Relationships Between Fish Lengths and Otolith Length in the Population of Chondrostoma regium (Heckel, 1843) Inhabiting Keban Dam Lake

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Abstract: In this study, the relationships between fish length (standard, fork, total) and otolith length of a total 506 specimens belong to the Chondrostoma regium (Heckel, 1843) fish species inhabiting Keban Dam Lake were examined. The otolith lengths were recorded as the greatest distance measured from the anterior to posterior edge by using a binocular microscope with a micrometer. There was a positive linear relationship between the otolith length and fish lengths obtained.

Key words: Chondrostoma regium, fish length, otolith length, Keban Dam Lake, Turkey

INTRODUCTION

Age determination in fish is very important parameter for assessing of some scientific data obtained from fisheries studies. Thus, age determination has been done in many studies and the other results have been examined depending on age. Basic information on age determination in fish has been given by some researchers[9-10]. In addition, comparative age determination in fish has been also conducted by some other researchers[11-12].

The size and shape of otoliths, which are an important bony structure used for age determination in fishes are variable according to species and size of fish[13-14]. By using the relationship between fish length and otolith length, it is possible to determine fish length from otolith length or vice versa. This information especially is very useful for analysis of digestive tract content of fishes feed on the other fishes. Furthermore, it is possible to estimate size and species of eaten fishes from otoliths which are found in digestive tract of the piscivorous fishes. So, this study was aimed to find out the relationship between fish lengths (standard, fork, total) and otolith lengths in Chondrostoma regium (Heckel, 1843). The findings will be very useful for the studies on subjects mentioned above.

MATERIALS AND METHODS

Keban Dam, was built on Euphrates River in the eastern part of Turkey, is the second larger artificial lake of Turkey. This lake, which is 845 m above the sea level has 675 km² surface area at maximum level. It has 160 m in maximum depth and 64100 km² in catchment area.

Fish specimens have been caught from Keban Dam Lake by gill nets with 18, 24, 32, 44 and 54 mm in mesh size between March 2001 and February 2002. Standard, fork and total lengths of fish samples were measured and then their sexes were determined. Otoliths were removed, cleaned and fixed in 96% ethyl alcohol according to method given by Chugunova[20]. Fixed otolith lengths were measured from the anterior to the posterior edge of the greatest distance. The results were separated according to sex and statistically tested with ANOVA[21].

The fish lengths-otolith length relationships were examined by using the following equation: y=a+bx, where, y=otolith length, x=fish length, a=intercept value, b=coefficient value

RESULTS

In this study, total 506 specimens belong to the Chondrostoma regium have been examined. Total, fork and standard lengths of them were ranged between 201-333, 186-310 and 174-287 mm, respectively. Otolith lengths were determined between 2.176-3.635 mm (Table 1).

A positive linear relationship between total length-otolith length, fork length-otolith length and standard length-otolith length were found in males, females and all fish (Fig. 1-9).
Table 1: Measured values of standard, fork, total and otolith lengths of fishes (male, female and all fish) and 95% confidence level values

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean (mm)</th>
<th>SD</th>
<th>Min. (mm)</th>
<th>Max. (mm)</th>
<th>95% C.L.(±SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Male</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total length</td>
<td>223</td>
<td>265.540</td>
<td>24.590</td>
<td>226.000</td>
<td>318.000</td>
<td>265.54±2.270</td>
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<tr>
<td>Fork length</td>
<td>223</td>
<td>244.380</td>
<td>23.160</td>
<td>207.000</td>
<td>295.000</td>
<td>244.38±3.090</td>
</tr>
<tr>
<td>Standard length</td>
<td>223</td>
<td>226.910</td>
<td>22.010</td>
<td>192.000</td>
<td>275.000</td>
<td>226.91±2.8880</td>
</tr>
<tr>
<td>Otolith length</td>
<td>223</td>
<td>2.854</td>
<td>0.280</td>
<td>2.201</td>
<td>3.558</td>
<td>2.854±0.036</td>
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<tr>
<td><strong>Female</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total length</td>
<td>283</td>
<td>266.440</td>
<td>26.500</td>
<td>201.000</td>
<td>333.000</td>
<td>266.44±3.0870</td>
</tr>
<tr>
<td>Fork length</td>
<td>283</td>
<td>245.710</td>
<td>24.870</td>
<td>186.000</td>
<td>310.000</td>
<td>245.71±2.8980</td>
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<tr>
<td>Standard length</td>
<td>283</td>
<td>228.050</td>
<td>23.580</td>
<td>174.000</td>
<td>287.000</td>
<td>228.05±2.7470</td>
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<tr>
<td>Otolith length</td>
<td>283</td>
<td>2.872</td>
<td>0.290</td>
<td>2.176</td>
<td>3.635</td>
<td>2.872±0.034</td>
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<tr>
<td><strong>All fish</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total length</td>
<td>506</td>
<td>265.950</td>
<td>25.660</td>
<td>201.000</td>
<td>333.000</td>
<td>265.95±2.2350</td>
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<tr>
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<td>24.120</td>
<td>186.000</td>
<td>310.000</td>
<td>245.12±2.1010</td>
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<tr>
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<td>506</td>
<td>227.550</td>
<td>22.890</td>
<td>174.000</td>
<td>287.000</td>
<td>227.55±1.9940</td>
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<tr>
<td>Otolith length</td>
<td>506</td>
<td>2.864</td>
<td>0.286</td>
<td>2.176</td>
<td>3.635</td>
<td>2.864±0.024</td>
</tr>
</tbody>
</table>

Fig. 1: Total length-otolith length relationships in *C. regium* (male)

Fig. 2: Total length-otolith length relationships in *C. regium* (female)

These relationships between otolith lengths-fish lengths were statically found significant (p<0.001). However, the effect of sex on otolith lengths of fish was statistically found non-significant.

**DISCUSSION**

Some researchers[14,15,18] have determined stronger and positive linear relations between fish length and otolith length in different fish species. In addition, Mascena and Betsill[11] found very stronger linear relation between otolith radius and total length in *Pomaxis annularis* species. But in comparison, findings of the present study showed that there was positive linear relationship between fish lengths (standard, fork and total) and otolith length in *Chondrostoma regium*, but it was not so stronger. The main reason for these different relationships between fish lengths and otolith lengths obtained by various researchers may be differences of fish species, habitat, food availability in surrounding and water quality.
In conclusion, it could be said that there was a medium and positive linear correlation between fish (standard, fork and total) and otolith lengths in *Chondrostoma regium*. This correlation was statistically significant (*p* < 0.001). Typically, otolith length is linearly related to length of fish until the fish reaches maximum size, thereafter the otolith increases only thickness. This linear correlation between body lengths and otolith lengths was stronger in younger individuals than that of olders. However, the level of this correlation also depends on some other factors such as feeding and habitat conditions of fish\(^{[4,7]}\).

**REFERENCES**