Anales de Biología 29: 105-113, 2007

COMUNICACIONES BREVES
(Short notes)

Incidence of lordosis in the freshwater mullet, *Liza abu* (Heckel, 1843) collected from Atatürk Dam Lake, Turkey

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Received: 26 july 2007
Accepted: 6 november 2007

Introduction

There have been numerous reports on spinal deformities in natural and reared fish populations which are relatively well described (Tutman, et al. 2000, Dulcic 2004, Jawad 2005). In wild fishes, the visible anomalies are usually encountered through fishing activities, angling, and scientific studies. They are used as indicators of water pollution, because of their high incidence in polluted areas (Bengtsson 1979). Lordosis (axial spinal curvature) is an anomalous condition in fishes which has been reported from a broad variety of fish groups (Dawson 1964, 1966, 1971, Dawson & Heal 1971, Endo et al. 1974, Andrades et al. 1996, Al-Harbi 2001). *Liza abu* (Heckel, 1843) (Mugilidae) is a species that lives in freshwater in the Middle East area (Öktener et al, 2006). In these areas, especially in Atatürk Dam Lake, Turkey, it has some local economical importance, mostly living and reproducing in the freshwater system during its whole life cycle. It is exposed to many physical and chemical variations, from temperature to pollution, in these most threatened ecosystems.

This paper describes a case of lordosis in two specimens of the teleost fish *Liza abu*. This is the first report about this abnormality in Turkey.

Material and methods

Two specimens of mullet, *Liza abu* showing lordosis (TL 125-126mm, SL 100-103mm, age 2^{+}) were caught by fishing line from Atatürk Dam Lake (South-east Anatolian Region) in the period June-August 2006 (Fig.1). Age was determined using fish scales viewed under light microscope.

Results and discussion

Spinal anomalies were visible on the fish body immediately after capture, with the spine curved at several places (Fig.2, A-D). The internal body spaces and organs were normally developed and placed except for the swimbladder of one of the two specimens which is shown to be shorter and deeper (Fig. 2,D). Slight vertebral deformities such as undulation of the neural spines and missing the posterior half of the 9th thoracic vertebra was noticed especially at the curvature regions (Fig. 2,B). Other osteological deformity in areas other than the spine is the undulated 1st spine of the 1st dorsal fin in both specimens. Three flexions of the vertebral column at the posterior end of the thoracic region were present in both specimens, but they differ in the number of vertebrae involved and the angle of the flexion. The number of vertebrae involved ranges 3-6 in both specimens (Fig. 2, B, D). The degree of lordosis is usually evaluated by measuring the angle between the lines passing through the two sides of vertebral column enclosing the curvature. The values of these angles are 133°, 84°, 105°, 92°, 108°, and 125° for the two specimens in question (Fig. 2, B, D, angles 1,2,3,4,5,6). The curvatures of 84° and 92°were considered the major lordotic cases where the angles are acute, while other curvatures show a moderate lordosis. Unlike other teleost fishes (Andrades et al., 1996), no irregular trajectory of the lateral line was noticed at the position of the moderate curvatures.

There are several factors that might cause lordosis in fishes; genetic, i.e. mutation (Chatain 1994); biological, i.e. absence of swimbladder (Chatain 1994, Andrades et al. 1996), parasites (Endo 1974, Heupel et

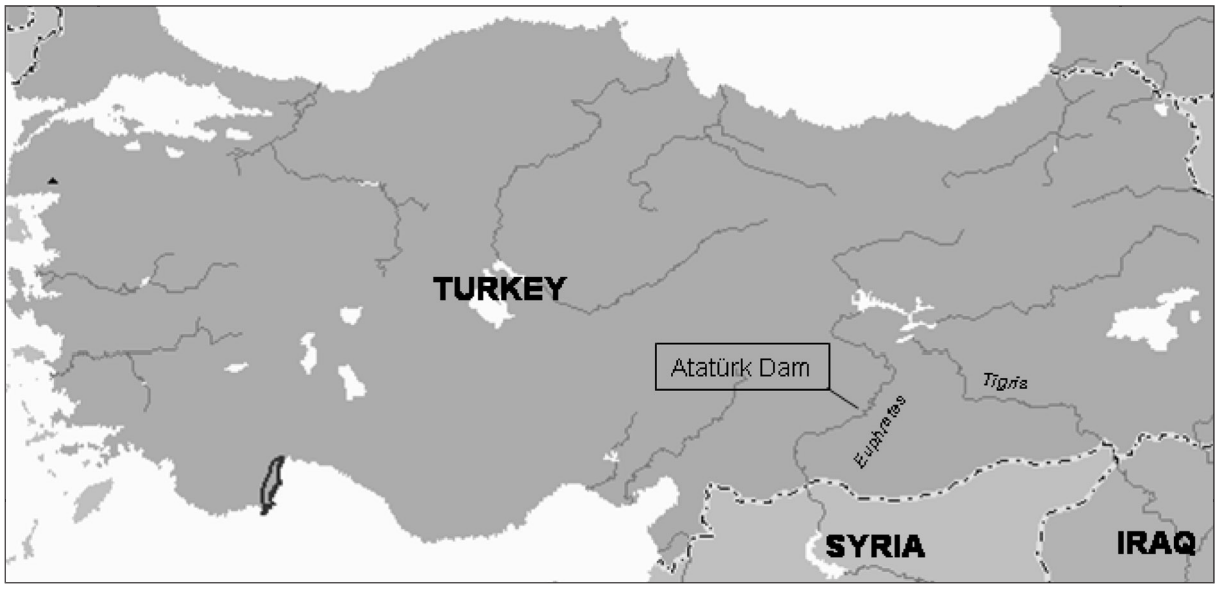

Figure 1. Map showing sampling site.
Figura 1. Mapa de capturas

al. 1999, Kent et al. 2004); effect of pollutant (Tutman et al. 2000, Villeneuve et al. 2005); nutritional (Al-Harbi 2001, Weinberger 1993), and ecological such as temperature (Wang 2000), water current (Harbi 2001, Backiel et al. 1984), mechanical stress (Tutman et al. 2000).

As to the absence and the inability to inflate the swimbladder during post-larval growth are factors seem to affect the development of spinal curvatures in fish (Kitajima 1978, Kitajima et al. 1977, Chatain 1994). This could have happened to the two mugilid specimens under investigation in this study especially one of the specimens shown to have short and deep swimbladder (Fig. 2, D), while the other specimen has a normal swimbladder (Figure 2, B).

Both water and sediments of Atatürk Dam Lake have been shown to have high levels of heavy metal (Karadede & Ünlü 2000, Atasoy et al. 2004). Such levels are also present in the tissue of *L. abu* living in the lake as Karadede et al. (2004) has recently reported. High pollutant levels are also recorded in both environment and fish tissue of *L. abu* in areas around the Atatürk Dam Lake (Ünlü & Gümgüm 1993, Gümgüm et al. 1994, Ünlü et al. 1996, Gümgüm et al. 2001). Variation in water temperature of the dam lake is very large, ranging from 12-28°C (Atasoy et al. 2004). Such a large variation in water temperature will definitely have a direct effect on the development of the vertebral column of the fish larvae. Water temperature as a factor causing vertebral column deformity in *Oreochromis mossambicus* (Peters, 1852) was discussed by Wang et al. (2000).

More detailed laboratory experiments and extensive field examinations are needed before conclusive statements can be made concerning the effect of the causative agents of lordosis such as gene mutations, infection with parasites, deficiency in nutrition, and effect of mechanical stress.

Acknowledgement

We wish to thank Chris Paulin, Museum of New Zealand, Te Papa Tongarewa for reading the manuscript, Shane Ahyong, National Institute of Water and Atmospheric Research (NIWA) for help with light photographs; Caoimhghin Ó Maolagáin (NIWA) for image enhanced X-radiography; Raymond Coory, Museum of New Zealand - Te Papa Tongarewa and Andrew Hosie (NIWA) for technical help in preparing figure.

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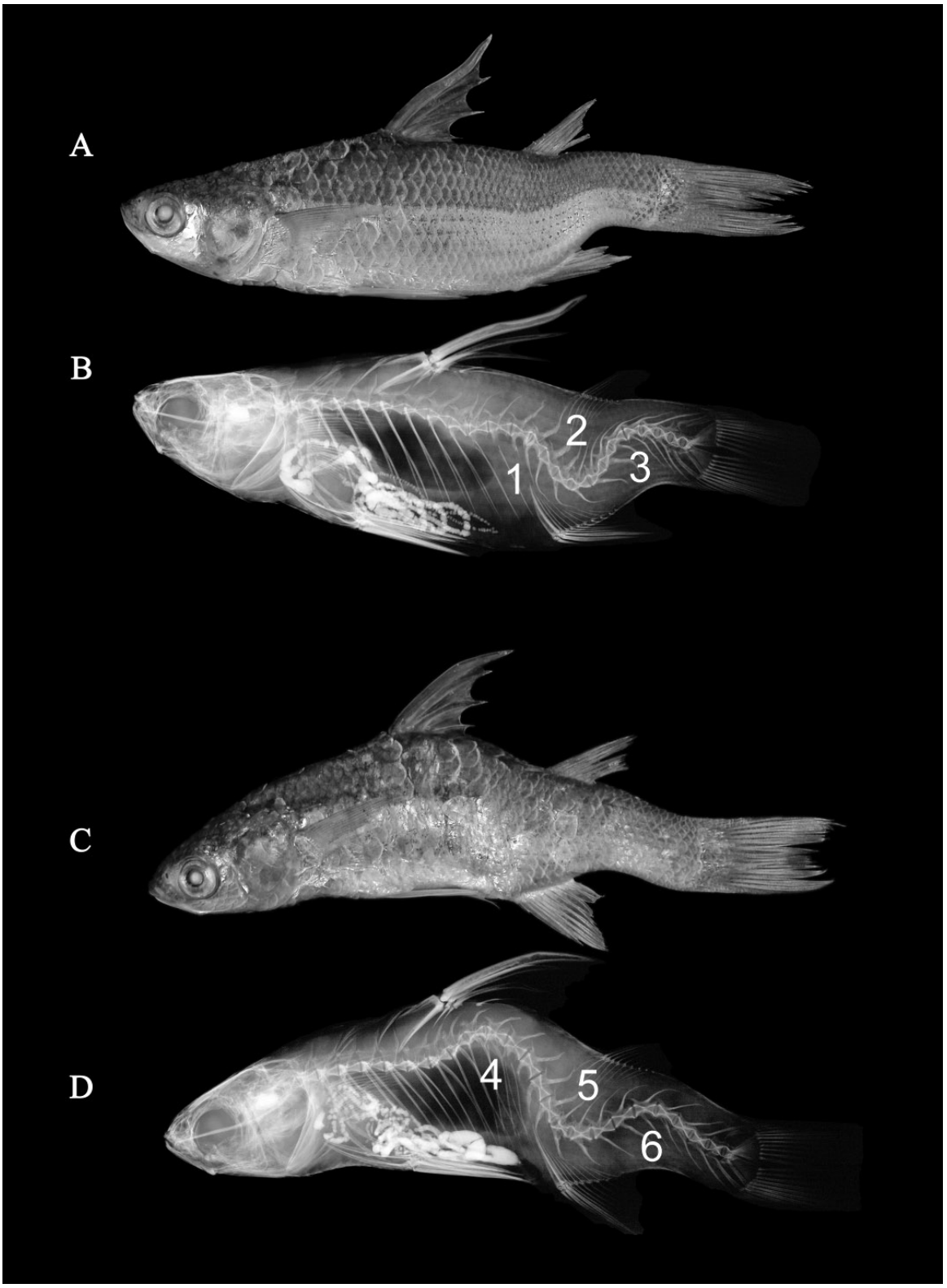

Figure 2. Lordosis in *Liza abu*. A & B. External view and X-radiograph of specimen A (Total length= 126 mm); C & D External view and X-radiograph of specimen B (Total Length= 125 mm). Angle values 1= 133°; 2°= 84°; 3= 105°; 4= 92°; 5= 108°; 6= 125°.
Figura 2. Lordosis in *Liza abu*. A y B. Vista externa y radiografía del especimen A (Longitud total = 126 mm); C y D. Vista externa y radiografía del especimen B. Valor de los ángulos, 1 = 133°; 2 = 84°; 3 = 105°; 4 = 92°; 5 = 108°; 6 = 125°.

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