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## 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<sup>[1-8]</sup>. In addition, comparative age determination in fish has been also conducted by some other researchers<sup>[9-11]</sup>.

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<sup>[5,7,12-19]</sup>. 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 km<sup>2</sup> surface area at maximum level. It has 160 m in maximum depth and 64100 km<sup>2</sup> 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<sup>[2]</sup>. 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<sup>[20]</sup>.

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

	N	Mean (mm)	SD	Min. (mm)	Max. (mm)	95% C.L.(±SD)
<b>Male</b>						
Total length	223	265.340	24.590	226.000	318.000	265.34±3.2270
Fork length	223	244.380	23.160	207.000	295.000	244.38±3.0390
Standard length	223	226.910	22.010	192.000	275.000	226.91±2.8880
Otolith length	223	2.854	0.280	2.201	3.558	2.854±0.036
<b>Female</b>						
Total length	283	266.440	26.500	201.000	333.000	266.44±3.0870
Fork length	283	245.710	24.870	186.000	310.000	245.71±2.8980
Standard length	283	228.050	23.580	174.000	287.000	228.05±2.7470
Otolith length	283	2.872	0.290	2.176	3.635	2.872±0.034
<b>All fish</b>						
Total length	506	265.950	25.660	201.000	333.000	265.95±2.2350
Fork length	506	245.120	24.120	186.000	310.000	245.12±2.1010
Standard length	506	227.550	22.890	174.000	287.000	227.55±1.9940
Otolith length	506	2.864	0.286	2.176	3.635	2.864±0.024

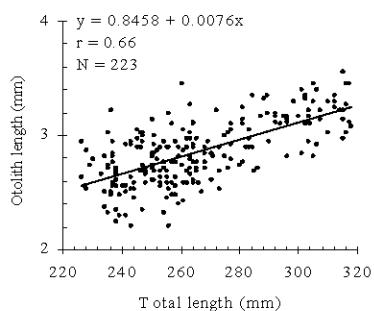


Fig. 1: Total length-otolith length relationships in *C. regium* (male)

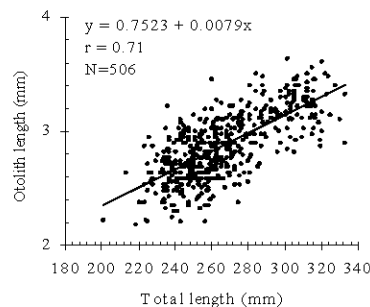


Fig. 3: Total length-otolith length relationships in *C. regium* (all fish)

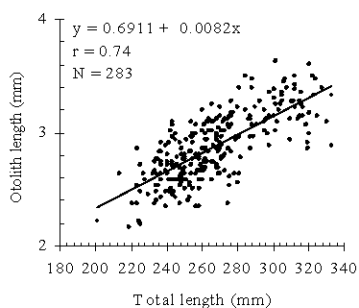


Fig. 2: Total length-otolith length relationships in *C. regium* (female)

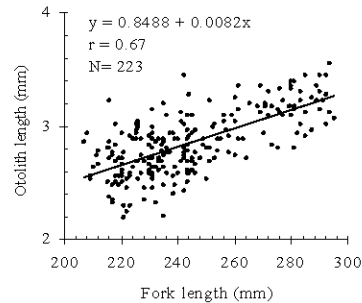


Fig. 4: Fork length-otolith length relationships in *C. regium* (male)

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<sup>[14,15,19]</sup> have been determined stronger and positive linear relations between fish length and otolith length in different fish species. In addition,

Maceina and Betsill<sup>[18]</sup> found very stronger linear relation between otolith radius and total length in *Pomoxis 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.

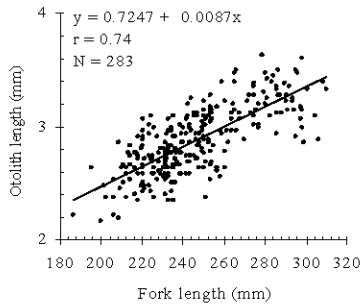


Fig. 5: Fork length-otolith length relationships in *C. regium* (female)

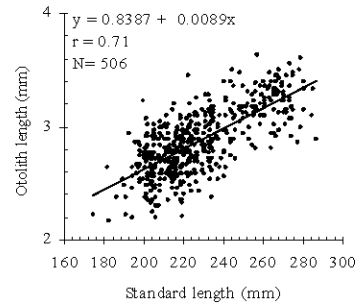


Fig. 9: Standard length-otolith length relationships in *C. regium* (all fish)

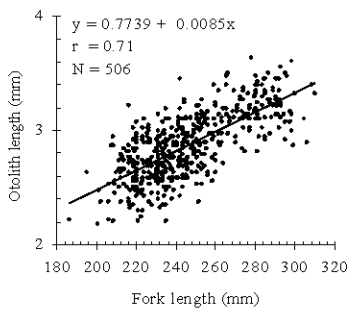


Fig. 6: Fork length-otolith length relationships in *C. regium* (all fish)

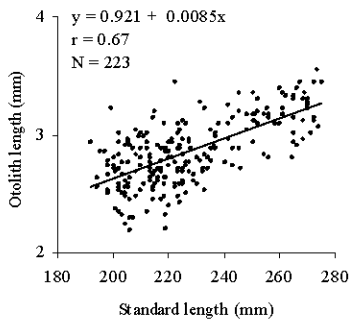


Fig. 7: Standard length-otolith length relationships in *C. regium* (male)

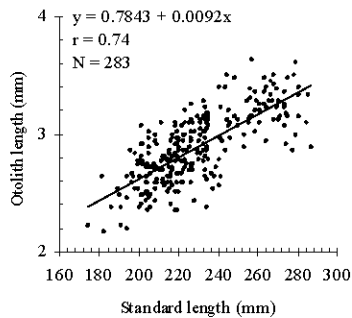


Fig. 8: Standard length-otolith length relationships in *C. regium* (female)

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 older. However, the level of this correlation also depends on some other factors such as feeding and habitat conditions of fish<sup>[4,7]</sup>.

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