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Research Article

Relationships between fish age and otolith size in spiny eel: *Mastacembelus mastacembelus* (Banks & Solander, 1794)

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Abstract

In this study, the relationships of age groups with length, width, and weight of sagittal otolith in a total 187 specimens belonging to the spiny eel, *M. mastacembelus* population inhabiting Karakaya Dam Lake were examined. Age groups of the population ranged between I and IX. The length, width, and weight of otoliths were found between 1.44 - 3.82 mm, 0.80 - 1.71 mm, and 0.30 - 3.80 mg respectively. There was a stronger and positive linear relationship between the otolith size (length, width, and weight) and age groups.

Keywords: *M. mastacembelus*, otolith size, age groups, Karakaya Dam Lake

1. Introduction

Spiny eel generally carries the whole characteristics of the Mastacembelidae with a thin and long body structures. On its prolonged head, there is a dangling trunk like, three leveled salient flesh on the brink of the nose (Figure 1). They have well developed sharp teeth on the jaws. There are 32 to 34 separately located spines between dorsal fin and the head. Three of these spines are also seen in front of the anal fin. They have no ventral fin (Geldiay & Balık 2007).

Figure 1. *Mastacembelus mastacembelus* (original)

Relationships between otolith and age in fish have been determined by many researchers (Boehlert 1985; Pawson 1990; Fletcher 1991; Worthington et al. 1995; Fowler & Doherty 1992; Araya et al. 2001; Pilling et al. 2003; Pino et al. 2004; Samsun & Samsun 2006; Metin et al. 2007; Metin & İlkyaz 2008).

The present paper describes the relationship between age groups and sagittal otolith size (length, width, and weight) in *M. mastacembelus* from Karakaya Dam Lake, Malatya, Turkey. We could not find any study dealing with the relationship between fish age and otolith size of this species in Turkey or any other country for comparison. So, the findings will be very useful for the studies on subjects mentioned above and for the corresponding studies which will be carried on for the other species in Mastacembelidae family.

2. Material and Method

Karakaya Dam Lake is the third largest dam lake on the River Euphrates (in respect to the surface area of lake) right after Keban Dam Lake and Karakaya Dam Lake which is situated 166 km downstream Keban Dam, in the locality of Seki Bağları, near the country of Çüngüş of Diyarbakır province. Other than Euphrates as the main river, Sultansuyu, Tohma Brook, and other small brooks and streams join Karakaya Dam Lake (Anul 1995).

This study was carried out between February 2002 and January 2003. During this time, 187 specimens of *M. mastacembelus* were examined. Fish specimens were caught by gill-nets with mesh-size ranging from 22 to 36 mm. The sexes of fish were determined. Vertebrae were used for age determination. Sagittal otoliths were removed, cleaned, and fixed in 96% ethyl alcohol according to method given by Chugunova (1963). The lengths and widths of otoliths were measured under trinocular microscope marked Olympus CX41 with Olympus DP25 monitoring system. The weights of otoliths were measured with AND-HR-200 (accuracy ± 0.1 mg).

Results were separated according to sex and the significance of differences between otolith size (length, width, and weight) values were determined by using "Duncan test" (statistical packet programme SPSS 12.0 for Windows) depending on age groups. However, the correlation coefficients of these relations were interpreted according to Fowler & Cohen (1992).

3. Results and Discussion

The age groups of the population ranged from I to IX (Figure 2). The length, width, and weight of sagittal otoliths (Figure 3) were ranged between 1.44 - 3.19 mm, 0.81 - 1.68 mm, and 0.30 - 3.40 mg in females, between 1.48 - 3.82 mm, 0.80 - 1.71 mm, and 0.40 - 3.80 mg in males, and between 1.44 - 3.82 mm, 0.80 - 1.71 mm, and 0.30 - 3.80 mg in all fish, respectively (Table 1).

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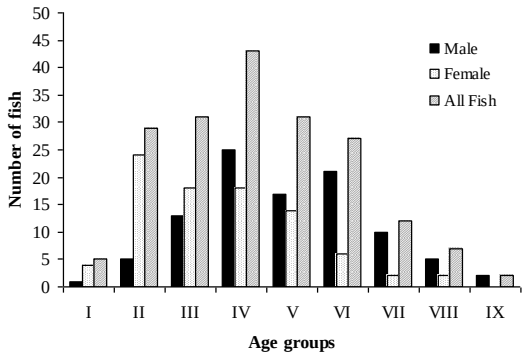

Figure 2. Distribution of *M. mastacembelus* population acordingto the age groups.

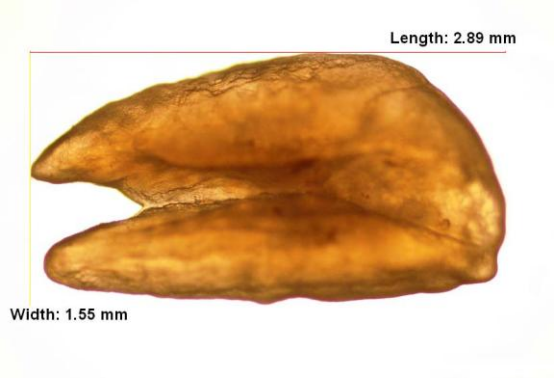

Figure 3. Sagittal otolith of *M. mastacembelus* (x40)

Table 1. Measured value of otolith size (length, width, and weight) and age groups of *M. mastacembelus* (female, male and all fish)

Otolith size (length, width, and weight)			Age groups								
			I	II	III	IV	V	VI	VII	VIII	IX
Female	Otolith length (mm)	N	4	24	18	18	14	6	2	2	-
		Min.	1.45	1.44	1.67	1.88	2.31	2.54	2.49	2.73	-
		Max.	1.76	2.52	2.66	2.73	2.82	3.19	2.92	2.87	-
		Mean	1.58^{a}	1.88^{ab}	2.20^{bc}	2.43^{cd}	2.59^{de}	2.94^{e}	2.71^{de}	2.80^{e}	-
		Std. D.	0.14	0.29	0.29	0.27	0.18	0.26	0.30	0.10	-
		Std. E.	0.07	0.06	0.07	0.06	0.05	0.11	0.22	0.07	
	Otolith width (mm)	Min.	0.81	0.82	0.98	1.05	1.29	1.33	1.48	1.40	-
		Max.	0.89	1.27	1.41	1.48	1.57	1.55	1.68	1.68	-
		Mean	0.85^{a}	1.01^{b}	1.17^{bc}	1.28^{cd}	1.41^{de}	1.39^{de}	1.58^{f}	1.54^{ef}	-
		Std. D.	0.03	0.12	0.15	0.14	0.11	0.08	0.14	0.20	-
		Std. E.	0.02	0.02	0.04	0.03	0.03	0.03	0.10	0.14	
	Otolith weight (mg)	Min.	0. 30	0. 30	0.60	0.80	1.50	2.00	2.20	2.40	-
		Max.	0. 40	1.50	2.10	2.50	3.10	2.90	2.80	3.40	-
		Mean	0. 38^{a}	0.81^{ab}	1.23^{bc}	1.74^{cd}	2.11^{de}	2.38^{ef}	2.50^{ef}	2.90^{f}	-
		Std. D.	0. 05	0.34	0.46	0.45	0.50	0.41	0.42	0.71	-
		Std. E.	0.03	0.07	0.11	0.11	0.13	0.17	0.30	0.50	
Male	Otolith length (mm)	N	1	5	13	25	17	21	10	5	2
		Min.	1.48	1.58	1.54	2.09	2.38	2.43	2.40	2.87	2.81
		Max.	1.48	2.02	2.71	2.80	3.01	3.06	3.06	3.82	3.15
		Mean	1.48	1.75^{a}	2.22^{b}	2.51^{c}	2.69^{c}	2.78^{cd}	2.76^{cd}	3.12^{e}	2.98^{de}
		Std. D.	*	0.17	0.34	0.17	0.22	0.20	0.22	0.40	0.24
		Std. E.	*	0.08	0.10	0.03	0.05	0.05	0.07	0.18	0.17
	Otolith width (mm)	Min.	0.80	0.94	0.95	1.25	1.22	1.27	1.28	1.36	1.48
		Max.	0.80	1.01	1.36	1.60	1.61	1.65	1.58	1.71	1.48
		Mean	0.80	0.97^{a}	1.18^{b}	1.36^{c}	1.39^{cd}	1.41^{cd}	1.44^{cd}	1.50^{d}	1.48^{cd}
		Std. D.	*	0.03	0.16	0.08	0.11	0.09	0.11	0.13	0.00
		Std. E.	*	0.01	0.04	0.02	0.03	0.02	0.04	0.06	0.00
	Otolith weight (mg)	Min.	0.40	0.40	0.60	1.50	1.70	1.50	1.70	2.00	2.60
		Max.	0.40	0.90	2.30	2.20	2.90	3.20	3.00	3.80	2.90
		Mean	0.40	0.66^{a}	1.37^{b}	1.90^{c}	2.15^{c}	2.30^{cd}	2.31^{cd}	2.72^{d}	2.75^{d}
		Std. D.	*	0.18	0.54	0.21	0.33	0.48	0.39	0.68	0.21
		Std. E.	*	0.08	0.15	0.42	0.08	0.10	0.12	0.31	0.15
All fish	Otolith length (mm)	N	5	29	31	43	31	27	12	7	2
		Min.	1.45	1.44	1.54	1.88	2.31	2.43	2.40	2.73	2.81
		Max.	1.76	2.52	2.71	2.80	3.01	3.19	3.06	3.82	3.15
		Mean	1.56^{a}	1.85^{b}	2.21^{c}	2.48^{d}	2.64^{de}	2.82^{efg}	2.75^{ef}	3.03^{g}	2.98^{fg}
		Std. D.	0.13	0.27	0.31	0.22	0.21	0.22	0.22	0.37	0.24
		Std. E.	0.06	0.05	0.06	0.03	0.04	0.04	0.06	0.14	0.17
	Otolith width (mm)	Min.	0.80	0.82	0.95	1.05	1.22	1.27	1.28	1.36	1.48
		Max.	0.89	1.27	1.41	1.60	1.61	1.65	1.68	1.71	1.48
		Mean	0.84^{a}	1.01^{b}	1.18^{c}	1.33^{d}	1.40^{de}	1.40^{de}	1.46^{e}	1.51^{e}	1.48^{e}
		Std. D.	0.04	0.11	0.15	0.11	0.11	0.09	0.12	0.14	0.00
		Std. E.	0.02	0.02	0.03	0.02	0.02	0.02	0.04	0.05	0.00
	Otolith weight (mg)	Min.	0.30	0.30	0.60	0.80	1.50	1.50	1.70	2.00	2.60
		Max.	0.40	1.50	2.30	2.50	3.10	3.20	3.00	3.80	2.90
		Mean	0.38^{a}	0.79^{b}	1.29^{c}	1.83^{d}	2.13^{de}	2.32^{e}	2.34^{e}	2.77^{f}	2.75^{f}
		Std. D.	0.05	0.32	0.49	0.34	0.41	0.46	0.38	0.63	0.21
		Std. E.	0.02	0.06	0.09	0.05	0.07	0.09	0.11	0.24	0.15

*Standard deviation and standard error could not be calculated for a single individual
a-g: Same letters in the same line are not statistically important (p>0.05).

A positive strong correlation between the age–otolith length (r = 0.93), between the age-otolith width (r = 0.96), and between the age–otolith weight (r = 0.99) were determined in females. A positive strong correlation between the age–otolith length (r = 0.94), between the age–otolith width (r = 0.91), and between the age–otolith weight (r = 0.96) were determined in males. A positive strong correlation between the age–otolith length (r = 0.95), between the age–otolith width (r = 0.92), and between the age–otolith weight (r = 0.97) were also determined in all fish (Figure 4-12).

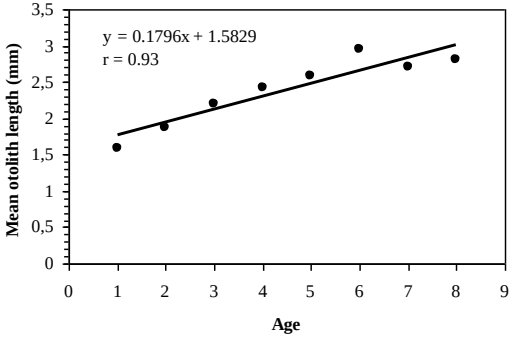

Figure 4. Mean otolith length vs. age of *M. mastacembelus* population (female).

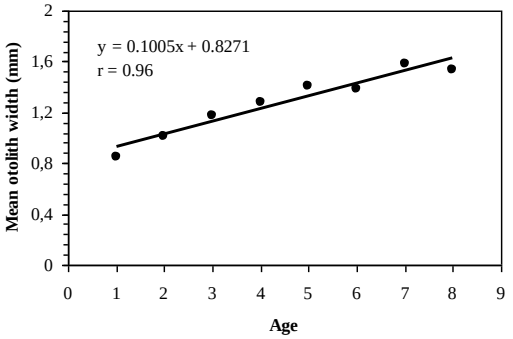

Figure 5. Mean otolith width vs. age of *M. mastacembelus* population (female).

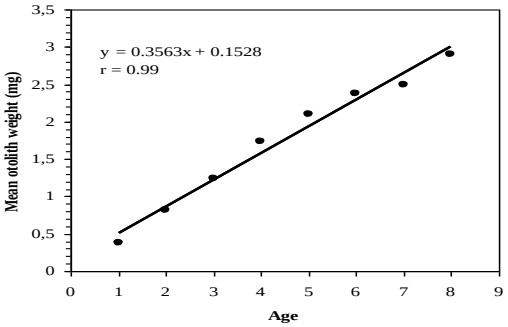

Figure 6. Mean otolith weight vs. age of *M. mastacembelus* population (female).

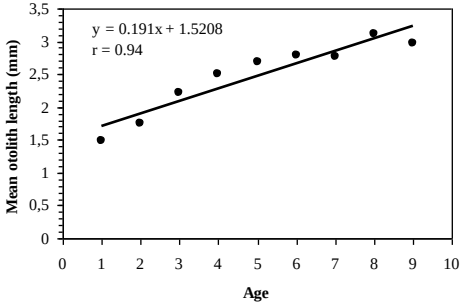

Figure 7. Mean otolith length vs. age of *M. mastacembelus* population (male).

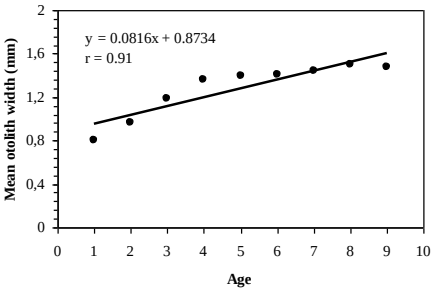

Figure 8. Mean otolith width vs. age of *M. mastacembelus* population (male).

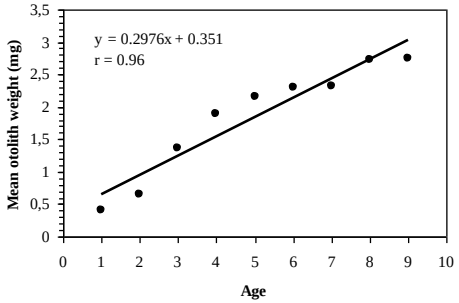

Figure 9. Mean otolith weight vs. age of *M. mastacembelus* population (male).

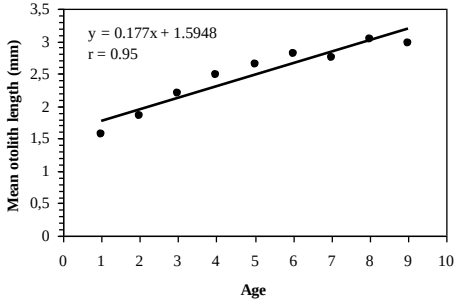

Figure 10. Mean otolith length vs. age of *M. mastacembelus* population (all fish).

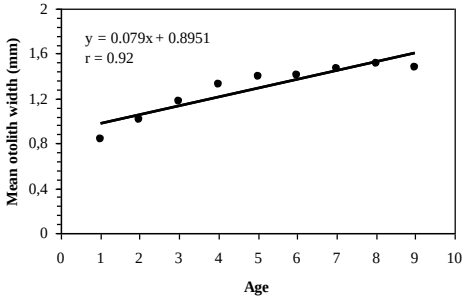

Figure 11. Mean otolith width vs. age of *M. mastacembelus* population (all fish)

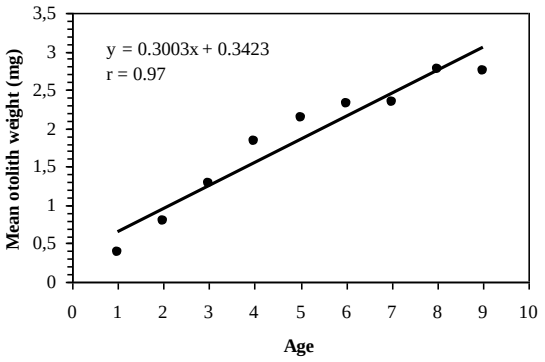

Figure 12. Mean otolith weight vs. age of *M. mastacembelus* population (all fish).

The strong correlations between the age-otolith sizes have been determined by some researchers (Fletcher 1991; Fowler & Doherty 1992; Worthington et al. 1995). According to Boehlert (1985), otolith weight and other measured variables could be used in age determination precisely. Some researchers such as Cardinale et al. (2000), in *Pleuronectes platessa* and *Gadus morhua* species; Samsun & Samsun (2006), in turbot (*Scophthalmus maeoticus*); Metin et al. (2007), in common pandora (*Pagellus erythrinus*); Metin & İlkyaz (2008), in poor cod (*Trisopterus minutus*) determined a strong relationships between the age-otolith weight. In present paper, especially the correlation between age and otolith weights was highest in both sexes. According to Bostancı & Polat (2007), the determination of otolith weight is much easier technique than the measurement process of otolith length and width, and widely used in the determination of fish age.

In conclusion, parallel to the findings of other researchers, obtained results yielded high correlation values between age and otolith weight particularly in the older individuals that the forms of age could not be determined easily, otolith weight could be used.

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