



First Record of *Salmo pelagonicus* Karaman, 1938 (Teleostei: Salmonidae) in the Karamenderes River, Turkey

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Abstract: *Salmo pelagonicus* Karaman, 1938 was described from Crna River, a tributary of the Vardar River (in Greece). *Salmo* specimens from the Karamenderes drainage (in Turkey) and Aliakmon River (in Greece), is identified as *Salmo pelagonicus*. We recorded for the first time *Salmo pelagonicus* in the Karamenderes River (Aegean Sea basin) in Turkey. It was compared with *Salmo* species in adjacent waters. Our comparison shows that the Karamenderes population differs from other species in neighboring basins. Also in this study, it was given detailed morphological characters of *Salmo pelagonicus*.

Keywords: Anatolia, Salmonidae, taxonomy, trout.

Salmo pelagonicus Karaman, 1938 (Teleostei: Salmonidae), Karamenderes Irmağından Türkiye İçin İlk Kayıt

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Öz: *Salmo pelagonicus* Karaman, 1938, Vardar Nehrinin bir kolu olan Crna Irmağından (Yunanistan) tanımlanmıştır. Türkiye'nin Ege bölgesindeki Karamenderes Irmağı ve Yunanistan'ın Aliakmon Nehri örneklerini *Salmo pelagonicus* olarak tayin edilmiştir. *Salmo pelagonicus* Karamenderes Irmağından Türkiye için ilk kayıt olarak verilmiştir. Karamenderes popülasyonu yakın havzadaki diğer Alabalık türleri ile karşılaştırmış ve bu popülasyonun farklı olduğu belirlenmiştir. Ayrıca bu çalışmada bu türün detaylı morfolojik karakterleri verilmiştir.

Anahtar kelimeler: Alabalık, Anadolu, Salmonidae, taksonomi.

INTRODUCTION

The genus *Salmo* are widely distributed some part of Europe, Asia and Africa. It also inhabits most of the streams and rivers of Turkey. Turan et al. (2010, 2011, 2012, 2014a, b, 2017, 2020) examined most of the Turkish populations and recognized thirteen species (see Turan et al. 2020).

The *Salmo* populations of the Karamenderes River had been reported as *Salmo trutta macrostigma* (Geldiay & Balık, 1999; Sarı et al., 2006), however, *S. macrostigma*, occurs only in Algeria (Kottelat, 1997; Delling & Doadrio, 2005; Kottelat & Freyhof, 2007). The other peri-

Mediterranean populations referred to as *S. macrostigma* belong to several species: *S. labecula*, *S. opimus*, *S. chilo*, and *S. kottelati* (streams and rivers flowing to the Mediterranean Sea), *S. okumusi*, *S. euphrataeus* and *S. fahrettini* (Euphrates River), *S. tigridis* (Tigris River), *S. cettii* (Italy), *S. farioides* (eastern Adriatic) (Delling, 2003, 2011; Delling & Doadrio, 2005; Turan et al., 2011, 2012, 2014a, b).

We give here a new record of a species of trout, *Salmo pelagonicus*, from the Karamenderes River (Aegean Sea basin), formerly misidentified as *S. trutta macrostigma*.

MATERIAL AND METHOD

Fishes were preserved in 5% formaldehyde after anaesthesia using MS-222. In all measurements and counts were followed Turan et al. (2010). Morphometric and meristic data of *Salmo abanticus*, *S. labrax*, *S. rizeensis*, *S. coruhensis*, *S. caspius* are from Turan et al. (2010). *Salmo macroptera* and *S. macedonicus* are from Chichkoff (1939) and Karaman (1936) respectively. The last two photographs were obtained from Maurice Kottelat.

RESULTS

Salmo pelagonicus Karaman, 1936 (Fig. 1)

Salmo trutta macrostigma (non Dumeril, 1858): Sarı et al. (2006: 37) (Çanakkale province; Bayramiç county; Ayazma and Adaçay streams, drainages of Karamenderes River).

New Records: FFR 03188, 30, 85–200 mm SL; Turkey: Balıkesir-Çanakkale border: stream Ayazma (39°44' N 26°50' E); a drainage of Karamenderes River (a coastal drainage). —FFR 03189, 7, 75–190 mm SL; Turkey: Çanakkale Province: stream Adaçay (39°48' N 26°54' E); a drainage of Karamenderes River. —MK 26557, 3, 47–158 mm SL; Greece: Aliakmon River.

Diagnostic characters of specimens from Kara Menderes River: It differs from all other species of *Salmo* in neighboring basins by such as morphological characters: general body colour brownish in life; one black spot behind eye; black ocellated spots on body few (less than 60), equal or greater than pupil, scattered on upper part of flank, on back (absent in predorsal area) and sometime below lateral line (immediately behind head); number of black spots not increasing size in males; red ocellated spots few (less than 30), approximately equal to pupil, conspicuous, usually scattered in two or three rows on median and lower part of flank; head length 26–30% SL in males, 25–28 in females; maxilla length 10–11% SL in males, 9–10 in females, reaching beyond eye in males larger than 130 mm SL and about 190 mm SL in females; length of mouth gape 11–15% SL in males, 11–13 in females; 109–115 lateral line scales; 26–29 scale rows between lateral line and dorsal-fin origin; 15–17 scales between lateral line and posterior base of adipose-fin; 20–23 scale rows between lateral line and anal-fin origin; vomer teeth few, usually organized in two irregular rows in males (Fig. 1a).

Identification of specimens of Karamenderes River: The general appearance is shown in Figures 1, morphometric and meristic data given in Tables 1 and 2. Body deep, upper profile markedly arched, ventral profile less arched than upper profile in males and females. Head short, dorsal profile straight in interorbital area, straight or

slightly arched on the snout in males, convex in females and conspicuously arched on the snout in juveniles. Mouth somewhat large, slightly subterminal in males and in females, and markedly subterminal in juveniles. Tip of lower jaw not curved upward in males and females. Maxilla moderately long, sexually dimorphic, reaching beyond eye in specimens larger than about 130 in males and 190 mm SL in females, upper edge slightly convex anteriorly and straight posteriorly in males, and slightly convex in females and juveniles. Snout with pointed tip in males, rounded in females and juveniles. Adipose-fin somewhat large, upper edge convex in both sexes and juveniles. Maximum known size approximately 220 mm SL (observed in the field).

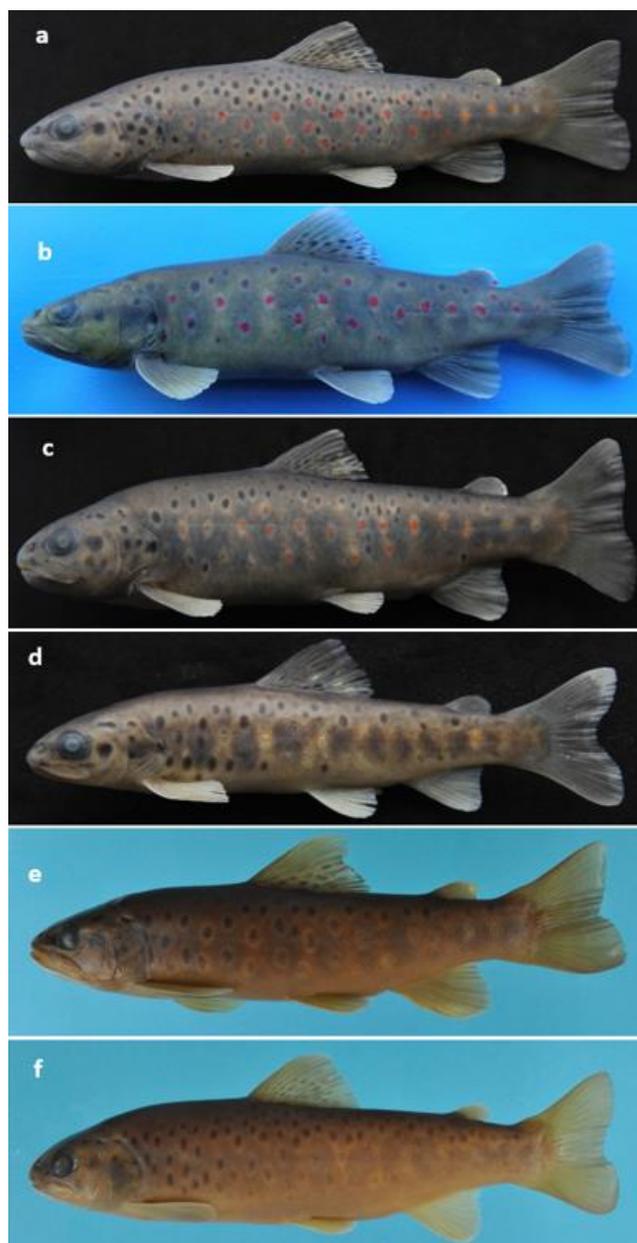


Figure 1. *Salmo pelagonicus*; Turkey: Karamenderes River; a, FFR 03187, 201 mm SL, male; b, FFR 03189, 192 mm SL, male; c, FFR03188, 200 mm SL, female; d, FFR03188, 92 mm SL, juvenile; Greece: Aliakmon River; e, photo by MK 26557, 158; 144 mm SL, male; f, photo by MK 26557, 144 mm SL, female.

Table 1. Morphometry of *Salmo pelagonicus*. Numbers in parentheses: mean.

Basin	<i>Salmo pelagonicus</i>	
	Aegean Sea	
	Kara Menderes River	
Drainage	Male	Female
Sex	n=16	n=17
Number of specimens		
Standard length (mm)	100-190	110-200
In percentage of standard length		
Head length	26.1–29.6 (27.7)	25.1–27.6 (26.3)
Predorsal length	47.3–49.8 (48.0)	45.1–48.1 (46.4)
Prepelvic length	53.6–58.2 (54.7)	51.1–56.8 (53.9)
Preanal length	72.4–76.5 (74.3)	72.7–75.6 (73.7)
Body depth at dorsal-fin origin	22.9–26.5 (24.1)	22.2–27.6 (23.8)
Body depth at anal-fin origin	15.8–19.2 (17.6)	16.2–19.2 (17.2)
Depth of caudal peduncle	9.7–11.3 (10.4)	9.4–10.9 (10.1)
Length of caudal peduncle	16.2–19.6 (17.5)	16.2–19.8 (17.9)
Distance between adipose and caudal fins	13.5–16.9 (14.9)	14.1–16.2 (15.1)
Body width at anal-fin origin	8.3–11.3 (9.6)	8.0–10.6 (9.4)
Length of dorsal-fin base	13.0–15.7 (14.8)	12.5–15.3 (13.6)
Depth of dorsal-fin	16.4–20.4 (18.7)	15.8–20.4 (18.6)
Length of adipose-fin base	2.5–5.0 (4.0)	2.4–4.2 (3.6)
Depth of adipose-fin	5.8–8.0 (7.3)	5.5–7.5 (6.8)
Length of pelvic-fin	10.5–15.8 (14.4)	11.7–15.6 (14.0)
Depth of anal-fin	15.2–17.4 (16.4)	15.0–17.2 (15.8)
Length of anal-fin base	7.9–12.1 (10.1)	9.6–11.2 (10.1)
Length of upper caudal-fin lobe	15.2–20.9 (17.8)	15.9–19.6 (17.7)
Length of median caudal-fin rays	11.8–13.9 (12.8)	11.1–13.2 (12.2)
Length of lower caudal-fin lobe	15.3–19.8 (18.0)	17.3–19.6 (18.5)
Snout length	7.0–8.4 (7.5)	6.5–7.7 (7.2)
Distance between nasal openings	3.9–5.7 (4.7)	4.0–4.8 (4.4)
Eye diameter	5.3–7.8 (6.6)	4.8–7.3 (6.2)
Interorbital width	6.7–8.8 (7.6)	6.5–7.5 (7.1)
Head depth through eye	11.7–14.4 (12.8)	11.3–13.2 (12.3)
Head depth at nape	16.3–19.1 (16.4)	15.5–17.5 (16.6)
Length of maxilla	9.5–11.0 (10.1)	8.5–9.3 (8.6)
Maximum height of maxilla	2.6–3.8 (3.0)	2.4–3.6 (2.8)
Width of mouth gape	8.0–11.7 (9.7)	7.4–9.6 (8.6)
Length of mouth gape	11.0–15.0 (13.0)	11.3–12.6 (11.8)

Adipose fin medium size, not reaching the base of the caudal fin, its upper edge convex in males, females, and juveniles. Dorsal-fin with 3–4 simple and 8–10½ branched rays, outer margin straight or slightly convex. Pectoral fin with 10–12 branched rays, outer margin convex. Pelvic fin with 1 simple and 7–8 branched rays, outer margin convex. Anal fin with 3 simple and 8–9½ branched rays, outer margin convex anteriorly, straight or slightly convex posteriorly in adult males, convex anteriorly concave posteriorly in females and juveniles. Caudal-fin slightly forked in adult males, forked in juveniles, and lobes pointed or slightly rounded in males and juveniles; slightly forked and lobes rounded in adult females. Lateral line with 109–115 scales; 26–29 scale rows between lateral line and dorsal-fin origin; 20–23 scale rows between lateral line and anal-fin origin; 15–17 scales between lateral line and posterior extremity of the base of the adipose fin (Fig. 1a). Gill rakers 11–13 + 6–7 on the outer side of first gill arch. Number of vomer teeth 17–23 in males, usually organized in two irregular rows.

The snout of males more pointed than that of females. Maxilla and a head length of males longer than that of females (26–30% SL, vs. 25–28).

Table 2. Frequency distribution of meristic features of five *Salmo* species from the Aegean Sea and adjacent basins.

Lateral line scales																
	N	109	110	111	112	113	114	115	116	117	118	119	120	121	X	
<i>S. pelagonicus</i>	34	2	3	4	6	7	5	3							112.3	
<i>S. abanticus</i>	21					2	2		5	2	4	4		2	117.1	
<i>S. labrax</i>	12				2		2		3	1		2		2	116.4	
<i>S. coruhensis</i>	41		2	2	6	3	7	8	7	3	3				114.3	
<i>S. rizeensis</i>	31						5	7	5	5	5	2	2		116.4	
Transverse line scales		Above lateral line						Below lateral line								
	N	26	27	28	29	30	31	32	X	18	19	20	21	22	23	X
<i>S. pelagonicus</i>	34	1	12	12	5				27.7			6	10	8	6	21.4
<i>S. abanticus</i>	21	6	5	4					27.6	2	4	11	4			19.8
<i>S. labrax</i>	12			3	1			5	30.3		2	1	2	5	2	21.3
<i>S. coruhensis</i>	41		6	13	7		5	2	28.9		9	13	15	2	2	20.4
<i>S. rizeensis</i>	31	4	7	9	8				28.0	6	8	9	8			19.6
Scales between adipose-fin insertion and lateral line									Gill rakers							
	N	14	15	16	17	X	16	17	18	19	20	X				
<i>S. pelagonicus</i>	34		16	11	3	15.4			9	21	4	18.9				
<i>S. abanticus</i>	21		4	17		15.8			4	12	10	19.0				
<i>S. labrax</i>	12		4	8		15.7	2	5	5			17.3				
<i>S. coruhensis</i>	41		9	22	12	16.1		5	18	14	6	18.5				
<i>S. rizeensis</i>	31	4	19	9	1	15.1	2	3	10	16		18.2				

General body colour brownish in life and preserved in specimens. Body dark brown on back and flank; belly light brownish to yellowish. The pattern of four broad blackish bands missing on the body of both sexes. A single black spot behind the eye. Zero to twelve black spots on opercula, smaller than the pupil. Zero to eight black spots on top of the head. Black ocellated spots on body less than 60, equal or slightly greater than pupil, scattered on

the upper part of flank, on the back and sometimes below lateral line immediately behind the head in males and females. In juvenile, black spots less than 40, larger than pupil, scattered on upper and lower parts of flank, and sometimes anterior part of the middle of flank. Red ocellated spots few (less than 30), conspicuous, usually scattered in two or three rows on the median and lower part of flank in males and females, one or two rows on the

middle of flank in juveniles. Adipose fin greyish, with 1-2 small red spots along the distal margin. Dorsal fin brownish to greyish, with 3-5 rows of black spots and 2-3 rows of red spots. Pectoral, pelvic and anal fins yellowish. Caudal and dorsal fins dark grey. Ten to 13 parr marks on the body, vertically oblong and slightly roundish, missing in specimens larger than about 190 mm SL.

Distribution and habitat: *Salmo pelagonicus* only known from the Vardar and Aliakmon rivers in Greece and Ayazma, and Adaçay streams, tributaries of Karamenderes River (Aegean Sea basin). It lives in small pools of streams with cold, clear and very swift flowing water. The bottom consists of rocks, stones, and pebbles.

DISCUSSION AND CONCLUSION

Karaman (1936), described *Salmo pelagonicus* as 'a deep and compressed body, a long and pointed head, a long and wide mouth, a long and narrow maxilla (reaching beyond about one eye diameter), a long and deep adipose-fin and vomer teeth with two rows. Our data of *Salmo pelagonicus* from the Kara Menderes River is overlapped with data in Karaman (1936).

Salmo pelagonicus distinguished from *S. abanticus* by the shape of the black spots on the flank (circular, vs. polygonal), the shape of the ring around the black spots (circular, vs. polygonal), the size of the black spots (equal or slightly greater than pupil, vs. markedly greater than pupil) and general body colour (greyish, vs. brownish) and the presence of red spots on the body in specimens larger than about 200 mm SL (vs. absent), *Salmo pelagonicus* further distinguished from *S. abanticus* by the arrangement of the vomer teeth (two irregularly rows, vs. one row).

Salmo pelagonicus distinguished from *S. labrax* by the general body colour in life (brownish, vs. greyish), the position of the dorsal fin in males (predorsal length 47–50% SL, mean 48.0, vs. 46–47, mean 46.5), the length of maxilla in males (10–11% SL, mean 10.1, vs. 9–10, mean 9.2) and the body depth in males (body depth at anal-fin origin 16–19% SL, vs. 19–21).

Salmo pelagonicus differs from *S. coruhensis* by the general body colour, the number and distribution of the black and red spots on the body, and the way they vary with increasing size. In *S. pelagonicus*, the general body colour is brownish; the black spots are few (less than 60), usually present on the upper part of the flank, rarely below lateral line, commonly missing on the middle of the flank in specimens larger than 140 mm SL; the number of black spots slightly increases with increasing size. The red spots are few (less than 30), present on the lower and median part of the flank. The number of red spots does not increase with size in both sexes. In *S. coruhensis*, the general body colour

is greyish; the black spots are numerous (more than 80), present on the whole upper half of the flank and the anterior part of the lower half of the flank, sometimes a few on the back in front of the dorsal fin in males larger than 200 mm SL. The number of red and black spots increases with increasing size. *Salmo pelagonicus* usually has a single conspicuous black spot behind the eye (on cheek and preopercule) at all sizes. *S. coruhensis* has two or three spots on the cheek and the preopercule in most individuals, rarely a single one and this number increase to 4–17 in males larger than about 250 mm SL.

Salmo pelagonicus is distinguished from *S. rizeensis* by having less lateral line scales (109–115, mean 112.3, vs. 114–120, mean 116.4); more scale rows between lateral line and anal-fin origin (20–23, mean 21.4, vs. 18–21, mean 19.6)(Fig. 1a, d); fewer vomer teeth (17–23 [n=10], vs. 30–37 [n=10]); and a somewhat smaller mouth gape in males (11–15% SL, mean 13.0, vs. 13.2–17.8, mean 15.5). Juveniles of *S. pelagonicus* (Fig. 1d) differ from those of *S. rizeensis* by the distribution of the red and black spots. In *S. pelagonicus*, the black spots on the body are few (less than 40) and scattered on the whole flank; there are very few red spots (less than 20) on the body, organised as one or two rows along the lateral line. In *S. rizeensis*, there are only a few (less than 30) black spots on the body and they are present on the back and the upper part of the flank; the red spots are organised in three or four irregular rows on median and lower parts of the flank.

Salmo pelagonicus distinguished from *S. macedonicus* and *S. macroptera* in Greece and Balkan Peninsula in the Aegean Sea basin by commonly the body colour and pattern, the number and size of spots, and their distribution on the body. In *S. pelagonicus*, black spots are few and usually present on the upper part of the flank, rarely below lateral line. The red spots are few and present on the lower and median part of the flank. Black spots are equal to or slightly greater than pupil and red spots are approximately equal to the pupil. In *S. macedonicus*, general body colour is silvery; black spots are numerous and usually present on the almost whole the flank. Red spots are absent or few and scattered along the lateral line. *Salmo pelagonicus* also differs from *S. macroptera* by having fewer lateral line scales (109–115, vs. 116–128) and fewer branched pectoral-fin rays (10–12, vs. 12–13) (Chichkoff, 1939; Karaman, 1936; Kottelat & Freyhof, 2007).

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