this experiment.

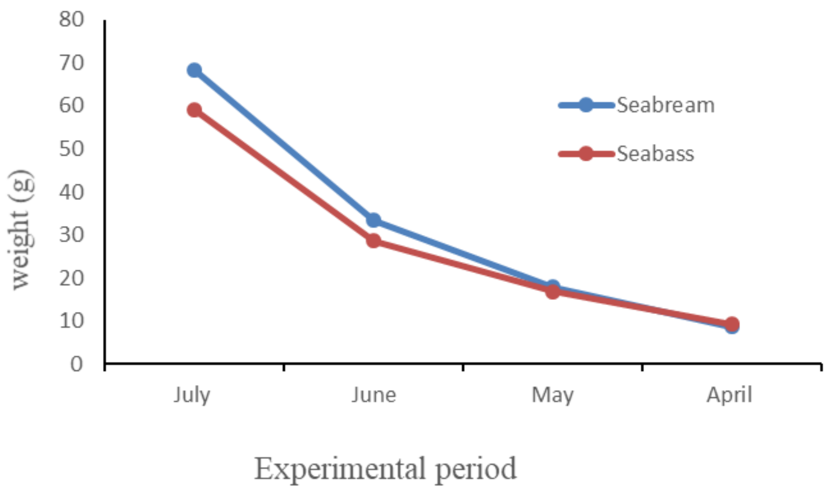

Figure :(1). Average monthly weight of Seabream and Seabass during the experimental period

Table: (4). Body composition (%) of Sea bream and Seabass reared in ponds

Proximate composition (%)	Seabream	Seabass	P Value
Moisture	66.44 ±0.56[a]	68.10 ± 0.72[b]	0.00
Crude protein	17.39 ±0.17[b]	16.78 ± 0.09[a]	0.00
Crude lipid	11.36 ±0.24[b]	10.62±0.29[a]	0.00
Crude ash	3.81±0.03[a]	3.90 ±0.04[b]	0.00

DISCUSSION

This research investigated the grow-out performance of Sea bream and Sea bass in a brackish water pond. There were no significant differences in water temperature among the ponds (p > 0.05), indicate stable environmental conditions during the experiment. Since the atmosphere is temperature is the major determinant of water temperature (Bonacina *et al.*, 2023), this implies that our experimental setup was under similar atmospheric conditions. However, the pH was significantly higher in the sea bass pond, possibly due to soil-related factors (Bhowmick *et al*., 2022; Ndayisenga and Dusabe, 2022). The significantly higher DO recorded in Seabream Pond could be because of metabolic physiology, which have more efficient oxygen utilization compared with the Seabass. A comparable result was reported by Altan (2020), showed that gilthead sea bream reared in earthen ponds at low salinity brackish water reached a higher wet weight, growth rate, and lower FCR values compared to European sea bass in the cultured at the same time. The current research also finds a lower FCR in the seabream pond compared with the seabass. The can be further supported with the protein efficiency ratio which was higher in Gilthead seabream compared with European seabass as observed in the current study and this was consistent with the finding of (Altan, 2020). This research compared the growth rate and feed utilization of the gilthead seabream and European seabass production reared in low salinity earthen pond in the Easter Mediterranean of Libya. Libya, with its extensive coastline and rich marine resources, possesses significant potential for aquaculture development. Seabass and seabream, two high-value fish species, have gained global prominence in aquaculture. This study provides an assessment of the potential of low-salinity pond aquaculture for sea bass and sea bream. As there is currently no commercial-scale seabass or seabream aquaculture in the area. The present study showed that the country's coastal waters are suitable for the grow-out of these species.

CONCLUSION

This research compared the growth rate of Gilthead Seabream and European Seabass reared in a low salinity pond in the Libyan Mediterranean coast. The 120-days rearing trial showed that the Gilthead Seabream grows faster with better-feed conversion compared with European Seabass. From the present study, it can be concluded that, the Libya Mediterranean coast is suitable for grow-out of the two species.

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