Turkish Journal of Fisheries and Aquatic Sciences 2: 77-81 (2002))

Sea Bream (*Sparus aurata* L., 1758) Fry Production in Turkey

İ. Oğuz Uçal*
Kılıç Su Ürünleri A.Ş., Türkevleri köyü, 48277, Milas, Muğla.

*Corresponding Address: Tel.: + 90.252.532 26 03; Fax: +90.252.532 25 59;
E-mail: kilicseafish@superonline.com

Abstract

Gilthead sea bream (*Sparus aurata*) and sea bass (*Dicentrarchus labrax*) are the marine fish species, which have characterized the development of marine aquaculture basin in the last two decades in Turkey. The substantial increase in production levels of these two high value species has been possible thanks to the progressive improvement in the technologies involved in the production of fry in hatcheries. As a result of this technological progress more than one hundred hatcheries have been built in the Mediterranean basin, working on these and other similar species. At present the farmed production of these two species that is derived from hatchery produced fry is greater than the supply coming from the wild.

Key Words: sea bream*, Sparus aurata*, fry.

Introduction

Sea bream (*Sparus aurata* LINNEAUS, 1758) is a very common and precious species, which is increasingly cultured in Mediterranean countries and in Turkey.

In order to produce this species, its life cycle must be well known

Although aquacultural production is made since many years, in Turkey, the first sea fish production was made in 1985.

In Mediterranean countries and Turkey, marine fish production is highly based on Sea Bream and Sea Bass production.

In Turkey, total production of these species was 7,620 tons in 1995. This production was reached to 23,000 tons in 1999, and 33,337 tons in 2000. 15,460 tons of this final production was belonging to sea bream production while in Mediterranean countries, total production in 2000 is 107,124 tons and 59,515 tons of it, was belonging to Sea Bream production.

Biology

Body is oval shaped and stretched on sides. Color is grey on dorsal and silverish yellow on ventral. Species is protoandric hermaphrodite; a male becomes a female after reaching approx, 700 grams.

Geographical Distribution

Common in Mediterranean, rarely found in South Atlantic.

In winter, fries are in low waters while adults are in deep waters.

The species is generally found on muddy-sandy biotopes covered by sea phanerogamae.

Reproduction

The production occurs at 16-18°C in October-December in Mediterranean Sea.

Catching

Troll nets and common fishing hook are mostly used.

Live Food for Sea Bream Larvae

Microalgae

Microalgae is used to directly feed the rotifer or to indirectly feed the larvae at the first step of feeding. Algae helps to hold the quality of water parameters at optimum ranges in larvae tanks, stimulates larvae immune systems, minimises bacteriological contamination and nitrogen concentration.

In Mediterranean country hatcheries, reserving of algae is made on wider areas than needed by production, by taking stock culture as base.

Generally chosen species: *Isochrysis galbana, Nannochloropsis oculata, Nannochloropsis gadinota, Tetracelmis suecica.*

Even though some of these species are not enough nutrition especially on ω3 fatty acids (HUFA) concentrations, they are chosen because of their rich protein potentials. Sizes, production aptitudes and inexistence of side effects like toxicity, are also matters for the selection of these species.

Parameters affecting algal growth and

production rates are:

Temperature: 18-24ºC
Salinity: 20-35 ppt
Lighting force: 1,000-2,000 luxes on small scale culture, 10,000 luxes with mass culture.
pH: 7.5-8.5

Rotifer (*Brachionus plicatilis*)

Feeds by filtering bacteria, algae, protozoa, etc.

Different species are present. Small "S" type is about 100-200 µ, Large "L" type is about 130-340 µ in lorica lenght.

Usually baker's yeast is used for preliminary culture, but in some cases, some special nutrients (rich in HUFA and vitamins) are used for enrichment.

Optimum culture conditions for rotifer culture:

Temperature: 25-27ºC
PH: 7.5-8.5
Light: 2000 lux.
NH_3: <1 ppm
Salinity: 25 ppt
Oxygen: 5-7 ppm

Artemia

The larvae's oral cavity enlarges during growing. For this reason Rotifer is replaced with *Artemia* which is bigger size.

10-15 days after hatching, larvae are fed by *Artemia* of size 430 µ. After this period, specially enriched *Artemia* of 500µ in total length are used.

Because of its floating capabilities and increased feeding potential, *Artemia* is a good prey for fry. Mostly important characteristic of *Artemia* is its cyst production (which holds the embryo during its resting phase).

Cyst incubation endures 24 hours in salt water at 30ºC under a highly lighted and ventilated area. Additional 12-24 hrs is required for enrichment of meta-nauplius.

Hatchery Production Procedures

Adult management

Main points at adult management:

- Sizing the adults.
- Recording the adults.
- Adaptation to tank conditions and long period stockings.
- Photoperiod (Hatching eggs by produciton program and by maturity).

Criterias for choosing adults

- Normal color and body shape.
- Unexistence of skeletal deformations.
- Whole health conditions.
- Biggest in its age group.
- Highest transformation and growing rate in its age group.

Quarantine

2 weeks before taking the adults to the production, they are taken into the quarantination tanks for caring of fist diseases.

Formalin (Formaldehit solution with 37-40% water).

Sinking to fresh water.

Bath with furan group antibiotics.

This care is applied 4 times every 3 days. After quarantination, adults are taken to the stock unity in hatchery.

Feeding the adults

2 different types of feeding are applied:

- From 3-4 months before the next spawning season, to Ovogenesis period; (which comes next to the end of hatching period) a protection diet is applied. Daily feeding rate is about 1-1.5% of total weight (biomass).
- Enriched diet to serve as main feed for gametogenesis needs during hatching period.

Dry pellet used at this diet, most exceed the potentials of important feeding elements such as EHA, DHA and PUFA fatty acids and vitamins.

Having the egg

Releasement of the eggs can be done either naturally or by hormon application.

1. Hormon application: (LH – Rha).
Min. Oocyte diameter (µm): 500
LH- Rha: (mg/kg CA): 1
Enjection times: 2 (4-6)

2. Inducement of spawning off season with temperature and photo period control : Having the egg by using day length and temperature.

Pre-period: Before natural hatching time.
Natural period: Natural environment time.
Post-period: After the natural hatching time.

Egg management

Sea bream eggs are pelagic. Eggs are disinfected before incubation (Table 1).

Egg quality:

- Unhatched or dead egg percentage must be below 5%.
- Eggs must be circular shaped, with a diameter of 980-990 µ, natural cell division must be present.

- Vitellus must be in good shape
- Eggs must have crystal opacity
- An oil globe of 230-240 µ must exist.
- Coryon face must be uncontaminated.

Breeding process and incubation phase

The incubation of the eggs takes place in the larvae tanks.

Disinfected eggs are transferred to the tanks with a rate of 0.1 g /*l*.

Air circulation is strong until the 85-90% of the eggs open. Air circulation is made by several ventilation systems placed in the tank.

Incubation time at 17-17.5ºC is about 48-60 hours. Darkness is applied.

Larval Production

Larval production parameters

Photoperiod and temperature application:

- Darkness in first 4 days
- At 18ºC, with the beginning of feeding, 16 hours of light, 8 hours of darkness

Aeration:

- Decreased for air bladder development
- Aeration must be at a level which larvae can feed normally and which the larvae and the feed are distributed homogenically

Flow: 10 l/min at the beginning, 20 l/min thereafter.

Oxygen: Saturation must be under 80% from beginning to the air bladder developed. Oxygen adding must be made after the start of active hunting. Optimum range is 6-8 ppm.

Salinity: 37-40 ppt

Feeding at larvae phase

First feeding: 'S' type Rotifer of size 50-90µ in lorica lenght is used at the beginning because of oral cavity, which has a size of 100 µ. After, bigger and wider choices of live feed are used depending on the larval development (Table 2).

Depending on water temperature: live feeding ends after 40-50 days, and crumbled pellet starts. Because of the importance of this phase, few quantities are used at the start (to prepare the larvae to get used to taste).

The feeding instinct of the larvae starts with light feeding in the morning. To not have problems at night (dying by starvation) and for being able to use live feed as last feed; using dry feed in this phase is important.

Days between 40 and 43 are the days where the postlarvae become juvenile. At this phase, the fish is ready for 'weaning'.

Air bladder appearance

Some researchers think that first activation of air bladder begins by swallowing air from the surface. That realizes by the temporary connection between the mouth and the air bladder.

Factors that affect normal air bladder appearance:

Table 1. Egg disinfection.

Disinfectants	Dosage	Time	Usage
Penicillin G	80 UI/ml	1 min	To 500 mg/10 *l* salt water For 100-200 eggs
Streptomycin SO_4	50 mg/ml	1 min	To 500 mg/10 *l* salt water For 100-200 eggs.
Active Iodine	50 ppm/lt	10 min.	$1.5x10^6$ times/8 *l*

Table 2. Larval development.

Age (day)	Length	Observations
1	3 mm	Hatch
2	3.5 mm	Appearance of pectoral fin
3	3.8 mm	Exotrophy beginning, pigmentation in the eyes 60% of feed bag, 40% of fatty drop absorbed
5	4 mm	First air (natal) bladder swollen 100% of feed bag, 70% of fatty drop absorbed
15	5 mm	Air bladder swollen ends, caudal tin development 100% of fatty drop absorbed
17	7 mm	Anal fin development
20	7.5 mm	Beginning of stomach development
45	11 mm	Second dorsal fin development
50	15 mm	Development of first dorsal and ventral fins. End of air bladder development (20-30%)

- Physical barriers at the middle face of air and water.
- Physio-morphological anomalies on newly hatched larvae
- Early disease
- Irregular and few feeding
- Irregular water conditions

Lack of air bladder causes skeletal deformation resulting some bad conditions as follow:

- Anomaly in swimming
- Less feeding
- Slow development

Realizing the lack of air bladder in early stage of production, it helps to decide the flow of the production program.

Hypertrophy

The air amount swallowed for creating the air bladder is much. That causes the air bladder to overgrow.

The risk for this situation is between the days 20 and 30.

These kinds of fish have no chance to normalize again and they must be destroyed.

To avoid this situation, regular production procedure must be followed. The fish must be prevented from environmental and physical stress.

Adaptation

Sea Bream Fry is growing in hatchery unit until it reaches a weight of 2-3 g.

For the quality of the water that feeds the unit an UV lamp for sterilisation and 50-100 μ filters are used and the environment is made comfortable.

Temperature: 18-22ºC

Salinity: 40%

Total Ammonia: <1ppm

Oxygen: Saturation rate at the water exit must be 80-100%

Photoperiod: 14 hours light, 10 hours darkness

Water exchange rate: 20%

Feeding

First stocking density: 10-20 fry/*l*

Temperature: 18ºC

Salinity: 35-37%

Fry biomass in 1 ton is used to estimate the amount of feed given.

Feed with live food: To avoid cannibalism and stress, 4 million *Artemia* metanauplii is given 3 times per day. This ends 6 days after passing to adaptation.

Feed with crumble pellet: First encounter happens on days 17-19.

Low feeding causes heterogeneity in fish lengths and cannibalism. High feeding causes for water pollution and increases the ammonia amount in water.

Before transferring fry, air bladder appearance, deformation rate and survival rate must be observed.

Air bladder control

A water of salinity 50ppt is prepared. Fishes anaesthesed with 200-400ppm phenoxyethanol are taken to the water. Normal fish float on the surface while those with unfunctional air bladders sink down to the bottom.

Deformation control

Skeleton, robust, operculum and vertebral column deformations.

Anaesthetised fish are placed on a flat surface such as a glass or PVC table, and observed.

In the cases smaller than 0.5 g, morphometry and sterostatic observation can also be made by x-rays.

Fry Transfer

Transfer is made in covered or uncovered cylindrical or rectangular tanks of volume 2-3 tons behind the transport vehicles that have oxygenation systems.

Saturation during transfer: 150-200%.

Fish density on short transports: 30-35 kg/m^3, 20-25 kg/m^3 on long transfers.

In long transfers an additionally refreshment of water 1 or 2 times makes the transport safer.

Fry Diseases

Operations for treating diseased fish populations:

- Removing environmental parameters.
- Observing fish behaviours.
- Having samples form lesions, blood, spleen, kidney and stain them.
- Having samples from spleen, anterior kidney, dorsal aorta and air bladder and cultivating them.
- Naming pathogenical bacteries and preparing pure culture.
- Antibiogram test: Under the test results effect, the treatment must begin 48 hours after.
- True treatment selection (Table 3).

Morphometrical and Morphoanatomical Standarts

Uriner calculosis

Made by phofate crystals of grayish and

Table 3. Sea Bream Pathogens.

Pathogens	Symptoms	Treatment
Bacteriological	Acute septicaemia	
Vibrio spp.	Lack of appetite Bleeding on flesh and ulcer	Nitrofurans
Pseudomonas spp.	Liquefaction and tumefaction On spleen and kenley	Tetracyclines
Pesturella spp.	Hemorogies on heart face Nodules on spleen	Chinolons
Parasites		
Monogeneans		
Furnestia echeneis	Gills	Formalin
Gyrodactylus spp.	Flesh	Formalin
Microcotyle chrysophryii	Gills	Formalin

yellowish color on adults and redish or green color on younger members, uriner calculosis appear on uretra or bladder.

It happens because of careless treatment and stress. It is not lethal but when seen in larval growing phase, it indicates a bad population quality.

Air bladder development

A functional air bladder has the 20-30% of the length of a member longer than 40-50 µm

An unfunctional air bladder appear half transparent and small under the microscope. It does not exceed 3-5%.

Its lack causes:

Decrease in growth rate

Vertebral column deformation longer than 20 mm

Skeletal deformations

Newly hatched larvae deformations: A bended body is the mostly seen example

Possible causes:

Insufficiency of feed on adults during ovogenesis, touch by hand, salinity and temperature shocks, environmental pollution.

Chin and operculum deformations: A single or both operculums may be missing or never exist. At larvae of 12-20mm, they can be seen under the microscope, on bigger members, they can be seen by eye. It affects growing performance.

Chin deformation causes dying by hunger or decrease growth rate.

Vertebral column deformations: Skeletal deformations are mostly effective between the 2nd and 6th vertebras. Melting of some vertebras, C shaped (scoliosis), S shaped (chphosis) and V shaped (lordosis) are vertebral column deformations.

If the fish is affected by the disease or the water circulation on larval phase was too strong, the chance of having lordosis increases.

At the roots of skeletal deformations lies:

Heavy metal and pesticide toxicity

Overstocking or lack of vitamins