Proceedings of the Zoological Institute RAS
Vol. 326, No. 3, 2022, pp. 143–150
10.31610/trudyzin/2022.326.3.143

УДК *597.556.332.3*

The first record of pectoral and pelvic fins deformity in the freshwater blenny *Salaria fluviatilis* (Pisces: Blenniidae) collected from Kızılırmak River, Turkey

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Submitted April 27, 2022; revised June 27, 2022; accepted July 1, 2022.

ABSTRACT

The freshwater blenny *Salaria fluviatilis* (Asso y del Rio, 1801) is a freshwater species that favors demersal environments. Individuals of this species live in rivers and brooks of Europe, North Africa and Israel. Three specimens of *S. fluviatilis* (*TL* 80.82 mm, 60.98 mm and 64.14 mm) collected from Kızılırmak River – Kesikköprü Bridge, Turkey during July 2021 showed deformities in both pectoral and pelvic fins. Degeneration was noted in the pectoral fin rays particularly the last ventral two soft rays (soft ray no. 13 and 14 counting from dorsal to ventral). They also look smaller than those in the normal specimen do. The degeneration in the soft ray no. 13 is less severe than soft ray no. 14. The x-ray of the abnormal specimen showed no other pectoral fin rays were deformed and the pectoral girdle was normal. In both specimens of *S. fluviatilis* that showed pelvic fin rays degeneration, the whole left pelvic fin and the right pelvic fin were completely degenerated and no soft rays are present. The possible causative factors of these anomalies are discussed. Our finding highlights the need for closer monitoring of the freshwater environment and for the identification of the specific factor that caused these abnormalities.

Key words: Blenniidae, fin anomaly, fin-rays, freshwater environment, pollution, *Salaria fluviatilis*, water temperature

О первом случае деформации грудного и брюшного плавников у пресноводной морской собачки *Salaria fluviatilis* (Pisces: Blenniidae) из реки Кызылырмак, Турция

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Представлена 27 апреля 2022; после доработки 27 июня 2022; принята 1 июля 2022.

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РЕЗЮМЕ

Морская собачка *Salaria fluviatilis* (Asso y del Rio, 1801) – *это пресноводный демерсальный вид, обитающий в реках и ручьях Европы, Северной Африки и Израиля*. У 3 экземпляров *S. fluviatilis* (длиной *TL* 80.82 мм, 60.98 мм и 64.14 мм), пойманных в реке Кызылырмак у моста Кесиккёпрю (Турция) в июле 2021, обнаружены деформации грудного и брюшного плавников. В грудном плавнике отмечена дегенерация лучей, особенно выраженная у двух нижних мягких лучей (№ 13 и 14, считая сверху), которые и выглядят короче, чем у нормального экземпляра. Дегенерация луча № 13 выражена в меньшей степени, чем луча № 14. Рентгенограмма аномального экземпляра показала, что другие лучи грудного плавника не деформированы, а грудной пояс находится в норме. У двух экземпляров *S. fluviatilis* наблюдали аномалии брюшных плавников: левый и правый брюшные плавники были полностью дегенерированы, мягкие лучи в них отсутствовали. Обсуждаются возможные причины возникновения этих аномалий. Описанные случаи свидетельствует о необходимости более углубленного мониторинга пресноводной среды с целью выявления конкретных факторов, вызвавших эти аномалии.

Ключевые слова: Blenniidae, аномалии плавников, плавниковые лучи, пресные воды, загрязнение, *Salaria fluviatilis*, температура воды

INTRODUCTION

The freshwater blenny *Salaria fluviatilis* (Asso y del Rio, 1801) is a freshwater species that prefers to live in a demersal environment (Riehl and Baensch 1996). Individuals of this species are distributed in the rivers and brooks of Europe, North Africa and Israel (Crivelli 1996). Individuals reach a maximum total length (TL) of 154 mm (Laporte et al. 2012) with a common length of 80 mm (Muus and Dahlström 1968), and the reported maximum age is five years (Kottelat and Freyhof 2007).

Adults occur in relatively shallow water including in low altitude lakes (Billard 1997). They are also found on the stony bottoms of streams and with the deepest and fastest microhabitats being preferred. In addition, they sometimes occur in coastal lagoons with low salinity (Kottelat and Freyhof 2007). They have also been recorded in the marine environment (Fricke et al. 2007).

The adults of this species feed on small benthic organisms, aquatic insects and pupae (Wilson 2009). They are oviparous (Breder and Rosen 1966) with females spawning for the first time at the end of the first year. Spawning lasts up to 3 years but with most females dying at the end of the first spawning year.

The literature on fish abnormalities is large and goes back to the sixteenth Century (Berra and Au 1981). Growth anomalies reported from wide range of wild and reared fish species (Boglione et al. 2006; Jawad and Hosie 2007; Jawad and Öktoner 2007; Koumoundouros 2008; Jawad and Al-Mamry 2012; Jawad et al. 2014).

Fin abnormalities are well known in both wild and aquaculture fish (Divanach et al. 1996). Incidences of fusion, dysgenesis, extra formation, displacement of the fin supporting elements (Koumoundouros et al. 2001) and curvature of the rays and spines (Daoulas et al. 1991) are reported for a wide range of fish species. Causes of fish anomalies have been ascribed to variation in water temperature in which the fish live Dionísio et al. (2012), viruses (Walker and Winton 2010), bacterial infection (Balebona et al. 1993), parasites (Cunningham et al. 2005), different types of pollution (Sadler et al. 2001) and radiations (Anbumani and Mohankumar 2012). Absence or abnormal development of pelvic fins and other parts of the body morphology in fishes have been previously reported and ascribed to inherited or postnatal deformities (Graham et al. 1986), in addition to chemical pollution (Sloof 1982) and other environmental factors (Graham et al. 1986). Pelvic fins are usually treated as manipulating parts, and their hydrodynamic role has not been widely considered as other types of fins in the fish body (Lauder and Drucker 2004; Yamanoue et al. 2010).

In Turkey, there are a limited number of studies that described cases of abnormalities in fins of fishes. Bayhan (2010) recorded a case of deformity in the caudal fin of the mugilid fish *Chelon ramada* (Risso, 1827) caught in the Izmir Bay (Aegean Sea), and Jawad et al. (2018) published on the caudal fin deformity in *Conger conger* (Linnaeus, 1758) collected from Çandarlı Bay (Aegean Sea). The present study describes for the first time three cases of deformity observed in both pectoral and pelvic fins of the fresh-

Fig. 1. Map showing the location of fish sampling.

water blenny *S. fluviatilis* collected from Kızılırmak River, Turkey (Middle Anatolia).

MATERIALS AND METHODS

Studied area

Specimens were collected in July 2021 from the Kızılırmak River at Kesikaat köprü Bridge (Kırşehir, Turkey; 38°57´N, 34°11´E) (Fig. 1) and the Kesikköprü Bridge (Fig. 2). The salinity of the sampling area is 0.874‰ and the water temperature was 22.1°C during the sampling period.

Materials

Three specimens of *S. fluviatilis* having a total length of 80.82 mm, 60.98 mm and 64.14 mm respectively showed deformity in both pectoral and pelvic fins were collected. Specimens were collected at depth of 1 meter using electrofishing device. The specimens were fixed in 4% formaldehyde solution for further examination and deposited in the Inland Fish Collection, Eğirdir Fisheries Faculty of Isparta University of Applied Sciences under catalogue number IFC-ESUF 06-0020. A normal specimen was collected from the same locality for morphological comparison (Fig. 3).

Methods

The skeletons of both normal and abnormal specimens were examined using a mammography unit (Siemens/Mammomat Inspiration 2013) at exposure time of 2.1 seconds available at Meddem Hospital, Department of Radiology, Mammography Section, Isparta, Turkey. Measurements were recorded to the nearest millimeter using a digital caliper. The body and fins were examined carefully for malformations, amputations and any other morphological anomalies.

Fig. 2. Kesikköprü Bridge (Kızılırmak River, Kırşehir).

Fig. 3. Normal specimen of *Salaria fluviatilis*, 75.58 mm *SL*, female.

RESULTS

Pectoral fin rays abnormality

A normal specimen of *S. fluviatilis* has a normal variation of soft pectoral rays of 12–14. The abnormal specimen showed degeneration in the last ventral two soft rays (soft ray no. 13 and 14 counting from dorsal to ventral). They also look smaller than those in the normal specimen (Fig. 4A). The degeneration in the soft ray no. 13 is less severe than what is present soft ray no. 14. In the former soft ray, nearly half of the ray is missing in comparison with the adjacent normal soft ray, while the soft ray no.14 is completely degenerated and only the base of this soft ray remains. The x-ray of the abnormal specimen showed no other deformed pectoral fin rays In addition the pectoral girdle was normal (Fig. 4B).

Pelvic fin rays abnormality

In both specimens of *S. fluviatilis* that showed pelvic fin rays anomaly, the whole left pelvic fin (Fig. 5A) and the right pelvic fin (Fig. 6A) were completely degenerated and no soft rays were present. The x-rays of the two abnormal specimens showed that the pelvic girdle of both specimens was not affected (Figs 5B, 6B).

DISCUSSION

There are several types of abnormalities reported for the paired fins of fishes. A complete absence of the pectoral and pelvic fins was reported in the clupeid species *Brevoorita patronus* Goode, 1878 from the Gulf of Menhaden (Marichammy 1970). The absence of pelvic fins was noted in *Trissina baelana* (Forsskål, 1775) by Hettier (1971), *Brevoorita smithi* Hildebrand, 1941 by Kroger and Guthrie (1973), Atlantic menhaden *B. tyranus* (Latrobe, 1802) by Radhakrishnan (1973), rainbow sardine *Dussumieria acuta* Valenciennes, 1847 by Babu (1975) and Baburao (1975), *Thryssa malabaricus* (Bloch, 1795) by Parimala (1983), *Nematalosa nasus* (Bloch, 1795) by Hore Ahmad (2010), *Cirrhinus mrigala* (Hamilton, 1822) by Jose et al. (2020) and in the cichlid species *Oreochromis niloticus* (Linnaeus, 1758) by Ugbomeh et al. (2022). Patten (1968) reported on a fused, absence and degenerate pelvic fins in freshwater fishes of Washington, USA streams. He suggested that such anomalies are the result of electrofishing activity or severe disturbances in early development stages.

The deformed specimens of *S. fluviatilis* examined here showed degeneration in either left or right of the paired fins. In spite of the absence of the left or right pelvic fins in the specimens of *S. fluviatilis* examined, all the other traits were comparable to those of the normal specimen, and it did not affect the normal growth of the fish. Similar results were obtained by Gangan et al (2018), where abnormalities in specimens of *Setipinna phasa* (Hamilton, 1822) and *S. taty* (Valenciennes, 1848) were noted. The reasons for such abnormalities were assigned to the unusual development of the muscle buds during the early development period (Gangan et al. 2018). Abnormalities in the development of both pectoral and pelvic fins of *S. fluviatilis* examined here might be the main cause for the occurrence of deformities in these two paired fins.

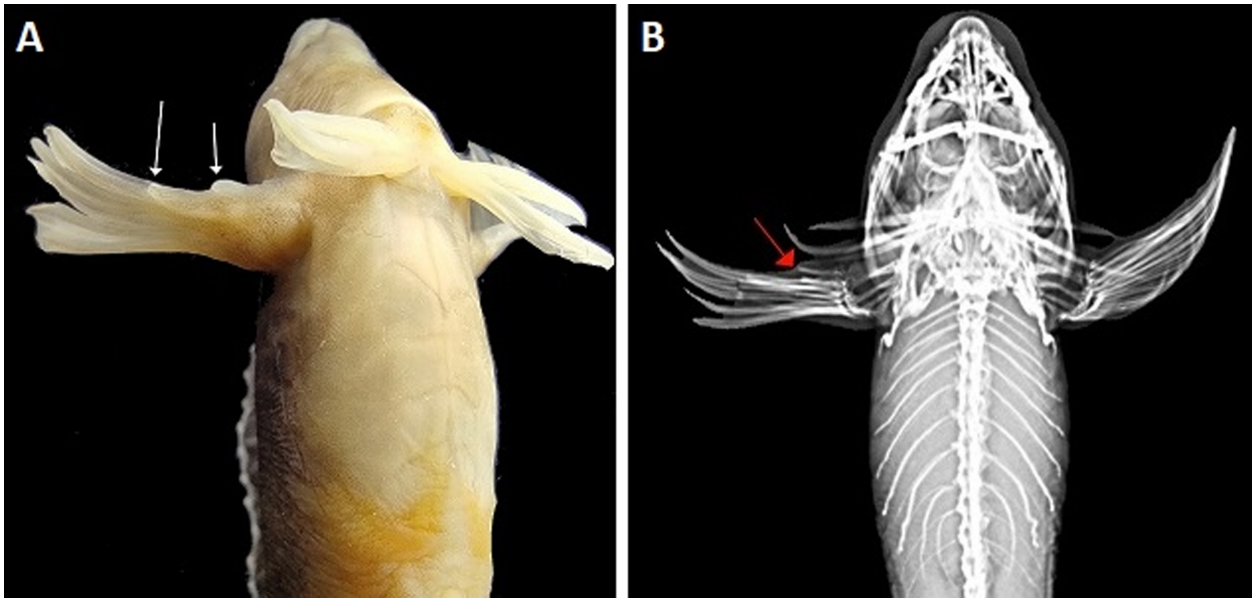

Fig. 4. Specimen of *Salaria fluviatilis* showing pectoral fin deformity (64.14 mm *TL*, female): A – degenerated rays (arrows); B – the same on radiograph.

Among the environmental factors that may affect the development of the fin in fishes is water temperature. Based on experimental studies on *Solea senegalensis* Kaup, 1858, Dionísio et al. (2012) suggested that the influence of temperature on developmental plasticity will cause osteological anomalies in fishes. Their results demonstrated a noteworthy effect of water temperature on the skeletal development of Senegalese sole during incubation of the egg. These findings highlight the significance of temperature variation during the early development of fish. The annual variation in water temperature of the Kızılırmak River, where the abnormal fish specimens collected, ranges between 12.1°C in winter and 30°C in summer (Aras 2017; Şener et al. 2020). Such wide ranges in water temperature might affect the development of morphological features of the fish living in this river.

Fig. 5. Specimen of *Salaria fluviatilis* showing pelvic fin deformities (60.98 mm *TL* mm, female): A – degenerated left fin (arrow); B – the same on radiograph.

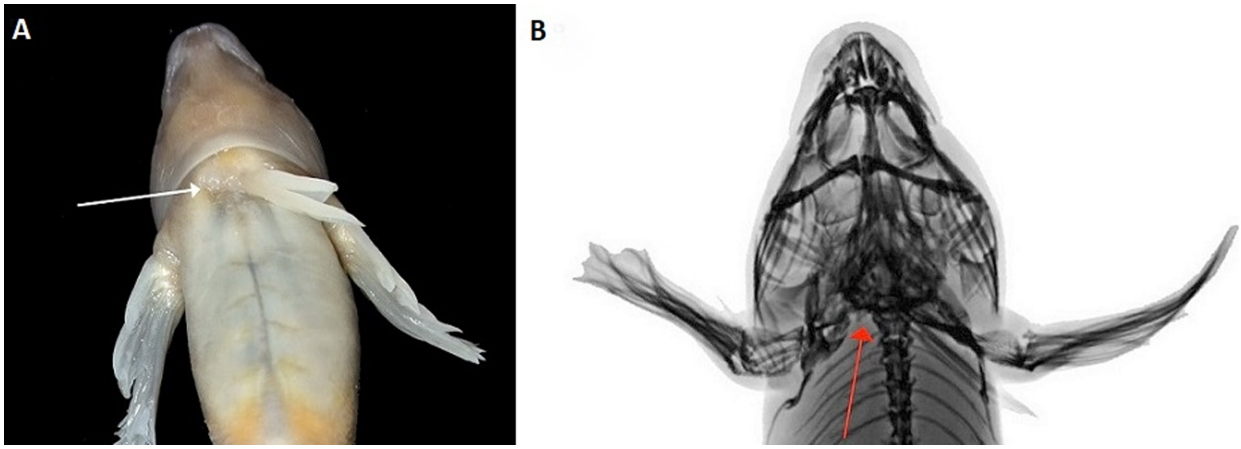

Fig. 6. Specimen of *Salaria fluviatilis* showing pelvic fin deformities (80.82 mm *TL*, female): A – degenerated right fin (arrow); B – the same on radiograph.

Degeneration of the paired fins in *S. fluviatilis* will likely affect the swimming activities and parental care of this fish. The pectoral and pelvic fins are involved in the maneuvering by fish (as well as body bending) The complexity of interactions among fins and the hydrodynamic roles of different fins in generating propulsive movements has only recently been studied (Drucker and Lauder 2001a, 2001b; Drucker and Lauder 2003). Pectoral fins are positioned at the ventrolateral margins of the body in basal ray-finned fish. This position may enhance yaw maneuvering (Lauder and Drucker 2004). In more derived ray-finned fish the pelvic fins have moved anteriorly and are located beneath the center of mass (e.g., Schrank et al. 1999). This transformation repositions the pelvic fins so that they have little effect on body yaw when used simultaneously but are capable of inducing roll movements. From the recent analyses of turning and maneuvering in fish, it is clear that fish actively use their pelvic fins as control surfaces during turning maneuvers (Lauder and Drucker 2004). Therefore, any deformity in the structure of the paired fins will have a direct effect on the swimming ability and its survival of the fish.

Further studies are needed to find the actual reasons behind the deformity of the pectoral and pelvic fins in *Salaria fluviatilis*.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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