

## SOME BIOLOGICAL CHARACTERISTICS OF MEANDER BLEAK, *ACANTHOBrama MIRABILIS* LADIGES, 1960, IN THE KEMER RESERVOIR, TURKEY

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**Abstract:** The age, growth and reproduction are described for 1122 *Acanthobrama mirabilis* Ladiges, 1960 (Pisces: Cyprinidae) from Kemer Reservoir (Turkey) from December 2004 to November 2005. Samples consisted of fish varying in fork length from 7.8 to 14.8 cm and weight from 6.20 to 46.11 g. Maximum age group determined was IV for females and III for males. Female:male ratio was 1:0.54. The von Bertalanffy growth equations were  $L_t=14.24[1-e^{-0.704(t+0.952)}]$  for males and  $L_t=15.45[1-e^{-0.577(t+1.025)}]$  for females in the Kemer Reservoir. Fecundity ranged from 4184 to 22377. Spawning period was between April and June.

**Key Words:** *Acanthobrama mirabilis*; age, growth rate; reproduction

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### Introduction

There are three species of *Acanthobrama* (*Acanthobrama mirabilis* Ladiges, 1960, *Acanthobrama marmid* Heckel, 1843 and *Acanthobrama centisquama* Heckel, 1843) in the inland waters of Turkey. The Meander bleak, *Acanthobrama mirabilis*, one of the species of this genus, is only distributed in branches of the Buyuk Menderes River (Saraykoy vicinity, Akçay stream catchment and Kemer Reservoir) and Lake Bafa in southwestern Anatolia (Bogutskaya 1997; Geldiay and Balık 2007; Sarı et al. 1999; Özcan 2007a). Endemic species is vulnerable in Menderes River (Crivelli 1996), extinct from Lake Bafa (Sarı et al. 1999). It is the dominant species in the Kemer Reservoir, which is eaten by local people. The species is locally called 'ulubat' and a benthopelagic fish species inhabits both lentic and lotic environments. Occurs in shoals in the marginal vegetation at depths not exceeding 5m, where it feeds mainly on zoobenthos and to a lesser extend aquatic plants (Balık 1995). Migrates in large schools during spawning season in the Menderes River. It's spawns at temperatures between 15 °C and 21 °C in areas of no flow of the Menderes River (Balık and Ustaoglu 1989). Population de-

clines of Meander bleak threatened by pollution (domestic and agricultural) and by the introduction of alien fish species. Some major predators, such as *Lepomis gibbosus* and *Carassius gibelio* are currently widespread in the Buyuk Menderes river basin (Özcan 2007a, b). Summer drought and land irrigation cause continuous habitat degradation or loss.

Knowledge on the biology of the *A. mirabilis* is very restricted. Only one studied the some biological aspects of the Meander bleak in Bafa Lake by Balık and Ustaoglu in 1989. The aim of present study is to investigate its age, growth and reproduction characteristics of the Meander bleak from the Kemer Reservoir.

### Study area

The study area (37° 32' N and 28° 32' E), on the Akçay stream which is one of the important branches of the Buyuk Menderes River, was created after an 180.50 m-high wall built in 1954-1958 by Turkish State Water Supply Administration (DSI) to irrigation, flood control and energy (Figure 1). The surface of the reservoir of Kemer is 14.75 km<sup>2</sup> and depth varied from 11.4 to 52.7 m. The

reservoir water reduce end of the summer-autumn months (May-September) for irriga-

tion. During this study, temperature and dissolved oxygen varied

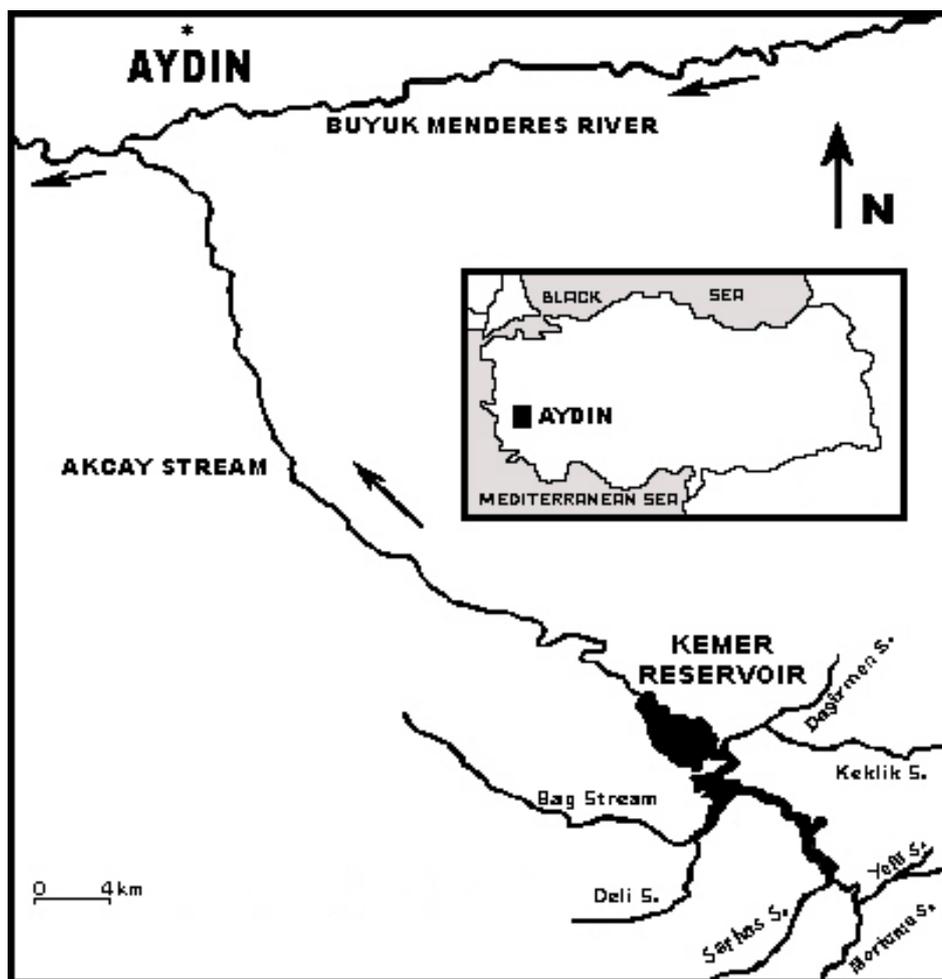


Figure 1. Map of study region

from 10.3 (February) to 27.9 °C (August) and from 5.0 (September) to 10.6 mg l<sup>-1</sup> (January), respectively. According to Özyalın (2007), the Kemer Reservoir classified as oligo-mezotrophic.

### Materials and Methods

A total of 1122 specimens were captured monthly from December 2004 to November 2005 in the Kemer Reservoir by means of 1000 m of gill nets of 18–45 mm mesh sizes and cast nets 12–22 mm mesh sizes (Figure 1). Fork length (FL) to the nearest 1 mm and body weight (W) to the nearest 0.01 g were recorded for all of individuals in the laboratory. Age determination was carried out from microscopic examination of scales. The scales of each sample were removed from the

posterior part of the body, and cleaned in a 10% solution of NaOH. Age determinations and age readings were performed according to Chugunova (1963).

The L–W relationships were determined using the equations:  $W = a L^b$  (Le Cren 1951). The parameters  $a$  and  $b$  of the L–W relationships were estimated by the least squares regression method. The significance of the regression was assessed by ANOVA, and different from the predictions for isometric growth ( $b=3$ ). The von Bertalanffy growth equations were calculated according to:  $L_t = L_{\infty}(1 - e^{-K(t-t_0)})$  for FL (Ricker 1975). Fulton's equation was employed to calculate the condition coefficient (K) for each individual fish:  $K=100 W/FL^3$ , where FL is

the fork length (cm) and W is the body weight (g) (Le Cren 1951).

Sex was determined by examination of the gonad tissue either by eye for large fish or with the aid of a lens for smaller fish. Sex ratio of the fish was studied using Chi-square test ( $\chi^2$ ). Gonads were weighed to an accuracy of 0.01 g and preserved in 4% formaldehyde solution for fecundity studies. The spawning period was determined by identifying monthly changes in the gonadosomatic index (GSI). The GSI was calculated as  $GSI = (\text{Gonad weight} / \text{Body weight}) * 100$  (Anderson and Gutreuter 1983). The fecundity of 91 females were estimated gravimetrically. Mature ovaries were subsampled (0.001 g) from anterior, middle and posterior portions of each ovarian lobe. Eggs from the anterior, middle and posterior parts of ovaries were measured under a stereomicroscope with an ocular micrometer. Samples of 30-40 eggs from each female were collected to measure the egg diameter.

## Results

A total of 1122 specimens of Meander bleak was caught and examined during December 2004 to November 2005. Fork length of specimen ranged from 7.8 to 14.8 cm (FL) weighed between 6.20 and 46.11 g. Males and females ranged from 7.8 to 13.2 cm, and 8.5 to 14.8 cm, respectively. Of the total fish examined, 727 (64.8 %) were females and 395 (35.2 %) males. The overall ratio of females to males was 1:0.54 and was significantly different ( $p < 0.05$ ).

Length-weight relationships were calculated for males, females and both sexes combined as:  $W = 0.0419L^{2.82}$  ( $r^2 = 0.93$ ),  $W = 0.0037L^{3.22}$  ( $r^2 = 0.91$ ) and  $W = 0.0094L^{3.06}$  ( $r^2 = 0.90$ ), respectively.

The von Bertalanffy growth equations were:  $L_t = 14.24[1 - e^{-0.704(t+0.952)}]$  for males and  $L_t = 15.45[1 - e^{-0.577(t+1.025)}]$  for females in the Kemer Reservoir.

The condition factors were calculated for seasons and sexes. Minimum and maximum values were calculated as 0.676 (autumn) and 1.114 (winter) for males, and 0.696 (autumn) and 1.137 (winter) for females (Figure 2).

Gonad development was studied by using the GSI values of samples. Mean GSI increased gradually from 2.78 in December to April where it peaked at 10.48. It then declined to 6.16 in May and subsequently more dramatically to 0.65 in June. After spawning, there seemed to be a six month quiescent period (June-November) (Figure 3). In order to determine the first maturity age of *A. mirabilis* in Kemer Reservoir, the gonads were examined morphologically which fixed the ratio positions of mature and immature specimens. Age at sexual maturity for females and males was estimated to be 2 year. We determined that the smallest mature female Meander bleak had a length of 14.1 cm and weight of 35.8 g. Measured with an ocular micrometer were 1030 oocyte diameters with a range from 0.44 to 1.10 mm; the average value was found 0.65 mm. Oocyte numbers in the ovaries varied from 4184 to 22377; the average value was found to be 10441.

## Discussion

The population of *A. mirabilis* in the Kemer Reservoir is composed of individuals ranging from 1 to 4 years of age; the 2 (42.6%) class was most abundant. The Meander bleak population was composed of 64.8 % female and 35.2 % male. Thus, overall sex ratio female to male (1:0.54) was biased significantly toward females ( $p < 0.05$ ). Çolak (1982) examined 4 year old specimen and reported sex ratio as 1:0.89. Balık and Ustaoglu (1989), who examined 1812 *A. mirabilis* from Bafa Lake, reported sex ratio as 1:1.31 for age groups between 2 and 7. Ünlü et al. (1994) stated that *A. marmid* maximally reach age group 5 in the Tigris River and sex ratio as 1:0.55. The overall sex ratio is close to 1:1 in many species, but may vary from species to species, may change from year to year in the same population (Nikolsky 1963).

The exponents of length-weight relationships (females:  $b = 3.22$  and males:  $b = 2.82$ ) of the Meander bleak in Kemer Reservoir show that growth is allometric. "b" values were close to estimations by

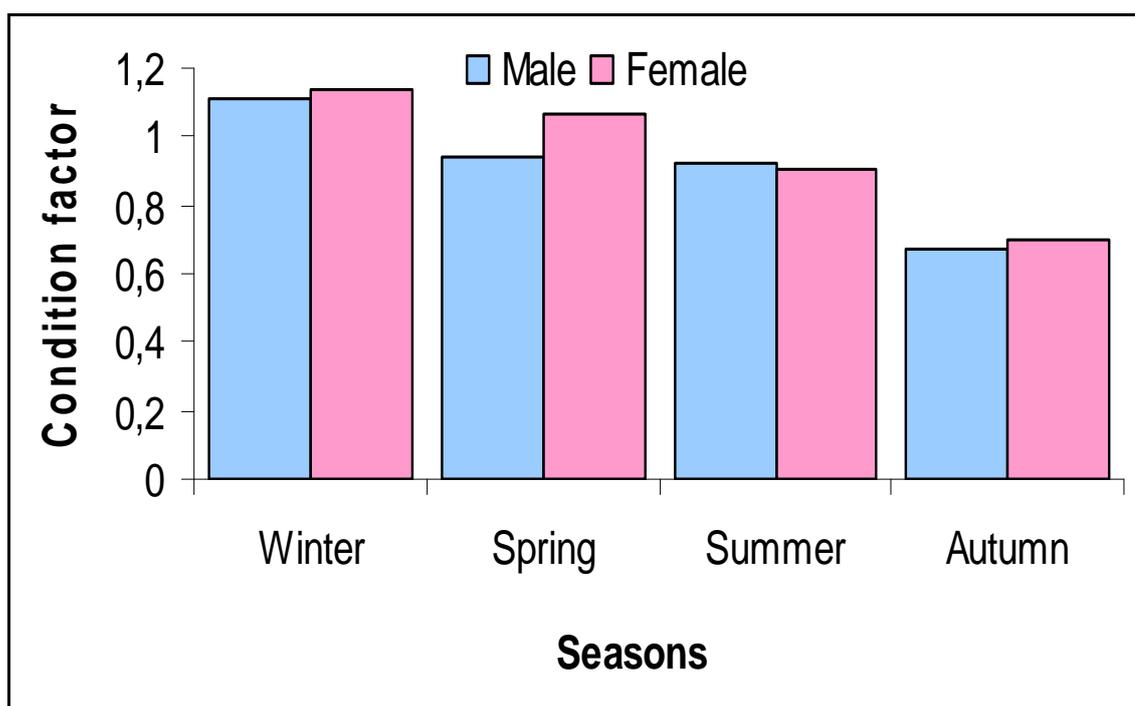


Figure 2. Condition factors as seasons for males and females of *Acanthobrama mirabilis*

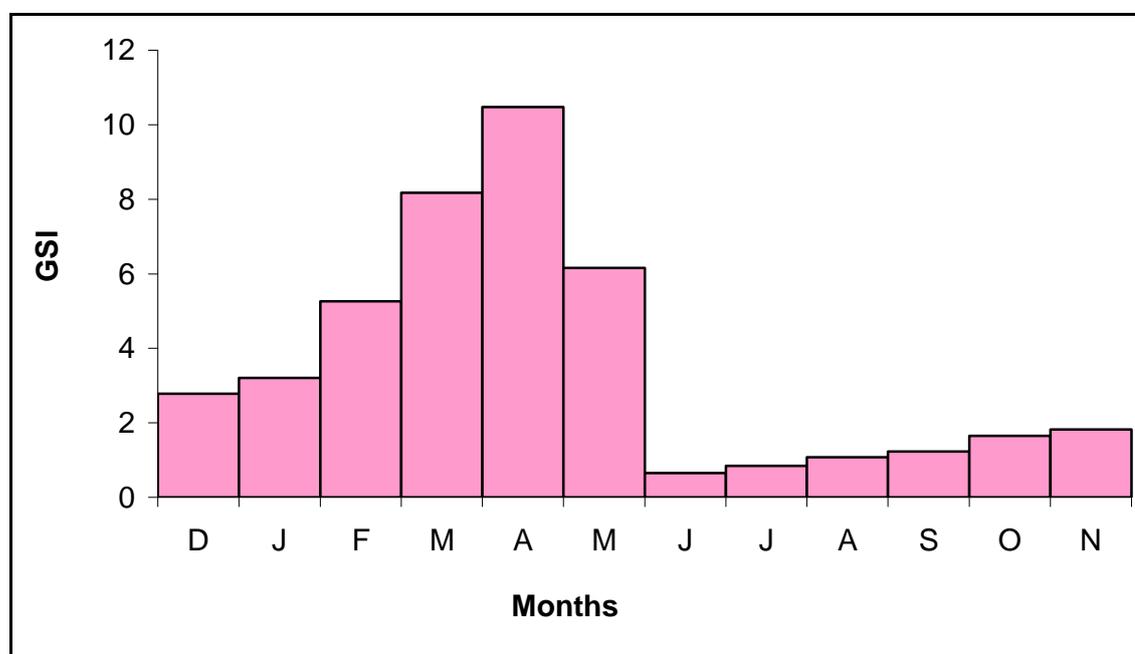


Figure 3. Gonadosomatic index as months

Çolak (1982) and Ünlü et al. (1994), but also different from those found by Balık and Ustaoglu (1989) (Table 1). The  $b$  values are often 3.0 and generally between 2.0 and 4.0. As the fish grows, changes in weight are relatively greater than changes in length due to approximately cubic relationships between fish length and weight. The  $b$  values in fish vary according to species, sex, age, seasons and feeding. In addition, changes in fish shape, physiological conditions, different amounts of food available, life span or growth increment can all affect the  $b$  growth exponent (Le Cren 1951; Bagenal and Tesch 1978).

Estimates of von Bertalanffy growth parameters indicated that females reach a larger asymptotic size ( $L_{\infty}$ ) than do males, but in contrast the growth rate ( $k$ ) of females was lower than for males. Çolak (1982) and Ünlü et al. (1994) pointed out similar situations (Table 1). The reasons for this may be that females grow faster than males, and live longer (Ricker 1975).

Condition factor values ranged from 0.676 to 1.114 for males and from 0.696 to

1.137 for females. Our values are similar to those given for the Bafa Lake (1.181-1.341) by Balık and Ustaoglu (1989); Tigris River (1.16-1.53) by Ünlü et al. (1994). Condition factor values in fish population may vary according to age, sex, fat reserve level, species, season, locality and year (Le Cren 1951).

Çolak (1982) reported that the marmid bleak spawns in Keban Reservoir from April to September. Balık and Ustaoglu (1989) stated that spawning of Meander bleak occurred from April to May in Bafa Lake. Ünlü et al. (1994) computed the spawning periods as being March and May for Tigris River. Elron et al. (2006) reported that Yarqon bleak spawning period occurred from February to April for Yarqon Stream. Considering GSI values computed in this study, the spawning occurred between April and June in Kemer Reservoir (Table 2).

Average egg diameter of Meander bleak, *A. mirabilis*, was 0.65 (range: 0.44-1.10 mm), smaller than those of *Acanthobrama spp.*, which was 8.20-1.30 mm (Svislotski 1960; Ünlü et al. 1994; Elron et al. 2006) (Table 2).

**Table 1. Parameters of the length-weight relationship ( $b$ ) and the von Bertalanffy growth equation ( $L_{\infty}$ ,  $k$ ,  $t_0$ ) for different species of genus *Acanthobrama* in different areas**

Author(s)	Species	Study area	Sex	Age	$b$	$L_{\infty}$	$k$	$t_0$
Çolak (1982) 1978	<i>A. marmid</i>	Keban Reservoir	M	1-4	2.95	28.5	0.314	-1.866
			F	1-4	2.70	28.9	0.261	-1.340
Çolak (1982) 1979	<i>A. marmid</i>	Keban Reservoir	M	1-4	2.15	24.8	0.693	-0.340
			F	1-4	2.39	26.7	0.510	-0.658
Balık and Ustaoglu (1989)	<i>A. mirabilis</i>	Bafa Lake	M	3-6	3.09	40.0	0.063	-5.068
			F	2-7	3.06	26.2	0.330	0.244
Ünlü et al (1994)	<i>A. marmid</i>	Tigris River	M	1-5	3.29	16.5	0.740	0.585
			F	1-5	3.40	17.2	0.659	0.360
Present study	<i>A. mirabilis</i>	Kemer Reservoir	M	1-4	2.82	14.2	0.704	-0.952
			F	1-4	3.22	15.5	0.577	-1.025

**Table 2. The spawning ages, lengths and seasons for different species of genus *Acanthobrama* in different areas**

	<i>A. mirabilis</i>	<i>A. marmid</i>	<i>A. telavivensis</i>	<i>A. terraesanctae</i>
Distribution	Büyük Menderes River Turkey	Menderes systems,	Tigris, Euphrates and Orontes River systems	Coastal streams, Israel
Maximum length	22.4 cm <sup>b</sup>	24.4 cm <sup>c</sup>	12 cm <sup>e</sup>	23 cm <sup>f</sup>
No. of age groups	4 or 6 <sup>a, b</sup>	4 or 5 <sup>c, d</sup>	5 <sup>e</sup>	6 or 7 <sup>g</sup>
Size and age at maturity	14.1-15.9 cm <sup>a, b</sup> third year <sup>b</sup>	18.6 or 20.0 cm <sup>c</sup> Second year <sup>c</sup>	4-5 cm <sup>e</sup> Second year	above 8 cm <sup>g, i</sup> third year
Spawning period	April to May <sup>b</sup> April to June <sup>a</sup>	April to September <sup>c</sup> March to May <sup>d</sup>	February to April <sup>e</sup>	November to May <sup>h</sup>
Fecundity	12000-20129 <sup>b</sup> 4184-22377 <sup>a</sup>	9000-13000 <sup>c</sup> 1215-8125 <sup>d</sup>	280-4200 <sup>e</sup>	no data
Mean egg diameter in final maturation stage	0.44-1.10mm <sup>a</sup>	1.19 mm <sup>d</sup>	850-1250µm <sup>e</sup>	820-1300µm <sup>i</sup>

<sup>a</sup>Present study

<sup>b</sup>Balık and Ustaoglu (1989)

<sup>c</sup>Çolak (1982)

<sup>d</sup>Ünlü et al (1994)

<sup>e</sup>Elron et al (2006)

<sup>f</sup>Davidoff (1986, cited from Elron et al 2006 )

<sup>g</sup>Ostrovsky and Walline (1999, cited from Elron et al 2006)

<sup>h</sup>Gafny et al. (1992, cited from Elron et al 2006)

<sup>i</sup>Svislowski (1960, cited from Elron et al 2006)

Fecundity ranged from 4184 to 22377 eggs per ripe ovary. Çolak (1982) reported from 9000 to 13000 eggs per female for the marmid bleak, Balık and Ustaoglu (1989) point out between 12000 and 21129 eggs per female for Meander bleak, Ünlü et al. (1994) stated that fecundity varied from 1215 to 8125 eggs per female for marmid bleak, Elron et al. (2006) reported that fecundity varied from 280 to 4200 eggs per female for Yarqon bleak. Fecundity in Kemer reservoir is similar to Balık and Ustaoglu (1989), but different from that reported by Çolak (1982), Ünlü et al. (1994) and Elron et al. (2006) (Table 2). Fecundity was correlated with the fish length, weight, age and gonad weight (Kuru 1987).

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