Age and growth of iridescent toothcarp *Aphanius mento* (Heckel, 1843) (Cyprinodontidae) in Seyhan Reservoir (Southeastern Mediterranean, Turkey)

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**Abstract**

The population structure of *Aphanius mento* in the Seyhan Reservoir was studied on the basis of 834 fish specimens (516 males and 318 females) caught on a monthly basis between September 2013 and August 2014. Fish were collected using dip nets of tulle with a 1 mm mesh size. The maximum age of fish was found to be 4 years for both sexes combined, the 1 year old age group comprised 62.2% of male samples. The overall sex ratio of females to males was 1:1.62. Von Bertalanffy growth parameters were $L_\infty = 54.33$ mm, $K = 0.399$ year$^{-1}$, $t_0 = -1.168$ years for females, $L_\infty = 52.72$ mm, $K = 0.397$ year$^{-1}$, $t_0 = -1.137$ years for males, and $L_\infty = 56.50$ mm, $K = 0.386$ year$^{-1}$, $t_0 = -1.257$ years for both sexes. The length (TL) - weight (W) relationship was $W = 0.00051 \times TL^{2.635}$, ($r = 0.965$) for males, $W = 0.00088 \times TL^{2.464}$, ($r = 0.987$) for females and $W = 0.00066 \times TL^{2.554}$, ($r = 0.974$) for both sexes. Condition factor ranged from 1.696 for males and 1.613 for females to 1.664 for both sexes. The mean condition factor (CF) was not significantly different between the sexes among all fish during different months ($p > 0.05$). The present study represents the first comprehensive information on the population structure of *A. mento* in the Seyhan Reservoir. The results of this study will contribute to the population management and conservation of this species and be useful in increasing knowledge on its ecology and biology.

**Keywords**: *Aphanius mento*, Growth parameters, Condition, Southeastern Mediterranean

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Introduction
The genus *Aphanius* belonging to the Cyprinodontidae family currently includes about 20 species distributed along the ancient coast of the Tethys Sea (Kosswig, 1955; Villwock and Franz, 1972; Wildekamp et al., 1999) and many species that are local endemisms (Wildekamp et al., 1999; Yogurtçuğlu and Ekmekçi, 2013).

In Anatolia, the genus *Aphanius* is represented by 15 species: *Aphanius anatoliae*, *A. asquamatus*, *A. danfordii*, *A. fasciatus*, *A. fontinalis*, *A. icoii*, *A. irregularis*, *A. maeandricus*, *A. marassantensis*, *A. meridionalis*, *A. mento*, *A. saldae*, *A. splendens*, *A. sureyanus*, *A. transgressi* and *A. villwocki* (Kuru, 2004; Fricke et al., 2007; Parenti, 2002; Pfleiderer et al., 2014, Çiçek et al., 2015; Yogurtçuğlu and Freyhof, 2018).

The genus *Aphanius* has no economic importance for human consumption. However, some species of this genus are aquacultured as ornamental fishes and scientifically used as material for some genetic studies (Güçlü, 2003; Sezen, 2011; Sezen and Olmez, 2012). Some species of the taxon are important because of their endemic character (Ergüden, 2015).

The iridescent toothcarp, *A. mento* (Heckel, 1843) is found in shallow waters among vegetation and feeds on insect larvae, crustaceans, and algae (Krupp and Schneider, 1989). It tolerates a wide range of physico-chemical parameters, such as temperature (2-28.5°C), pH (7.5-8.5), salinity (1-3 g L⁻¹) and dissolved oxygen (5-8.4 mg L⁻¹) (Güçlü and Küçük, 2008; Sezen and Olmez, 2012).

The presence of this species was reported for the first time in the Seyhan Reservoir by Alagöz (2005) and Ergüden and Göksu (2012) and the present study provides the first comprehensive information on the population structure of *A. mento* in the Seyhan Reservoir. The results of this study will contribute to the population management and conservation of this species and be useful in increasing knowledge on its ecology and biology.

Materials and methods
Sampling
The study was carried out in the Seyhan Reservoir (37°03’38” N; 35°19’32” E), that covers a total surface area of 67.82 km². The average height from the sea is 67 m (Fig. 1). The Seyhan Reservoir is

![Figure 1: Map of the study area (Seyhan Reservoir).](image)

**Measurements and age determination**

Fish were collected from September 2013 to August 2014 using dip nets of tulle with a 1mm mesh size. Samples were then preserved in 4% formalin. The age of the fish was determined from the scales taken from the left side of the body, between the end of the thoracic fin and the beginning of the dorsal fin. According to Lagler (1966) age was determined by taking 8-10 scales from each fish. Observations were made using a stereoscope with transmitted light. All readings for each scale preparation were undertaken twice by independent readers without prior knowledge about sex, length, or capture time. The total length (TL) of all preserved fish was measured to the nearest 0.01 mm. The total body weight (W) was recorded using an electronic balance to the nearest 0.001g.

**Growth parameters and Condition factor**

\[ W = a \times TL^b \]

where \( W \) is the weight in g, \( TL \) the total length in cm, \( a \) and \( b \) the parameters to be established (Ricker, 1975). The relationship between total length and
weight was calculated separately for each gender.

The growth of the A. mento was calculated with the following Von Bertalanffy growth equations:

\[ L_t = L_\infty \left( 1 - e^{-K(t-t_0)} \right), \]

where \( L_t \) is the total length at age \( t \), \( L_\infty \) the average asymptotic length (mm), \( K \) is the body growth parameter, \( t_0 \) the theoretical age and \( a \) and \( b \) constants (von Bertalanffy, 1938).

Condition factor of fish was estimated using Fulton’s condition factor formula (Sparre and Venema, 1992):

\[ CF = \frac{W}{TL^3} \times 100. \]

where \( W \) is the total weight, \( TL \) is the total length, and \( b \) is the coefficient of allometric relation.

Statistical analyses

A chisquare (\( X^2 \) (0.05)) test was used to detect differences between the overall ratio of males to females (Düzgüneş et al., 1995). The relationship of weight to total length was established by the exponential regression equation. The linearized form of the power function was used in a regression analysis to estimate the length-weight relationship parameters. Slopes of the regression lines and mean length for each sex was compared using a t test (Zar, 1999).

Prior to the analyses, ln-ln plots of length and weight values were performed for visual inspection of outliers in accordance with Froese (2006). Growth was considered positively allometric if the estimate of \( b \) was approximately equal to or greater than 3 and negative if it was less than 3. All the statistical analyses were performed at 95% confidence limits using Excel 2017 and SPSS.20 computer software.

Results

A total of 834 fish (516 males and 318 females) were caught and examined during the study period. Age composition ranged from 1 to 4. Overall, the percentages of males and females in each age class were as follows: age 1, 38.50% and 18.95%; age 2, 19.30% and 15.59%; age 3, 2.99% and 2.63%; age 4, 1.08% and 0.96%. The maximum age was found to be 4 years for both sexes combined, the 1 year age group comprised 62.20% of males samples. Besides 1 and 2 year age groups were predominantly males (Table 1). The sex ratio of females to males was 1.00:1.62 and it was statistically significant according to \( X^2 \) analysis (\( \chi^2 = 12.731, p < 0.05 \)).

<table>
<thead>
<tr>
<th>Length intervals (mm)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>13-16.9</td>
<td>62</td>
<td></td>
<td></td>
<td></td>
<td>62</td>
</tr>
<tr>
<td>17-20.9</td>
<td>199</td>
<td></td>
<td></td>
<td></td>
<td>199</td>
</tr>
<tr>
<td>20.9-24.9</td>
<td>216</td>
<td>132</td>
<td></td>
<td></td>
<td>348</td>
</tr>
<tr>
<td>25-28.9</td>
<td>91</td>
<td></td>
<td></td>
<td></td>
<td>91</td>
</tr>
<tr>
<td>29-32.9</td>
<td>68</td>
<td>25</td>
<td></td>
<td></td>
<td>93</td>
</tr>
</tbody>
</table>

Table 1: Aphanius mento Age-length structure in Seyhan Reservoir.
The size of *Aphanius mento* in the population ranged from 13.6 to 44.0mm and weight varied from 0.05 to 1.10g. Female specimens were longer than males. There was no significant difference between sexes in overall total length and total weight (t-test, \( p > 0.05 \)) (Table 2). The length class interval 21-24.9 mm was the most abundant for males and females. The length frequency is presented in Fig. 2. The length-weight relationships calculated for males, females and combined sexes of *A. mento* were as follows: 

\[
W = 3.282 + 2.635 \times \log L \\
(\text{for males, } r^2=0.965, \ n=516) \\
W = 3.292 + 2.464 \times \log L \\
(\text{for female, } r^2=0.987, \ n=516) \\
W = 3.178 + 2.554 \times \log L \\
(\text{for combined sexes, } r^2=0.973, \ n=834)
\]

The exponent of length-weight relationship, \( b \), showed negative allometry (Figs. 3, 4, 5). The slopes (\( b \) values) of the total length-weight regressions were significantly different between sexes (t test, \( p < 0.05 \)). A geographic comparison concerning the length-weight relationship for the species was also made using the results reviewed from previous studies (Table 3).

The following von Bertalaffy growth equation was obtained for both sexes: 

\[
L_t = 56.50 (1 - e^{-0.386(t+1.257)}) \\
(\text{Table 4).}
\]

\( L_\infty \) values for males and females were 52.72 and 54.33mm (\( L_t \)) respectively, whereas observed maximum lengths were 41.5mm for males and 44.0mm (\( L_t \)) for females. The total lengths were statistically not significantly different in all age groups (t test, \( p > 0.05 \)). Comparison of growth performance for the different *Aphanius* species is given in Table 5. Examining the Fulton’s condition factor (CF) for *A. mento*, males had the best well-being with a mean condition factor of 1.696±0.47 whereas it was 1.613±0.22 for females and 1.664±0.21 for the total sample. The mean monthly condition factor ranged from 1.31 to 1.91 in males and from 1.40 to 1.86 in females (Fig. 6). The condition factor differences between males and females were not significant (\( p > 0.05 \)).
Table 2: Descriptive statistics and length–weight relationships for *Aphanius mento*, Seyhan Reservoir.

<table>
<thead>
<tr>
<th>Sex</th>
<th>n</th>
<th>L_{min-max}</th>
<th>W_{min-max}</th>
<th>A</th>
<th>b</th>
<th>95% CI of b</th>
<th>r²</th>
<th>Growth Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>516</td>
<td>13.6-41.5</td>
<td>0.05-1.00</td>
<td>0.00522</td>
<td>2.635</td>
<td>2.59-2.67</td>
<td>0.965</td>
<td>A (-)</td>
</tr>
<tr>
<td>Female</td>
<td>318</td>
<td>14.0-44.0</td>
<td>0.06-1.10</td>
<td>0.000881</td>
<td>2.464</td>
<td>2.43-2.49</td>
<td>0.987</td>
<td>A (-)</td>
</tr>
<tr>
<td>Combined</td>
<td>834</td>
<td>13.6-44.0</td>
<td>0.05-1.10</td>
<td>0.000663</td>
<td>2.554</td>
<td>2.52-2.58</td>
<td>0.974</td>
<td>A (-)</td>
</tr>
</tbody>
</table>

*n*, sample size; L, length (mm); W, weight (g); SE, standard error; CI, confidence interval; a, intercept of the relationship; b, slope of the relationship; r², coefficient of determination.

Table 3: Comparison of growth parameters for *Aphanius* species in the different areas.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Species</th>
<th>Locality/ Country</th>
<th>Sex</th>
<th>n</th>
<th>L_{min-L_{max}} (TL, mm)</th>
<th>a</th>
<th>b</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guezi et al. (2017)</td>
<td><em>A. fasciatus</em></td>
<td>Ayata Lake, Algeria</td>
<td>M</td>
<td>-</td>
<td>22.5-57.6</td>
<td>0.013</td>
<td>2.809</td>
<td>0.863</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>F</td>
<td>-</td>
<td>16.7-60.2</td>
<td>0.013</td>
<td>2.848</td>
<td>0.861</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>M+F</td>
<td>1868</td>
<td>16.7-60.2</td>
<td>0.013</td>
<td>2.866</td>
<td>0.869</td>
</tr>
<tr>
<td>Koutrakis and Tsikiris (2003)</td>
<td><em>A. fasciatus</em></td>
<td>Porto-Lagos, NE Aegean, Greece</td>
<td>-</td>
<td>16</td>
<td>29.0-52.0</td>
<td>0.00980</td>
<td>3.312</td>
<td>0.953</td>
</tr>
<tr>
<td>Tarkan et al. (2006)</td>
<td><em>A. fasciatus</em></td>
<td>Kıcıçıkçıkmece Lagoon, Turkey</td>
<td>-</td>
<td>11</td>
<td>38.0-53.0</td>
<td>0.01820</td>
<td>2.940</td>
<td>0.909</td>
</tr>
<tr>
<td>Dulic and Glamuzina (2006)</td>
<td><em>A. fasciatus</em></td>
<td>River Neretva estuary, Croatia</td>
<td>-</td>
<td>10</td>
<td>28.0-53.0</td>
<td>0.00990</td>
<td>3.312</td>
<td>0.944</td>
</tr>
<tr>
<td>Andreu-Soler et al. (2006)</td>
<td><em>A. iberus</em></td>
<td>Segura River basin, Spain</td>
<td>M+F</td>
<td>753</td>
<td>13.0-42.0</td>
<td>0.01610</td>
<td>3.020</td>
<td>0.987</td>
</tr>
<tr>
<td>Verdiell-Cubedo et al. (2006)</td>
<td><em>A. iberus</em></td>
<td>Mar Menor Lagoon</td>
<td>-</td>
<td>337</td>
<td>8.0-40.0</td>
<td>0.01670</td>
<td>2.981</td>
<td>0.984</td>
</tr>
<tr>
<td>Esmaeili and Ebrahim (2006)</td>
<td><em>A. vladykovi</em></td>
<td>Shalamzar Spring, Iran</td>
<td>M+F</td>
<td>319</td>
<td>18.0-56.0</td>
<td>0.01540</td>
<td>3.148</td>
<td>0.990</td>
</tr>
<tr>
<td>Alavi-Teghane et al. (2011)</td>
<td><em>A. vladykovi</em></td>
<td>Shalamzar Spring, Iran</td>
<td>M</td>
<td>41</td>
<td>25.0-38.0</td>
<td>0.01070</td>
<td>3.276</td>
<td>0.962</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>F</td>
<td>78</td>
<td>15.0-46.0</td>
<td>0.00830</td>
<td>3.482</td>
<td>0.989</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>M+F</td>
<td>148</td>
<td>15.0-61.0</td>
<td>0.00770</td>
<td>3.534</td>
<td>0.979</td>
</tr>
</tbody>
</table>

W=aL^b

*a, intercept of the relationship; b, slope of the relationship; r², coefficient of determination.

*Length type: FL; Fork Length
N, number; M male, F, female; TL, total length; a, intercept of the relationship; b, slope of the relationship; r, correlation coefficient.
Table 4: Von Bertalanffy growth parameters and equation of *Aphanius mento*

<table>
<thead>
<tr>
<th>Sex</th>
<th>(L_\infty) (mm)</th>
<th>(k)</th>
<th>(t_0)</th>
<th>Growth equations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>52.72</td>
<td>0.397</td>
<td>-1.137</td>
<td>(Lt=52.72 \left[1-e^{-0.397(1+1.137)}\right])</td>
</tr>
<tr>
<td>Female</td>
<td>54.33</td>
<td>0.399</td>
<td>-1.168</td>
<td>(Lt=54.33 \left[1-e^{-0.399(1+1.168)}\right])</td>
</tr>
<tr>
<td>Combined</td>
<td>56.50</td>
<td>0.386</td>
<td>-1.257</td>
<td>(Lt=56.50 \left[1-e^{-0.386(1+1.257)}\right])</td>
</tr>
</tbody>
</table>

Table 5: Growth performance comparisons of *Aphanius species* from different sampling area.

<table>
<thead>
<tr>
<th>Study</th>
<th>Species</th>
<th>Sex</th>
<th>(L_\infty)</th>
<th>(k)</th>
<th>(t_0)</th>
<th>Locality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leonardos and Sinis (1999)</td>
<td><em>A. fasciatus</em></td>
<td>F</td>
<td>78.62</td>
<td>0.245</td>
<td>-1.200</td>
<td>Mesolonghi Lagoon</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M</td>
<td>75.68</td>
<td>0.246</td>
<td>-1.190</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>A</td>
<td>77.58</td>
<td>0.257</td>
<td>-1.020</td>
<td></td>
</tr>
<tr>
<td>Leonardos and Sinis (1999)</td>
<td><em>A. fasciatus</em></td>
<td>F</td>
<td>108.16</td>
<td>0.115</td>
<td>-2.090</td>
<td>Etolikon Lagoon</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M</td>
<td>80.72</td>
<td>0.178</td>
<td>-1.550</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>A</td>
<td>97.78</td>
<td>0.145</td>
<td>-1.580</td>
<td></td>
</tr>
<tr>
<td>Guezi et al. (2017)</td>
<td><em>A. fasciatus</em></td>
<td>F</td>
<td>80.00</td>
<td>0.172</td>
<td>-1.377</td>
<td>Ayata Lake</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M</td>
<td>77.58</td>
<td>0.138</td>
<td>-2.236</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>A</td>
<td>83.60</td>
<td>0.148</td>
<td>-1.620</td>
<td></td>
</tr>
<tr>
<td>Güçlü (2012)</td>
<td><em>A. anatoliae</em></td>
<td>A</td>
<td>54.51</td>
<td>0.279</td>
<td>-1.345</td>
<td>Lake Eğirdir</td>
</tr>
<tr>
<td>Güçlü et al. (2007)</td>
<td><em>A. anatoliae</em></td>
<td>F</td>
<td>94.44</td>
<td>0.160</td>
<td>1.580</td>
<td>Burdur Lake</td>
</tr>
<tr>
<td>sureyanus</td>
<td></td>
<td>M</td>
<td>79.22</td>
<td>0.220</td>
<td>1.140</td>
<td></td>
</tr>
<tr>
<td>Güçlü and Küçük (2008)</td>
<td><em>A. mento</em></td>
<td>A</td>
<td>23.51</td>
<td>0.041</td>
<td>-2.904</td>
<td>Kurkgoz Spring</td>
</tr>
<tr>
<td>Karslı and Aral (2010)</td>
<td><em>A. danfordii</em></td>
<td>A</td>
<td>51.49</td>
<td>5.945</td>
<td>-0.502</td>
<td>Sirakarağacalar Stream</td>
</tr>
<tr>
<td>Yogurtcuoglu and Ekmekci (2013)</td>
<td><em>A. danfordii</em></td>
<td>F</td>
<td>126.63</td>
<td>0.090</td>
<td>-2.350</td>
<td>Kızılırmak Basin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M</td>
<td>61.20</td>
<td>0.190</td>
<td>-2.760</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2: Length frequencies of *Aphanius mento* in the Seyhan Reservoir.
Figure 3: The length-weight relationships of *Aphanius mento* from the Seyhan Reservoir for males.

Figure 4: The length-weight relationships of *Aphanius mento* from the Seyhan Reservoir for females.

Figure 5: The total length-weight relationships of *Aphanius mento* from the Seyhan Reservoir for combined sexes.
Figure 6: Mean condition factor for males and females of *Aphanius mento* during September 2013 to August 2014.

**Discussion**

In this study, the males to female sex ratio for *A. mento* from the Seyhan Reservoir was found to be 1.62:1.00. This ratio was similar to those reported for *A. mento* (1.10:1.00) in Kırkgöz Spring (Güçlü and Küçük, 2008), *A. anatolicae* (1.07:1.00) in Eğirdir Lake (Güçlü, 2012), (2.10:1.00) and *A. fasciatus* in Mariut Lake (Penaz and Zaki, 1985), but differs from *A. fasciatus* (1:2.44) in Mesolongi and Etolikon Lagoons (Leonardos and Sinis, 1999), *A. sureyanus* (0.64:1.00) in Burdur Lake (Güçlü *et al.*, 2007) and *A. danfordii* (1:1.21) in Hırfanlı.

Rezervoir. This differences may be due to fishing equipment, sample size and genetic structures of the examined populations.

The analysis of size and age showed that *A. mento* is a small-sized fish with populations mainly made of young individuals. Population length structure of *A. mento* in the Seyhan Reservoir ranged from 13.6-44.0 mm. However it was different in the results reported by Güçlü and Küçük (2008) for *A. mento* in Kırkgöz Spring (24.6-87.8mm). This difference may be caused by differences in the habitats and sampling methods. Total length and body weight of *A. mento* indicated that the females of each age class and each season were longer (Table 2) and heavier than the males. Leonardas and Sinis (1999) reported similar results for *A. fasciatus* in the Mesolongi and Etolikon lagoons.

The age of *A. mento* from the Seyhan Reservoir ranged from 1 to 4. According to Nikolsky (1980) a wide range in age distribution in a population can be an indication of enough food in the water system. The age range for *Aphanius* species was similar to that of *A. anatolicae* from the Eğirdir Lake ranging from 1 to 4 (Güçlü, 2012) and to that of *A. sureyanus* from Burdur Lake ranging from 0 to 4 (Güçlü *et al.*, 2007). However, the age range of this study was different from those reported in other studies: *Aphanius mento* from
Kırkgöz Spring had a wider age range (0-7) (Güçlü and Küçük, 2008), A. fasciatus in Mesolongi and Etolikon Lagoon (Greece) ranged from 0-6 (Leonardos and Sinis, 1999) and from 1-6 in Ayata Lake (Algerian), Aphanius vlady KOvi in Modar Dokhtar Spring (Middle Zone of Iran) ranged from 0-2 (Keivany and Soofiani, 2004), A. dandfordii from Sırakarağaçlar Stream (Turkey) ranged from 0-2 (Karşlı and Aral, 2010), and from 0-5 in Kızılırmak (Yogurtcuoğlu and Ekmekçi, 2013). According to Güçlü (2012) these differences may be due to the genetic structure of the populations.

In this study, b values within the length-weight relationships of A. mento were determined as 2.554 for combined sexes. The allometry coefficient of the length-weight relationship indicate a negative allometric growth for males (b=2.635) and females (b=2.464) in the Seyhan Reservoir. In Kırkgöz Spring (Turkey) Güçlü and Küçük (2008) found negative allometric growth in males (2.403) and in females (2.256) for A. mento and similarly in Ayata Lake, Guezi et al. (2017) calculated negative allometric growth in males (2.809) and in females (2.848) for A. fasciatus. However, in Mariut Lake, Penaz and Zaki (1985) reported positive allometric growth in females (3.619) and negative growth in males (2.740) for A. fasciatus. In addition, Leonardos and Sinis (1999) found positive allometry for males and females for A. fasciatus and A. vlady KOvi in Mesolongi and Etolikon lagoons and Alavi-Yeganeh et al. (2011) in Shalamzar Spring (Iran) (Table 3). The origins of these differences probably are biotic and environmental factors. According to Bagenal and Tesch (1978), length-weight relationships may be influenced by sex, maturity, geographical location and environmental conditions.

The correlation coefficient (r) of the length-weight relationship of A. mento was 0.974 for combined sexes. The value is similar to A. dandfordii (Yogurtcuoğlu and Ekmekci, 2013; Karşlı and Aral, 2010), A. iberus (Andreu-Soler et al., 2006) and A. sureyanus (Güçlü et al. 2007), but different from A. anatolicae (Güçlü, 2012), A. mento (Güçlü and Küçük, 2008), A. fasciatus (Guezi et al., 2017) and A. vlady KOvi (Keivany and Soofiani, 2004). These situations may be caused by the habitats and also by morphological differences.

The average asymptotic total length \( (L_\infty) \) values showed that females of this population had a higher length growth rate than males and \( L_\infty \) value was calculated as 54.33 mm for females and 52.72 mm for males. Similarly, Güçlü (2012) determined \( L_\infty \) value of 54.51 mm for females for A. anatolicae in Lake Eğirdir, Isparta (Turkey). However, different values were reported for the total sample of A. mento (\( L_\infty \) value 23.51mm) in Kirkgöz Spring (Güçlü and Küçük, 2008) and for A. fasciatus from Mesolongi and Etolikon lagoons, with \( L_\infty \) values of 94.44 mm and 79.22 mm for females and males, respectively) (Leonardos and Sinis, 1999). Different values of \( L_\infty \) can be explained by environmental conditions such as salinity and temperature.
Condition factor values ranged from 1.61 to 1.69 with a mean of 1.66 for the total sample of *A. mento*. The highest condition factor for males and females was in February. Average condition factor for the same species was found to be 2.55 in Kirkgöz Spring by Güçlü and Kucük (2008), and 1.72 in Hirfanlı Reservoir for *A. danfordii* by Kirankaya et al. (2014). Guzei et al. (2017) also reported values similar to those found in the present study: 1.41 in females and 1.20 in males for *A. fasciatus* in Ayata Lake (Algeria). The condition factor may vary by sex, age, feeding condition, season, reproduction cycle (Alavi Yeganeh et al., 2011; Kiani et al., 2016).

Since no information currently exists on the growth parameters of *A. mento* in the Seyhan River Basin (Adana, Turkey), this paper is an important contribution to the science and fisheries management applications for this species.

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**References**


Cyprinodontidae), *Journal of Evolutionary Biology*, 16, 17-36.


Sezen, S., 2011. Determination of embryological and larval development stages of *Aphanius mento* (Heckel, 1843) in Kırkgöz
Erguden, Age and growth of iridescent toothcarp *Aphanius mento* (Cyprinodontidae) in...

Source. MSc Thesis, University of Süleyman Demirel. 40 P (In Turkish).


