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Short communication

RELATIONSHIPS BETWEEN FISH LENGTH AND OTOLITH LENGTH IN THE POPULATION OF *CAPOETA CAPOETA UMBLA* (HECKEL, 1843) INHABITING HAZAR LAKE, ELAZİG, TURKEY

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ABSTRACT. In this study, the relationships between otolith length and fish length (total, fork and standard) of a total of 251 specimens of the *Capoeta capoeta umbla* (Heckel, 1843) (Cyprinidae) species inhabiting Hazar Lake were examined.The otolith lengths were measured for the whole otolith (in an anterior to posterior direction) by using an ocular microscope with a micrometer.There was a strong relationship between the otolith lengths and fish lengths obtained.

Key words: *CAPOETA CAPOETA UMBLA*, OTOLITH LENGTH, HAZAR LAKE, TURKEY

Determining fish age by examining otolith length has been reported by many researchers (Lagler 1956, Chugunova 1963, Tesch 1968, Ozdemir and Sen 1986, Beamish and McFarlane 1987, Bradford and Geen 1987, Brothers 1987, Ekingen and Polat 1987, Maceina and Betsill 1987, Celikkale 1991, Erkoyuncu 1995, Polat and Isık 1995, Geldiay and Balık 1996, Akyol et al. 1997, Metin et al. 1997, Avsar 1998).

Fish length-otolith length (Akyol et al. 1997, Metin et al. 1997) and fish length-otolith radius (Bradford and Geen 1987, Brothers 1987, Maceina and Betsill 1987) relationships have also been determined.

The present study is aimed at determining the fish length-otolith length relationships in *Capoeta capoeta umbla* (Heckel) from Hazar Lake, Elazıg, Turkey.

Fish samples were collected from four different stations in Hazar Lake (Fig. 1) between November 1996 - October 1998 by using trimmer nets with 18, 24, 32 and 54 mm meshes. The otoliths of the sampled fish were removed after their total, fork and standard lengths were measured.

The otoliths were dried, cleaned with 96% ethyl alcohol and examined under a binocular microscope (Polat and Isık 1995).

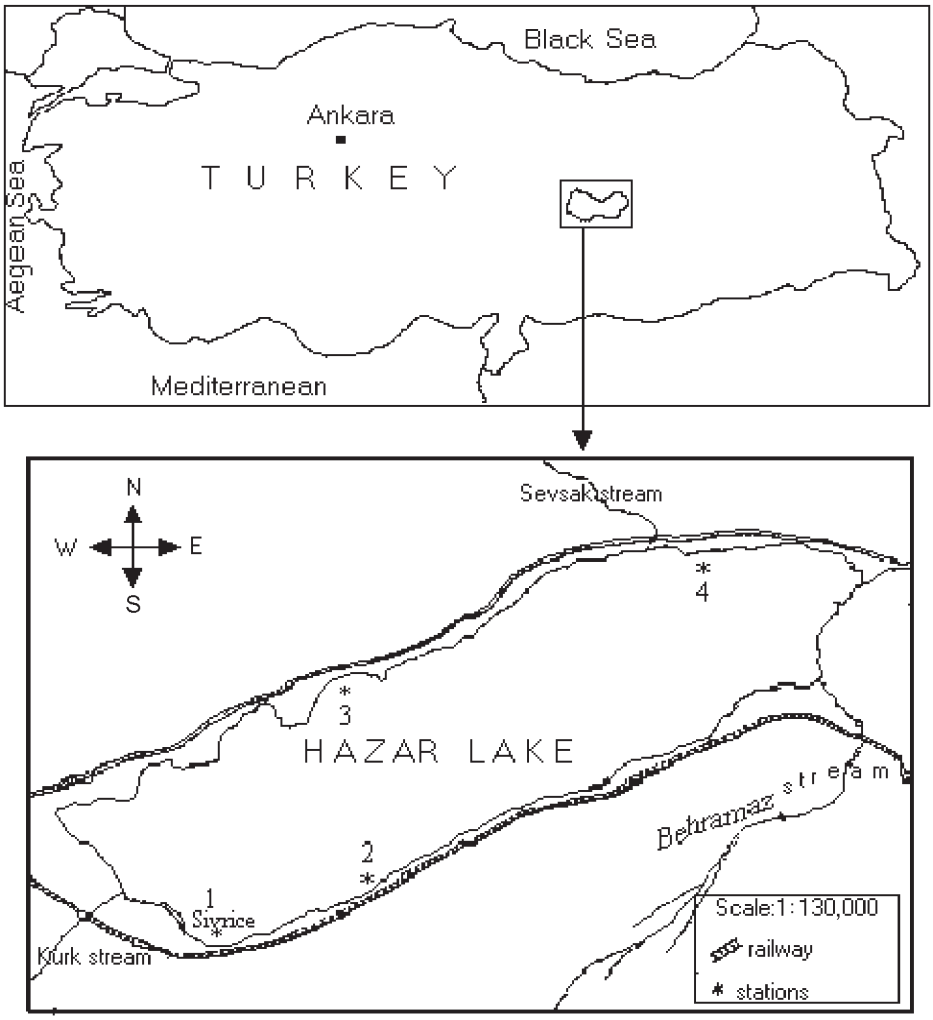

Fig. 1. The location of Hazar Lake, Elazıg, Turkey (Sen and Ozdemir 1986).

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

Sex-linked changes in fish length and otolith length were examined statistically with the ANCOVA test (Fowler and Cohen 1992).

Total length-otolith length, fork length-otolith length and standard length-otolith length relationships of males, females and all fish were examined and a strong posi-

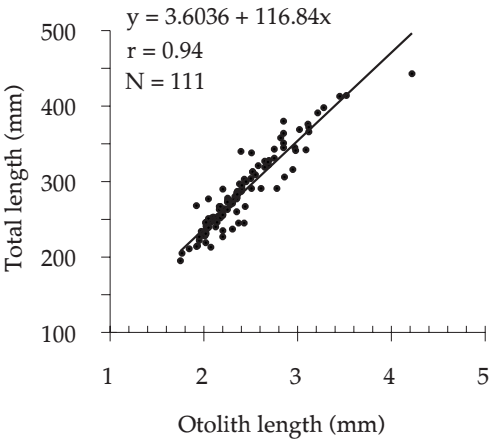

Fig. 2. Total length-otolith length relationships in *C. c. umbla* (male).

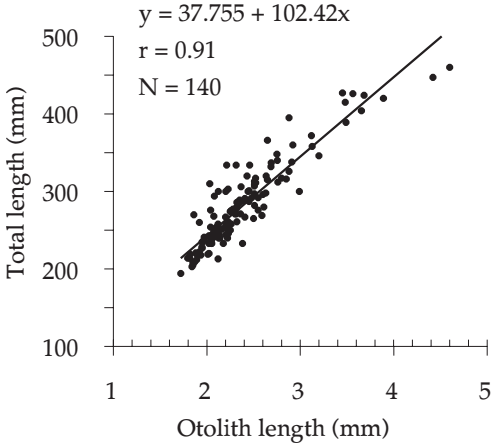

Fig. 3. Total length-otolith length relationships in *C. c. umbla* (female).

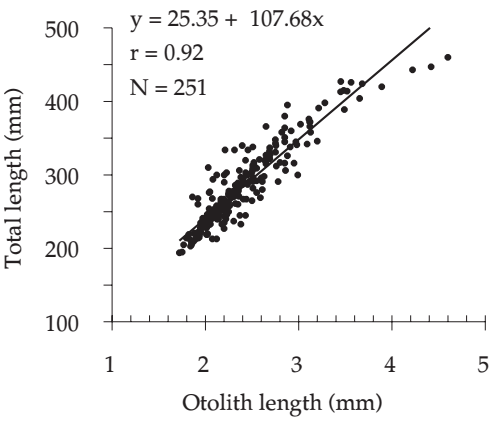

Fig. 4. Total length-otolith length relationships in *C. c. umbla* (male-female).

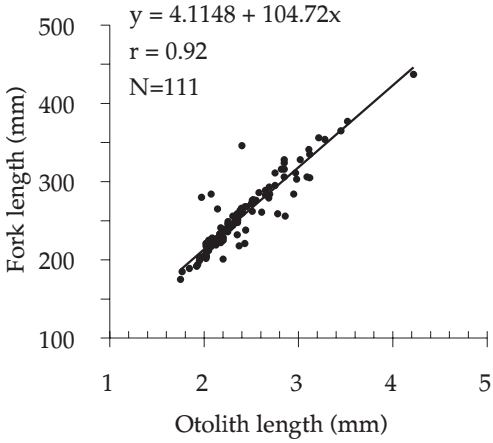

Fig. 5. Fork length-otolith length relationships in *C. c. umbla* (male).

tive linear relationship was found between fish lengths (total, fork and standard) and otolith length (Figs. 2-10).

The total, fork and standard lengths and otolith lengths of fish are given in Table 1.

In this study, fish samples ranged 194-460 mm in total length, 167-437 mm in fork length, 156-399 mm in standard length and 1.72-4.60 mm otolith length (Table 1).

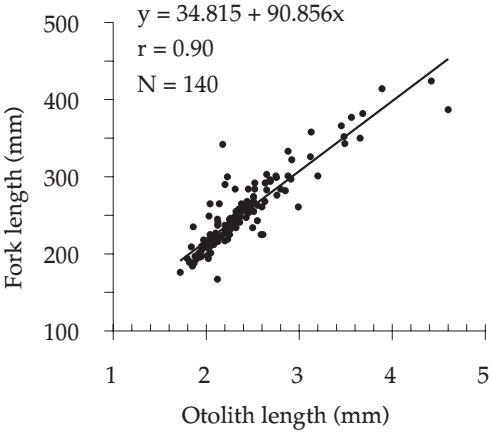

Fig. 6. Fork length-otolith length relationships in *C. c. umbla* (female).

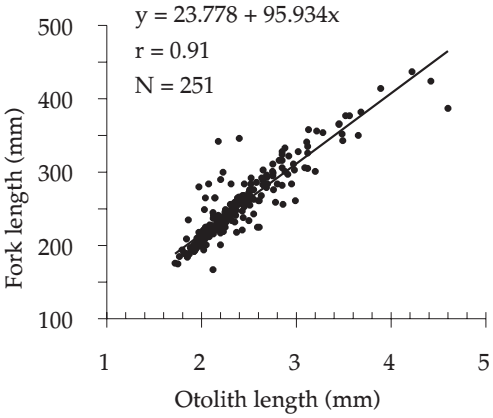

Fig. 7. Fork length-otolith length relationships in *C. c. umbla* (all fish).

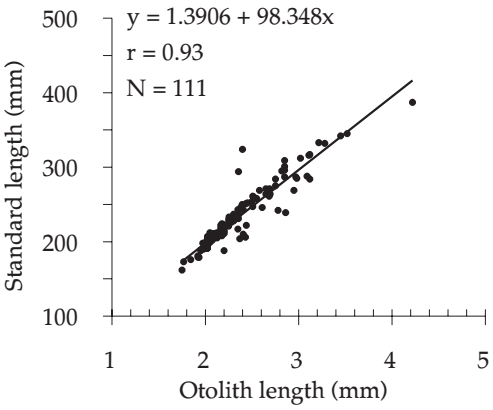

Fig. 8. Standard length-otolith length relationships in *C. c. umbla* (male).

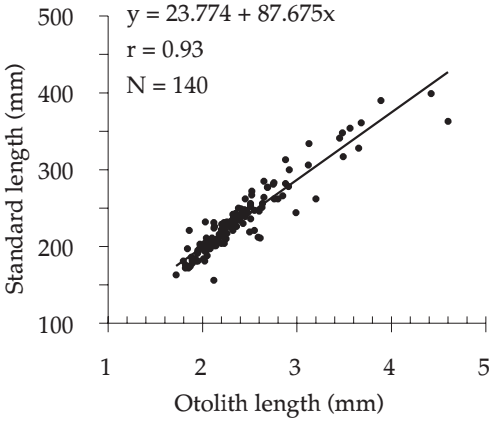

Fig. 9. Standard length-otolith length relationships in *C. c. umbla* (female).

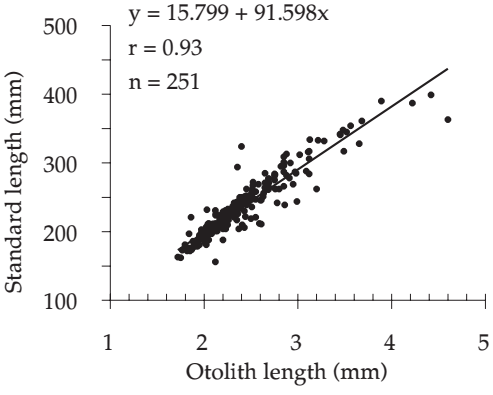

Fig. 10. Standard length-otolith length relationships in *C. c. umbla* (all fish).

TABLE 1

Measured values of total, fork, standard and otolith lengths of fish (male, female and all fish (male + female)) and 95% confidence level values

	N	Mean (mm)	SD	Min. (mm)	Max. (mm)	95% C.L. (± SD)
Male						
Total length	111	282.60	51.79	195	443	282.60 ± 9.63
Fork length	111	254.18	47.26	175	437	254.18 ± 8.79
Standard length	111	236.24	43.95	162	387	236.24 ± 8.17
Otolith length	111	2.3879	0.41	1.75	4.22	2.3879 ± 0.07
Female						
Total length	140	281.39	54.84	194	460	281.39 ± 9.08
Fork length	140	250.94	49.21	167	424	250.94 ± 8.15
Standard length	140	232.34	45.77	156	399	232.34 ± 7.58
Otolith length	140	2.3788	0.49	1.72	4.60	2.3788 ± 0.08
All fish						
Total length	251	281.93	53.41	194	460	281.93 ± 6.60
Fork length	251	252.37	48.29	167	437	252.37 ± 5.97
Standard length	251	234.06	44.93	156	399	234.06 ± 5.55
Otolith length	251	2.3829	0.45	1.72	4.60	2.3829 ± 0.05

Sex-linked changes in fish lengths and otolith lengths were found to be statistically significant ($P < 0.05$, ANCOVA test).

In conclusion, it is obvious that there was a very strong correlation between total length-otolith length, fork length-otolith length and standard length-otolith length in *Capoeta capoeta umbla*. A similar, strong correlation between fish length-otolith length have also been found in some other fish species (Akyol et al. 1997, Metin et al. 1997). Maceina and Betsil (1987) found a strong positive correlation between total length and otolith radius in white crappie *Pomoxis annularis* Raf.

REFERENCES

Akyol O., Metin G., Unsal S. 1997 - Relationship between otolith to fork lengths of sardine (*Sardina pilchardus* Walbaum, 1792) in the bay of İzmir (Aegean Sea) - Mediterranean Fisheries Congress. 9-11 April 1997, İzmir, Turkey: 925-929.

Avsar D. 1998 - Fisheries Biology and Population Dynamic - Baki Publication, Adana, Turkey, 303 pp. (in Turkish).

Beamish R. J., McFarlane G. A. 1987 - Current trends in age determination methodology. In: Age and Growth of Fish [Eds.] R. C. Summerfelt and G. E. Hall, Iowa State University Press, Ames, Iowa: 15-42.

Bradford M. J., Geen G. H. 1987 - Size and growth of juvenile chinook salmon back-calculated from otolith growth increments. In: Age and Growth of Fish [Eds.] R. C. Summerfelt and G. E. Hall, Iowa State University Press, Ames, Iowa: 453-461.

Brothers E. B. 1987 - Methodological approaches to the examination of otoliths in aging studies. In: Age and Growth of Fish [Eds.] R. C. Summerfelt and G. E. Hall, Iowa State University Press, Ames, Iowa: 319-330.

Celikkale M. S. 1991 - Fish Biology - Black Sea Technical University. College of Marine Science and Technology Press, Trabzon, Turkey, 387 pp. (in Turkish).

Chugunova N. I. 1963 - Age and Growth Studies in Fish. Israel Program Scientific Translations. No. 610 National Science Foundation, Washington D.C., 132 pp.

Ekingen G., Polat N. 1987 - Age determination and length-weight relations of *Capoeta capoeta umbla* (Heckel, 1843) in Lake Keban - Doga Tr. J. Zoology 11 (1): 5-15.

Erkoyuncu I. 1995 - Fisheries Biology and Population Dynamic - 19 May University Press, No. 95, Sinop, Turkey, 265 pp. (in Turkish).

Fowler J., Cohen L. 1992 - Practical Statistics for Field Biology - John Wiley and Sons. Chichester, New York, Brisbane, Toronto, Singapore, 227 pp.

Geldiay R., Balık S. 1996 - Freshwater Fishes of Turkey - Second Edition, University of Aegean, Faculty of Fisheries press, Bornova, İzmir, Turkey, 519 pp. (in Turkish).

Lagler K. F. 1956 - Freshwater Fishery Biology - W. M. C. Brown Company. Publishers, Dubuque, Iowa, 421 pp.

Maceina M. J., Betsill R. K. 1987 - Verification and use of whole otoliths to age white crappie. In: Age and Growth of Fish [Eds.] R. C. Summerfelt and G. E. Hall, Iowa State University Press, Ames, Iowa: 267-278.

Metin G., Akyol O., Hossucu M. 1997 - Otolith and age determination from otoliths of the bony fishes - Mediterranean Fisheries Congress, 9-11 April, 1997, Izmir, Turkey: 895-901 (in Turkish).

Ozdemir N., Sen D. 1986 - Age determination by scale, vertebra and operculum of *Leuciscus cephalus orientalis* (Nordmann, 1840) in the Euphrates - The Journal of Fırat University 1 (1): 101-111.

Polat N., Isık K. 1995 - Aging methods and growth rates of siraz fish (*Capoeta capoeta* Guldenstaedt, 1773) in Altınkaya Dam Lake - Doga Tr. J. Zoology, Ankara, Turkey 19: 265-271 (in Turkish).

Sen D., Ozdemir N. 1986 - Contents of the Alimentary Tracts of *Capoeta capoeta umbla* (Heckel, 1843) (Pisces: Cyprinidae) in Hazar Lake, Elazıg 8 - National Biology Congress, İzmir, Turkey: 644-655 (in Turkish).

Tesch F. W. 1968 - Age and Growth. In: Methods for Assessment of Fish Production. Fresh Waters [Ed.] W. E. Ricker, IBP. Handbook No. 3, Blackwell Scientific Publ. Oxford and Edinburg: 93-123.

STRESZCZENIE

ZWIĄZEK MIĘDZY DŁUGOŚCIĄ OTOLITÓW I DŁUGOŚCIĄ RYB GATUNKU *CAPOETA CAPOETA UMBLA* (HECKEL 1843) ZASIEDLAJĄCYCH JEZIORO HAZAR, ELAZIG, TURCJA

Celem badań było określenie związku między długością otolitów a długością ciała (analizowano długość całkowitą, długość ciała i długość ogonową) *Capoeta capoeta umbla* (Heckel 1843) (Cyprinidae). Przebadano 251 osobników zamieszkujących jezioro Hazar, położone w środkowej Turcji. Próby ryb pozyskiwano w okresie od listopada 1996 do października 1998, z czterech stanowisk znajdujących się w różnych częściach zbiornika (rys. 1). Do weryfikacji istotności związku długość ryb - długość otolitów użyto równania regresji prostoliniowej. Stwierdzono, że zależności te były wysoce istotne statystycznie, a współczynniki korelacji równań regresji opisujących te zależności przyjęły wartości od 0,90 do 0,94 (rys. 2-10). Zależności te były wysoce istotne statystycznie zarówno dla samic, jak i samców tego gatunku (tab. 1).

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