# Induced Spawning of Gilthead Seabream, Sparus Aurata, (Linnaeus, 1857), under Environmental Control.

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## Abstract:

*A practical experiment on induced spawning is carried out under a control environment, using hatchery tanks of MBRC in Tagura. Gilthead seabream, Sparus aurata (L.), is a eurythermic fish, and is one of the important commercial marine species, cultured for its high economic value, both extensively in brackish water lagoons and intensively in tanks and floating cages in the Mediterranean sea. The experiment has been carried out for 9 months under a control of temperature and photoperiod.*

*Spawning success was achieved from winter to spring season. Production of eggs increased gradually from November 2008 to February 2009. A total of (18456 mls), eggs were obtained during the experimental period, some of them were stocked in separate tank for hatching larvae, but unable to carry out larval rearing due to high mortality (80%).*

*Further study is necessary in terms of survival rate of larvae on experimental level as well as large scale hatcheries.*

***Key word**: Induced spawning, Sparus aurata , Environment control*

## 1.Introduction:

The gilthead seabream, *Sparus aurata* (*L.*), Order: Perciform, Family: Sparidae), is a marine species which has eurythermal (10 – 36 C° ) and euryhaline (5 _ 60ppt ) capacities (Coll, 1983 ; Chervinski, 1994), and it is resistant to high variations in the environment. *S. aurata* is abundant in the Mediterranean sea, and has also been reported in the Black Sea and Eastern Atlantic coasts (FAO, 1979).This fish is most commonly found in coastal waters and hypersaline lagoons. Natural spawning occurs during winter (January to February) in the Eastern Mediterranean (Coll, 1983).

Considered as a carnivorous species, its natural dites is composed mainly of crustaceans and molluscs (Arias, 1980; Wassef and Eisawy, 1984). *S. aurata* was first cultured in the early 1970"s in extensive systems in Italy with other countries joining these effort in later years (Kissil, 1981). This consisted of stocking wild juveniles into coastal brackish lagoons, often in polyculture, and harvesting them every 2-3 years at a size of 400g. High market prices and ease of acclimation to rearing conditions

soon made *S. aurata* a species much in demand from farmers who believe in its potential as a source of income even under intensive culture conditions Now a days, cultivation practices in the Mediterranean region vary considerably, mainly due to environments factors and quality of water resources available.

On the local environment there is no study have been conducted or published before regarding the hatcheries as well as spawning of marine species like *S. aurata* or *Dicentrarchus labrax (L.*.) The principal objective of this study involved an experiment that was carried out under environmental control (temperature & light), in order to induce spawning of *S. aurata* locally for the first time.

## 2.Materials And Methods:

### 2.1.Experimental SET-UP:

The experiment was carried out between June, 2008 to February 2009, for one cycle of spawning. This corresponding to a total of 9 months including of 6 months of captivity and acclimation period.

### 2.2.Spawning Tank:

One concrete tank of MBRC hatcheries, of size (250 cm by 150 cm and of depth 150 cm), were used and located indoor. The tank covered by a black nylon to avoid the light coming from outside and received by a control system of light, water systems and aeration. The tank designed as a brood stock tank for spawning with a pipe connected with a planktonic net for eggs collection.

**2.3.Water System:**

The tank supplied by a two water systems of borehole water of constant temperature (22 C°), and a salinity of (37ppt) and ambient water of different temperature between (10-35 C°) and a constant salinity of (37ppt).

**2.4.Light Regime:**

The fish were kept under a natural photoperiod, and their times of spawning by the end of November, when the light was about 10 hours per day and decreasing. There after a quarter of an hour is reduced per week until the correct light hours are reached spawning . The temperature should follow what would be natural for the given number of light hours.

**2.5.Brood Stock:**

The large fish of adult *S. aurata* obtained from the previous cage stock of a government company of (Rass Elhell Fish Farm), and transfer to the experimental tank of MBRC in Tajura, with sufficient oxygenation to avoid stress. The fish had been kept in captivity for several months before spawning. 14 adult brood stock were selected. The female to male sex ratio was (1:1), and the average weight for the female was about 2.6 kgs and for the males 2.2 kgs and then transfer gently to captivity tank under a control of the environment for spawning.

**2.6.Food Regime :**

The main food were used for feeding to the fish, were squid, mollusca, mackerel and a pelleted commercial food of 8mm diameters (PROVIMI. B.V Holland). Three feeding regimes were evaluated over an

experimental period, 3 days/week feed dry pellets; 2 days/week feed squid and 2 days / week feed other food. Feeding rates were 2.0%BW/day, for twice a day in the morning (8.00 am) and in the afternoon (16.00 pm).Brood stock food were described by (Aguis, 1999).

**2.7.EGG Collection:**

In the early morning before feeding, usually the eggs expelled by the fish in the water and all the floating eggs collected in the mesh .Lift the net up and ensure eggs collect at the bottom of the net, then transfer to a bucket with clean water and wash gently. Transfer eggs out of the net to the conical eggs separating tank and allow to settle for a few minutes after that, collect dead eggs and dirt through bottom drain and gently transfer floating eggs to a measuring container to determine volume of the eggs. take some sample for measuring quality and quality check. The last step within 3-4 minutes transfer the floating eggs to the incubation tank for hatching.

**2.8.Statistical Analysis:**

Using weekly of data of eggs production in terms of volume in mls, and the average volume of the eggs per week were calculated , in addition to the mean values of water quality analysis per month are also recorded.

**3.Results:**

**3.1.Spawners:**

The experiment was running in June 2008, under a control of environments such as water quality , photoperiod and feeding. The mean temperature of water system (Borehole water) were used during the period between June-October, were constant of 21C°, and then changed to an

(Ambient water) of a temperature was between 14-16 C°, during the period from November, 2008 to February, 2009. Other parameters such as salinity 37ppt, oxygen 8.0mg/l , pH 7.0 and ammonia <0.5 mg/l, remain constant. Table (1) . Show mean values of the water quality parameters used during the period of the experiment .The photoperiod following the temperature . light regimes started by 12 hours light by 12 hours dark. At the beginning of November and the end of February, the light regimes changed at about 10 hours per day and decreasing. Table (2). Show the mean values of water temperature and photoperiod were used during the period of the experiment. After the regulation of the temperature and the photoperiod the fish started spawning in the first week of December till February and expelled a high quantity of floating eggs on the water surface of the tank were collecting in the net.

### 3.2.Eggs Production:

The first recorded of spawning was 19/12/2008. The spawner was daily induced of eggs during the period from December-February. Removal of the Egg from the collector took place daily in the early morning and some times in the afternoon. The volume of the viable eggs was then recorded by transferring the eggs together with some sea water to a 2 liter measuring cylinder. The total volume of eggs present in two or three samples. Eggs were measured by using a 1000 mils measuring cylinder. By the time high production of eggs were obtained, from 1658 mils of fertilize eggs in December to 2650 mils in February. Table 3 Show the results of egg quantity and quality during the experimental period.

### 3.3.Hatching Larvae:

After checking the quantity and quality of eggs by separating the fertilize eggs from nonfertilizing, the eggs were then transfer to a 1.5 $m^3$ cylinder conical fiberglass tank for incubation in order to start rearing larvae. The eggs hatched between 36 to 48 hours after stocking. No light was provided during incubation of eggs and till the third day after hatching. Feeding on live food such as (Algae & Artemia) was started. After one week of feeding , no results have been obtained due to high mortality of the stock larvae. The rearing larvae were carried out many times but no results have been observed

**Table (1). Mean values of water quality parameters during the experimental period.**

| Months | O2 (mg/l) | pH | S% | Ammonia(mg/l) |
|---|---|---|---|---|
| June,2008 | 8.0 | 0.7 | 37.0 | <0.05 |
| July | 7.0 | 0.7 | 37.0 | <0.06 |
| August | 8.0 | 0.7 | 37.0 | <0.05 |
| September | 6.0 | 0.7 | 37.0 | <0.05 |
| October | 8.0 | 0.7 | 37.0 | <0.05 |
| November | 8.0 | 0.7 | 37.0 | <0.05 |
| December | 8.0 | 0.7 | 37.0 | <0.05 |
| January,2009 | 8.0 | 0.7 | 37.0 | <0.05 |
| February | 8.0 | 0.7 | 37.0 | <0.05 |

**Table (2). Mean values of water temperature (C), and photoperiod (hours/day) during the experimental period.**

| Month | light/Hours | Dark/Hours | Temperature (C) |
|---|---|---|---|
| June,2008 | 14.00 | 10.00 | 22.00 |
| July | 13.45 | 10.15 | 22.00 |
| August | 12.30 | 11.30 | 21.00 |
| September | 11.45 | 12.15 | 20.00 |
| October | 11.00 | 13.00 | 20.00 |
| November | 10.15 | 13.45 | 16.00 |
| December | 10.00 | 14.00 | 14.00 |
| January, 2009 | 10.00 | 14.00 | 14.00 |
| February | 10.00 | 14.00 | 14.00 |

**Table 3. Quantity and quality of fertilize eggs of *Sparus aurata*, during the spawning season.**

| Date | Weeks | Quantity of fertilize eggs (mls) | Eggs quality |
|---|---|---|---|
| 19/12/08 | 1 | 1658 | good |
| 27/12/08 | 2 | 1670 | good |
| 04/01/09 | 3 | 1709 | good |
| 12/01/09 | 4 | 1877 | v.good |
| 20/01/09 | 5 | 1933 | good |
| 28/01/09 | 6 | 1943 | good |
| 05/02/09 | 7 | 2036 | v.good |
| 13/02/09 | 8 | 2580 | excellent |
| 19/02/09 | 9 | 2650 | excellent |

**Total production** **(18456) mls of eggs**

**Total number of brood stock (14); Sex ratio (1:1).**

## 4.Discussion:

The final results of the trial show that the spawning of *S. aurata* was occured between November till February depends on the decrease of the temperature from 22-16C and the photoperiod by decreasing of the light regimes. The spawning increase by the time started in the winter to spring season. From the biological point of view , the spawning seasons of *S. aurata* and other Mediterranean species such as *D. labrax*, were occurs in winter season (FAO,1992 ). The observations from the experiment conform to the results reported by (Shelbourn et al, 1974), for marine fishes ; (Wing field and Grimm, 1977), for *Pleuronectus plattessa*; (Kuo and Nash, 1975); (Liao, 1975) and Nash and Shehadeh, (2005), who study the induced spawning of grey mullet, *Mugil cephalus*, found that the winter condition has direct effect on breeding of the fish. Thus it may be concluded that the effect of the environment from a warm water (22C°) to a cold water (14C°) and by decreasing of the light regimes from 12-10 hours changed would induce of spawning and allow the fishes to expelled the eggs.This result was agree with (Coll, 1983, and Tandler and Helps, 1985), working on environment effects and hatchery of European species such as S. aurata and *D. labrax* (L.), Previous study at Haifa laboratory showed that *S.aurata* kept in cages grow continuously until onset of their breeding season in December ( Pitt et al, 1977); and (Harvey and Hoar, 2008). The main factors affecting spawning are temperature in breeding cycle of marine fish. There are only a few studies/ examples of direct photoperiod effects( Brett, 1979).Table. 3 shows the quantity and quality of fertilize eggs throughout the experiment. The total production of the eggs was 18456 mils during the spawning season . Spawning was started in winter and increasing in spring season . It could be due to effect of some

factors such as the water quality or feeding. Thus , it is clear from these observation, that *S. aurata* usually the breeding season in the natural water was in spring and they expelled the eggs in one or two seasons in several times around the year, but high fecundity always occurs in the beginning of spring. These found by (Tandler et al, 1989 ). Working on the effect of temperature and photoperiod on spawning and egg production of *S.aurata*. Fertilizing eggs were netted and brought into the hatchery in a glass bicker. After that , eggs were damaged by the netting net settled to the bottom of the incubation tank .Small quantity of the floating eggs were stocked, these process repeated until the incubation were stocked with 100 mils. Hatching of eggs occure in 48 hours, after one week of incubation, high mortality was observed, (80%) of the total hatching larvae. (Tandler and Mason, 1983), Working on larval production of *S. aurata* were found higher mortality in the initial larval rearing than the other stages and their growth affects by many factors. It is concluded that, hatching larvae were unable to rearing till weaning stage, may be due to several factors, biologically, such as swim bladder inflation of the larvae (Chatains, 1989), found the same problems of swim bladder inflation on the larval stage of *S.aurata* and *D. labrax*, or due to the live food quality or mechanical factors of water system used it could be contaminated due to the lack of biological filtration system.

## 5.Conclusion:

The results of the present study clearly indicate that the process of spawning in *S. aurata* are associated with the season change of the environment .This association is evident both of low temperature in the winter season and lower of the photoperiod. The spawning of *S.aurata*

was occurred between December to February with high production of eggs in spring season. The fact that the fish during the spawning seasons may be consumed more food than the other season. For hatching larvae, mortality was higher which had failed to feed these larvae were very small, and difficult to see alive or dead. Larval rearing were unable to be carried out due to many factors, such as swim bladder inflation, water quality, as well as the quantity and the quality of the live food were unavialble. There is no doubt the present study has yielded very interesting results, both from the biological and economic aspects of *S. aurata* at least the first time of spawning marine fish in Libya. Much work is needed in order to improve overall cycle of *S. aurata*, these must take into consideration all factors which affect it., including feeding, pathology as well as environmental factors.

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