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Investigations on weight loss occuring in winter season and growth of gilthead sea bream (*Sparus aurata*) reared in the Black Sea

Karadeniz'de yetiştirilen çipura (*Sparus aurata*)larda kış aylarında görülen ağırlık kaybı ve büyüme üzerine araştırmalar

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Abstract

In this research, weight loss occurring in winter season and growth performance of gilthead sea bream (*Sparus aurata* L., 1758) have been investigated in a cage on Eastern Black Sea coast. Fish (n=2590) with initial mean total length of 11.1±0.17 cm, body weight 24.4±1.14 g, condition factor of 1.7±0.02 were stocked in a cage on 11 September 1996 and fed by hand three times a day, up to they were satisfied. At monthly intervals, 30 fish were taken as sample and their total lengths and body weights measured to determine growth, food conversion, feeding rates and condition factor. After 421 days at the end of the experiment, mean values of total length, body weight and condition factor were determined as 26.3±0.28 cm, 258.9±9.47 g and 1.7±0.02 respectively. It is observed that growth almost ceased after November when the seawater temperature dropped below 16 °C, the fish have lost weight between January and April, then growth rate increased as depending on rising the seawater temperature.

Keywords: Gilthead sea bream, *Sparus aurata*, weight loss, growth, Black Sea,

Introduction

Gilthead sea bream (*Sparus aurata* linne 1758) belongs to Sparidea family and is a species of Sparus genus. Geographic distribution of gilthead sea bream extents from Black Sea to Atlantic, to Baltic Sea and even North Sea, but it is mostly caught in the Aegean Sea and Mediterranean (Bouchot, 1987).

Gilthead sea bream culture has been started in Mediterranean countries such as France and Italy in 1970s and 10 years later applied in Aegean Sea in Turkey (Benli and Uçal, 1990). In recent years, it was thought that it could be cultured in the Black Sea. Surface temperature of the Black Sea changes from 7 to 29 °C and salinity range is between 14 and 18.5 ‰ (Murray, 1991). Gilthead sea bream tolerates temperature of 5 – 28 °C and salinity of 5 – 50‰. Optimal temperature range is between 22 – 24 °C for best growing (Alpbaz, 1981; Cnexo, 1983; Bouchot, 1987; Benli and Uçal, 1990).

In practical fish farming, it is the aim of all farmers to grow their fish as quickly and cheaply as possible while producing a quality product to sell. Fish growth is obviously dependent on a number of factors including species, age, genetic potential and water temperature (Jackson, 1988; Priede and Secombes, 1988). In spring and summer, growth rates of fish tend to be high, whereas in autumn and winter low and many fish may lose weight (Dobson and Holmes, 1984).

In this study, weight loss occurring in winter season and growth of gilthead sea bream were investigated in the Black Sea conditions. There is not sufficient data on growing of gilthead sea bream in the subtropical seas such as Black Sea and it is considered to help the practical farming of this species.

Material and Method

The study was carried out between 11 September 1996 and 20 October 1997 in Trabzon-Yomra Fisherman Shelter. Gilthead sea bream juveniles (n=2590) of 11.1±0.17 cm in length and 24.4±1.14 g in weight were transferred from Adana-Yumurtalık to a sea cage that belonged to Central Fisheries Research Institute and their growth followed up until 20 October 1997.

The 4x4x4 m floating cages were made of timber, galvanised 1 inch pipes and Styrofoam construction supporting 4, 12, 18 and 24 mm mesh knotted nylon nets. Seawater temperature, dissolved oxygen, pH and salinity were measured daily. All fish in the experiment received a dry pelleted commercial feed of following composition: crude protein 46%, crude fat 10%, crude fibre 3%, ash 13%, calcium 2.2% and phosphate 1.5% and fish fed *ad libitium* by hand three times a day, up to they were satisfied.

Before being weighed and measured, fish were fasted 24 hours to allow the gut to be emptied. They were anaesthetised in a 1:25000 solution of MS-222 (meta-aminobenzoic ethy lester) in water. At monthly intervals, 30 number of fish were randomly taken as sample and their lengths were measured by Von Bayer box and weighted .

Results and Discussion

During this study, maximum average monthly sea water temperature (27.4 °C) was measured in August and minimum temperature (8.1 °C) was observed in February. Dissolved oxygen concentration was found low (6.1 mg/lt) when temperature became maximum and it increased (10.2 mg/lt) when temperature decreased in winter season. Salinity changed between 16.5 – 18.1 ‰ and pH ranged 7.9 – 8.3. These salinity values were lower than Aegean and Mediterranean, but not limited growth of gilthead sea bream in the Black Sea.

The optimum temperature for growth varies with fish species. In spring and summer, growth rates tend to be high, whereas in autumn and winter at low temperatures food intake and growth are low and many fish species may lose weight (Bond, 1979; Dobson and Holmes, 1984; Bone *et al.*, 1995).

At the end of growing season, the fish that were 11.1± 0.17 cm in length and 24.4 g in weight with 1.7 condition factor at the beginning, reached 26.3±0.28 cm in length and 258.9 g in weight with 1.7±0.02 condition factor after 421 days (Table 1).

In fisheries numerous mathematical formulas have been proposed to describe fish growth, but commercial farm purposes it is best described in terms of Specific Growth Rate.

Table 1. Growth of gilthead sea bream by days

	Length (cm)			Weight (g)		
Days	Min.	Max.	Mean±s.e.	Min.	Max.	Mean±s.e.
1	9.1	12.9	11.1±0.17	13	38	24.4±1.14
13	12.2	16.0	14.2±0.14	34	76	50.4±1.75
47	12.9	17.7	15.5±0.19	36	87	63.7±2.27
75	14.3	18.0	16.0±0.18	47	93	68.1±2.34
103	14.5	17.9	16.1±0.16	49	98	69.3±2.33
133	15.5	18.5	16.2±0.18	64	105	68.8±2.43
160	14.2	18.0	16.2±0.16	43	99	67.2±2.52
187	14.7	18.2	16.3±0.14	48	98	65.7±1.55
217	13.5	18.2	16.3±0.19	33	100	63.3±2.42
252	14.8	19.3	17.0±0.02	48	129	79.2±3.28
280	16.3	20.2	18.3±0.03	62	139	98.6±3.73
313	18.7	22.4	20.7±0.19	110	198	152.8±3.86
342	19.7	25.4	22.4±0.25	125	296	196.2±7.60
373	21.8	25.8	23.9±0.20	174	323	242.0±7.09
421	21.5	27.4	26.3±0.28	167	351	258.9±9.47

The most useful and practical expression is that of specific growth rate which is the percentage daily increase in weight. Specific growth rate depends on food intake and so can be adjusted to produce fish for target selling dates. Specific growth rate is also dependent on various environmental factors. Exception occurs when temperature fluctuates with the seasons. Specific growth rate declines in winter and then increases again in the spring as water warms up (Jackson, 1988; Priede and Secombes, 1988).

Gjerdem and Gunnes (1978) have reported that growth of rainbow trout (*Oncorhynchus mykiss*) almost ceased when winter sea water temperatures had fallen below 4 °C for a long period and Okumuş *et al.* (1997) reported that growth of sea bass (*Dicentrarchs labrax*) almost ceased during winter season, when temperature dropped to °C 16 and due to long fasting period important losses occurred and also that they determined negative SGR in winter season for sea bass.

The specific growth rate for gilthead sea bream, reported by Gordin *et al.* (1987) as 0.3 in land based ponds on the Mediterranean coast, Bermüdez *et al.* (1989) 0.6 in cages on the Mediterranean coast, Alpbaz *et al.* (1991)

0.6 and 0.7 in cages on the Aegean coast, Şahin *et al.* (1997) 0.4 and Çiftçi (1997) 1.3 and 1.1 in tanks on the Eastern Black Sea coast.

In this study, specific growth rates were determined as the highest 6.0 between first 1-13 days, but a negative SGR was found between 133 and 217 days. Average SGR was established as 0.8 and an acceptable growth (SGR□0.5) considered overall rearing period, although it was negative between January and April when temperature fell below 10 °C (Figure 1).

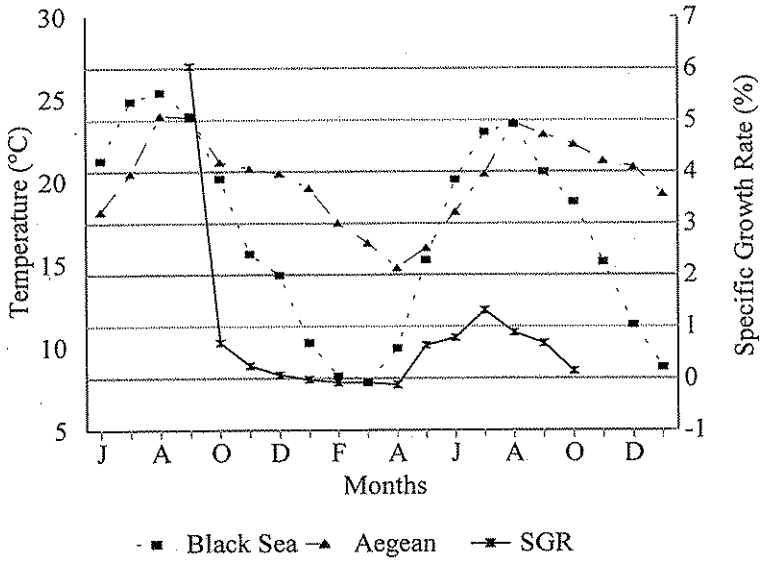

Fig. 1. Specific Growth Rate of gilthead sea bream by months

Some authors have reported that FCR was found by Bermüdez *et al.* (1989) 3.0 in cages, Tekin (1996) 2.3, 2.4 in cages on the Aegean Sea coast, Genç *et al.* (1997) 1.1 – 2.4 in tanks on the Aegean coast, Şahin at all (1997) 3.8 and Çiftçi (1997) 2.1 - 2.2 in tanks on Eastern Black Sea coast. It is observed that feed conversion varied with temperature in overall rearing period and was determined 8.1% as the highest between 1 and 13 days and food intake almost ceased between 133 and 217 days. Average FCR was calculated as 1.6 for the overall rearing season. Condition factor changed depending on food intake and ranged between 1.4±0.02 and 1.8±0.02. Considering the results in the overall rearing season, it can be said that the fish got enough feed for growing.

In conclusion, it seems that the temperature is the main factor limiting the growth in Eastern Black Sea, especially fish lost weight and negative growth rate occurred in the fasting season including January, February and March when temperature dropped below 10 °C. But, growth performance of gilthead sea bream acceptable for rearing of this species by considering overall rearing season, it can be advised that the cage farming with good management may be practised in the Black Sea.

Özet

Bu araştırmada çipura (*Sparus aurata* L., 1758)'nın Doğu Karadeniz koşullarında büyüme ve kış aylarında görülen ağırlık kaybı incelenmiştir. Denemede ortalama olarak 11.1 ±0.17 cm total boy, 24.4±1.14 g ağırlık 1.7±0.02 kondisyon faktörüne sahip balıklar (n=2590) kafese 11 Eylül 1996'da kafese stoklanmış ve günde üç kez doyuncaya kadar el ile yemlenmiştir. Büyüme, yem değerlendirme oranı ve kondisyon faktörünü belirlemek için balıkların total boy ve ağırlıklarının yaklaşık bir aylık aralıklarla 30 adet balık örnek olarak alınmış ve ölçülmüştür. 421 günülük besleme sonunda, balıkların ortalama total boyu 26.3±0.28 cm, ağırlığı 258.9±9.47 g ve kondisyon faktörü 1.7±0.02 olarak gerçekleşmiştir. Kasım ayından sonra deniz suyu sıcaklığı 16 °C'nin altına düştüğünde büyümenin hemen hemen durduğu, balıkların Ocak-Nisan ayları arasında ağırlık kaybına uğradığı, daha sonra su sıcaklığının artması ile büyüme oranında artış olduğu gözlenmiştir.

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