



Rutilus albus sp. n. (Teleostei: Cyprinidae) from Lake Skadar

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Abstract

Background and Purpose: *Rutilus albus* was recorded in Lake Skadar for the first time in 1988 (11) under the name *Rutilus basak ohridanus* (Karaman, 1924). Since then it has been quoted in the literature under that name.

Material and Methods: In addition to the material used for morphological analysis (holotype and paratype), an additional twenty specimens were caught from the sublacustrine spring Ćurijan (Jan, Feb. 1993) and 65 from the sublacustrine spring Raduš (January, February. 1993). They were also used for other biological and ecological analyses. Twenty-five morphometric and nine meristic characters were measured according to Holčík (19).

Results: From *Rutilus rutilus* (nominal species) *Rutilus albus* differs by its subterminal mouth, lower number of branched rays in A and D fin, and significantly less intense colour of all fins. From the species *Rutilus ohridanus* (Karaman, 1924), which also occurs in Lake Skadar, it is most prominently distinguished by the subterminal position of the mouth. From *Rutilus basak* it is distinguished by a larger number of gill rakers and darker peritoneum. In addition to these characteristics, *R. albus* is also characterized by a specific combination of meristic and certain morphometric characters by which it is distinguished from other species of the genus *Rutilus*: maximum body depth 22.5–27.5 % SL; head length 22.0–27.5 % SL; eye diameter 4.0–7.0 % SL; length of base of anal fin 13.0–15.5 % SL; length of base dorsal fin 12.0–14.5 % SL; length of pre-anal fin 63–70 % SL; length of caudal peduncle 20.5–23.5 % SL; distance A–C 30.5–36.5 % SL. Modal value of branched rays in D and A fin is 8. Meristic characters are: branched rays in fins D 8–9, A 8–9, V 8, P 15–17; L.L. 41–46; vertebrae. 38–40; pharyngeal teeth 5–5; gill rakers 8–11/12–16 (mean = 9.0/ 13.9).

Conclusion: *Rutilus albus*, a new cyprinid species from Lake Skadar, is described.

INTRODUCTION

Taxonomic-systematic status of species from *Rutilus rubilio* complex has been confusing and unclear in the past (1, 2). In the middle and in the second half of the 20th century, many accepted the belief that there is only one species (*R. rubilio*) with many subspecies (3, 4, 5, 6, 7 and others) in the drainage basin of Adriatic and Ionian Sea. Some of them maintained this belief even later (8, 9). However, Bianco and Taraborelli (10) demonstrated that two, mainly allopatric, species exist in the waters of Italy, and that one species – *R. basak*, (Heckel & Kner, 1858) exists in the waters of Central Dalmatia. Further, Maric (11) quotes that in the drainage of Lake Skadar two species occur in sympatry, while according to Bogutskaya & Iliadou (12) in the waters of

Western Greece there is only *Rutilus panosi*. According to Kottelat & Freyhof (13), there are seven valid species from the genus *Rutilus* in this region. From a survey of the available literature, it can be concluded that there are at least six valid species in this area, which for a number of years have been referred to as *R. rubilio*.

It frequently happens that wrong conclusions are derived when comparing the results of own research with literature data. This is a consequence of the incompleteness of data, or sampling a single population, or examining a small number of specimens. Additionally, there are cases of printing errors, which inevitably lead to mistakes in comparisons. A typical example is that of meristic characters of *Rutilus* sp. from Lake Ohrid in a paper by Karaman (2), or, for instance the size of eggs for *Rutilus* sp. from Lake Skadar in a paper by Ivanović (14). The first example has contributed to a several decade long confusion regarding the morphological characteristics, and consequently number of species and systematic status of *Rutilus* sp. in Lake Ohrid. In the second example, the size of eggs of 4.5–5.7 mm for *Rutilus* sp. from Lake Skadar, lead Bianco & Tarborelli (10) to conclude that it is a separate, non-described species. The latter is a clear case of a mistake, because *Rutilus* sp. and related species mainly have eggs that are usually 2 mm in diameter, and often smaller than that, but rarely larger. In many other cases the mistake cannot be easily discovered. One such mistake which causes confusion is erroneous marking or determination in museums. Consequently, this leads to merging of species, or wrong determination and description of new ones.

Having compared the morphological data of specimens of the two species from Lake Skadar he studied with the literature data on *Rutilus* sp., Marić (11) determines one of them, as *Rutilus basak ohridanus* (Karaman, 1924). The objective of the paper is to demonstrate that this was an erroneous determination, and that this population is significantly distinguished from *R. basak*, as well as from others species of the genus *Rutilus* described so far. *R. albus* has a larger number of specific morphological, anatomic and biological characteristics that distinguish it from other species, and therefore it represents a new species. Marić & Radujković (15) have proved that Vladykov & Petit (16), Fowler (17), Šorić (18), and other authors erroneously cited and described the specimens from Lake Ohrid as: *Rutilus aula natio karaman*, *Rutilus rubella karamani*, *Rutilus rubilio*, which in fact belong to the species *Rutilus ohridanus*, which was already described by Karaman (2).

MATERIAL AND METHODS

In addition to the material used for morphological analysis (holotype and paratype), an additional twenty specimens were caught from the sublacustrine spring Curijan (Jan, Feb. 1993) and 65 from the sublacustrine spring Raduš (January, February. 1993). They were also used for other biological and ecological analyses.

The entire material was collected by trawl nets.

All results of the morphometric character analysis are presented in Tables 1 and 2, and the measurements per-

formed by one person. The measurements were taken using calipers with 0.1 mm preciseness.

Twenty-five morphometric and nine meristic characters (the characters used are presented in Tables 1 and 2) were measured according to Holčík (19). The last two branched rays articulated on a single pterygiophore in dorsal and anal fins are noted as one ray. The number of lateral line scales were count only of the pored scales. For calculation of the average value of scale size, ten scales were taken from each of the 20 specimens, from the central part of the row of scales immediately above the lateral line.

Abbreviations used: NHMM, Natural History Museum of Montenegro, UMFSP, University of Montenegro, Faculty of Science, Podgorica, Montenegro; L.L. lateral line; SL, standard length; TL, total length; D, A, V, P, and C – pine dorsalis, analis, ventralis (pelvic), pectoralis, and caudalis; $M \pm sm$, mean and error of mean; SD, standard deviation.

Validity of the *Rutilus* spp. discussed in this paper is based on the approach by Kottelat (20) and Kottelat & Freyhof (13), except for the populations from lakes Ohrid and Prespa, which have been treated as *Rutilus ohridanus* (Karaman, 1924), according to Marić & Radujković (15).

RESULTS

Rutilus albus, new species.

Rutilus basak ohridanus – Marić, 1989 (locality: Skadar Lake, Montenegro)

Holotype. NHMM 600–347, 139.9 mm SL, 169.1 mm TL, male with mature gonads; Montenegro: Lake Skadar; sublacustrine spring Vaškaut 19°17' 12.81 »E 42°06'26.30« N; D.Marić, 17 February 1992.

Paratype. UMFSP 022, 19, 96.0–168.1 mm SL, Montenegro: Lake Skadar; sublacustrine spring Vaškaut 19°17' 12.81»E 42°06'26.30« N; D.Marić, 17 February 1992.

Diagnosis: *Rutilus albus* is characterized by a typical subterminal mouth, so the lower lip is shorter than the upper one, snout rounded. Body silver white colour in life, while the peritoneum is striking by dark (black). Dorsal, anal, pectoral and ventral fins are yellowish, pale or transparent. Caudal fin is elongated (<20% TL), sharp, spear-shaped and deeply cut. Dorsal and ventral fins are slightly concave. Scales are relatively small ($4.07 \pm 0.05/SL$) and smaller than diameter of the eye. *Rutilus albus* is distinguished from other species of the subgenus *Rutilus* by the following combination of char-



Figure 1. *Rutilus albus*, Montenegro: Lake Skadar. NHMM 600-347, holotype, 139.9 mm SL, 169.1 TL mm, male.

acters: maximum body depth 22.5–27.5 % SL; head length 22.0–27.5% SL; length of base of anal fin 13.0–15.5% SL; length of base dorsal fin 12.0–14.5% SL; length of pre-anal fin 63–70% SL; length of caudal peduncle 20.5–23.5% SL; distance A–C 30.5–36.5% SL; branched rays in fin D 8–9; branched rays in fin A 8–9; branched rays in fins V 8; branched rays in fins P 15–17; L.L. 41–46; vertebrae. 38–40; pharyngeal teeth 5–5, gill rakers on first left gill arch 8–11/12–16 (mean=9.0/13.9). Modal value of branched rays in fins D and A is 8.

Description: See Figure 1 for general appearance and Tables 1 and 2 for morphometric and meristic data. Body is elongated and spindle-shaped, especially in juvenile and sub-adult specimens. Body has a silver white colour, while the peritoneum is striking dark (black). Mouth subterminal, snout rounded. Dorsal and ventral fins are slightly concave. Dorsal, anal, pectoral and ventral fins are transparent during the winter, whereas they are slightly pigmented yellowish or pale in summer. The scales of the back (above lateral line) are pigmented along their free margins (small pigment dots). There are no pig-



Figure 2. *Rutilus albus* – mouth.

ments or very few (exposed in anterior half of the back) on the scale pocket. The pigments along the free margin of flank scales are even less notable. They are relatively small ($4.07 \pm 0.05/SL$) and smaller than diameter of the eye. Eye diameter 4.0–7.0 % SL (in young fish it is larger 7% SL), equal or shorter than snout, 2.0–2.2 times in postorbital length. Distance between the eyes (interorbital width) 9.5–11.0% SL equal to length of base A, 2.0 times in length of dorsal fin. Head length equal to maxi-

TABLE 1

Morphometric data on *Rutilus albus* from Lake Skadar.

Characters	Holotype	Paratypes (n – 19)		
		Range	M± sm	SD
Body total length in mm	169.1	123.6–201.0	137.8	19.9
Standard length in mm	139.0	96.0–168.1	114.1±3.8	17.1
mm (%)		in % of standard length		
Total length	(121.6)	120.7–124.5	120.8±0.52	2.34
Body depth	38.3 (27.6)	22.6–27.6	24.5±0.24	1.10
Depth of caudal peduncle	14.0 (10.1)	8.5–10.3	9.5±0.11	0.52
Head length	34.5 (24.8)	22.0–27.6	24.6± 0.28	1.28
Snout length	9.5 (6.8)	5.5–8.5	6.9±0.15	0.70
Interorbital width	12.8 (9.2)	9.4–10.7	10.0±0.08	0.39
Eye diameter	7.3 (5.2)	4.1–7.0	5.8±0.14	0.67
Postorbital distance	18.3 (13.1)	11.1–13.5	11.9±0.19	0.86
Predorsal length	71.0 (51.1)	50.2–53.7	51.8±0.35	1.60
Postdorsal length	55.5 (39.9)	36.3–39.9	38.2±0.22	1.00
Prepelvic length	66.7 (50.0)	46.6–50.7	48.8±0.30	1.37
Postpelvic length	74.3 (53.4)	50.6–57.2	53.7±0.38	1.71
Pre-anal length	96.5 (69.4)	63.0–70.7	68.1±0.34	1.56
Length of caudal peduncle	32.4 (23.3)	20.4–23.6	22.2±0.23	1.07
Length of base D	19.0 (13.7)	12.1–14.5	13.3±0.14	0.67
Length of D	28.7 (20.6)	18.3–22.7	21.0±0.25	1.13
Length of caudal fin (C)	27.6 (19.8)	18.6–22.9	20.7±0.26	1.17
Length of base A	15.0 (10.8)	9.2–11.1	10.4±0.15	0.70
Length of A	20.0 (14.4)	13.1–15.6	13.9±0.22	1.00
Length of P	27.0 (19.4)	17.4–20.7	19.6±0.17	0.77
Length of V	22.3 (16.0)	14.8–17.3	16.4±0.19	0.88
Distance P-V	34.0 (24.5)	21.7–25.7	23.9±0.23	1.04
Distance P-A	62.0 (44.6)	40.3–46.8	43.8±0.41	1.85
Distance V-A	30.7 (22.1)	18.2–23.1	20.3±0.27	1.22
Distance A-C	48.4 (34.8)	30.6–36.4	33.6±0.30	1.35

TABLE 2

Meristic data of *Rutilus albus* from Skadar Lake.

Characters	Holotype	Paratypes (n – 19)		
		Range	M ± sm	SD
Branched (soft) rays of D	8	8–9	8.1±0.01	0.03
Branched (soft) rays of A	8	7–9	8.2±0.01	0.03
Branched (soft) rays of P	17	15–18	16.1±0.21	0.67
Branched (soft) rays of V	8	8	8	–
Lateral line scales – l.l.	44	41–46	43.4±0.28	1.27
Scale between l.l. and D-fin origin.	8	8–9	8.6±0.10	0.48
Scale between l.l. and V-fin origin.	4	3–4	3.9±0.06	0.30
Vertebrae	–	38–40	39.1±0.12	0.62
Gill rakers-ext. series	–	8–11	9.00±0.14	0.85
Gill rakers-int. series	–	12–16	13.9±0.18	1.10

mum body depth. The largest body depth rarely exceeds 25% of the SL, whereas TL is <120% SL. Depth of caudal peduncle about 2.0–2.3 times in its length.

Prepelvic length (46.6–50.7%SL) slightly less than predorsal length (50.2–53.7), so that the pelvic origin behind dorsal base. Position of anal fin is moved forwards, so that the length of caudal peduncle is larger (20.5–23.5% SL), as well as the distance A–C (30.5–36.5% SL). Length of base A (9.0–11.0. SL) 2 times length of C, and less than length of base D. Length of dorsal fin (18–23% SL) equal to distance V–A, slightly greater than length of pectoral fin (17.5–21.5 SL), and significantly greater than length of fins A and V.

Scales relatively small (about 4.0% SL), 41–46 (usually 42–44) on lateral line; 8–9 (usually 9) between L.L. and dorsal-fin origin and 3–4 (usually 4) between L.L. and pelvic-fin origin. Dorsal and anal fins with 8–9 (usually 8) branched rays; pelvic fin with 8 branched rays, pectoral fin with 15–17 (usually 16) branched rays. Vertebrae 38–40; pharyngeal teeth 5–5; gill rakers on first left gill arch 8–11/12–16 (mean=9.0/13.9).

Besides morphological data presented by Marić (11), there are no other data on this species. Data on meristic characteristics given in that paper differ for the present data for the number of scales in L.L. the amplitude of which is 41–45 and average value of 41.8.

Habitat and biology: So far species *Rutilus albus* has been recorded only from Lake Skadar (Figure 3). This Lake was formed by inundation of the karstic field. It is located at 19°15' of the Eastern longitude and 40°10' of the Northern latitude, at the very South of the Republic of Montenegro. It is at the border with Albania, to which one third of the lake area belongs. During the period of average water levels, the altitude of the lake surface is 4 m, and its size around 370 km² (21). Northern and north-western sides are overgrown by dense submerged and emergent vegetation (*Phragmites* sp., *Ceratophyllum* sp., *Myriophyllum* sp., *Potamogeton* sp., *Trapa* sp., *Nymphaea* sp) which is expanding (22).

Studied material and the material used in the paper by Marić (11) were collected from sublacustrine springs in

the winter period, when this species gathers there with a large number of other species. In the southern part of the Lake there are five, and in the northwestern there are eight, large sublacustrine springs, where large numbers of fish gather during the winter period, making them the most important places for fishing. Abundance of both species from the genus *Rutilus* make over 50% of the total fish in these wintering sites (23). During the winter period, *Rutilus albus* used to be found only in the springs along the southern bank of the Lake, and its abundance is significantly smaller than that of *Rutilus ohridanus*. For a number of years this relation in the locality of Raduš has been 20:1. On this locality, a sexually mature female (TL = 220.1 mm, SL = 181.0 mm) in the 4th stage of maturity was caught (15 January). Average egg size is around 1.8 mm, and around 470 units of mature eggs per 1 gram was counted. Specimens (n = 60) up to 120 mm in length (SL) and 35 g in weight, caught in February were sexually immature. *R. albus* spawn earlier in the season than *R. ohridanus*. *R. albus* can grow up to 250 mm in length and reach a weight of up to 200 g. Biology of *R. albus* has not been sufficiently studied.

Etymology: The specific name *albus* is derived from the Latin word *albus*, meaning white.

Figure 3. Map of distribution of *Rutilus albus*.

DISCUSSION

In his paper, Marić (11) clearly demonstrated that two species of the genus *Rutilus* occur in sympatry in Lake Skadar. However, because of the above mentioned reasons, *R. albus* has been determined as *R. basak*. This paper proves that *R. basak* does not occur in Lake Skadar. *R. basak* is distributed in the drainage basin of the Neretva River and in the neighboring smaller lakes (10, 13). Comparison of the available collected material unambiguously demonstrates that *R. albus* is significantly distinguished from *R. basak* (and other species from the surrounding), primarily for the number of gill rakers, subterminal position of the mouth and black peritoneum. *R. albus* is distinguished from *R. basak* from the Neretva River and *R. ohridanus* (population from Skadar, Ohrid and Prespa Lakes) and *Rutilus* sp. from Lake Vegoritits by its dark dots on the scales (on the back). In *R. albus* the scales on the back (above lateral line) are pigmented along their free margins, and no pigments or very few (exposed in anterior half of body) on scale pocket (Figure 4). In other mentioned species, the scales on the lateral sides are pigmented along their free margins and in the scale pockets forming blackish mesh, what is striking above the lateral line; or pigmented at the base of scale (pigment dots are mostly located in scale pockets, Figure 5). The body colour is prominent, so the local fishermen easily distinguish three species under the same common name »brack«(roach): spotted roach (*Pachichylon pictum*), yellow roach (*R. ohridanus*) and white roach (*R. albus*). Body colour *R. albus* is silvery white, resembling at first glance *Chondrostoma* sp. or *Alburnus scoranza* for its outer appearance.

The scales are: 41–46 (usually 42–44) on lateral line; 8–9 (usually 9) between L.L. and dorsal-fin origin and 3–4 (usually 4) between L.L. and pelvic-fin origin. For this combination of scale number *R. albus* is significantly distinguished from the other *Rutilus* spp. from the neighboring waters. They are relatively small ($4.07 \pm 0.05/SL$) and smaller than in the remaining *Rutilus* spp. occur in the Adriatic Drainage Basin (around 4.5% SL). Differences between this (*R. albus*) and *Rutilus ohridanus* Karaman, 1924 (= *Rutilus prespensis vukovici* Marić, 1989) from Lake Skadar were analyzed in detail in the paper by Marić (11). Along the lateral sides there are no brownish midlateral stripes that are typical of *R. aula*. Yellowish, almost transparent fins, clearly distinguish it from typical



Figure 5. *Rutilus ohridanus* – scales.

species *R. rutilus*, and *R. rubilio*, from which it is also clearly distinguished by a smaller number of branched rays (usually 8) in anal and dorsal fins. *Rutilus pigus*, *Rutilus heckeli*, *Rutilus meidingeri* and some already mentioned species, as well as the populations from Lake Vegoritits in Greece, have significantly more branched rays (1, 24, 25, 26, and other authors). Some of the mentioned species, as well as *Rutilus ylikiensis* and *Rutilus frisii*, have a higher number of scales in lateral lines. According to the morphological characters, *R. albus* is closest to the *Rutilus* spp. from neighboring waters. However, it is also significantly distinguished from them in a certain number of characters (Figure 6, Table 3.), primarily by the subterminal mouth, very black peritoneum, and combination of morphological characters.

In conclusion, it can be stated that *R. albus* and *R. ohridanus* occur in sympatry in Lake Skadar, whereas *R. basak* populates the Neretva River drainage basin. Also, according to Marić & Radujković (15), only one species – *R. ohridanus*, occurs in lakes Prespa and Ohrid (and their tributaries). The latter conclusion is also supported by a paper by Šorić (18). Furthermore, accepting the approach by Kottelat & Freyhof (13), it follows that there are 17 valid of *Rutilus* spp. in European waters, one of which is also *Rutilus albus* sp. n. The pulation from Lake Vegoritits in Greece remains not described and unresolved.

This study has demonstrated that: *R. albus* occurs only in Lake Skadar; not listed in species described so far; *R. karamani* is a synonym for *R. ohridanus* (Karaman, 1924)



Figure 4. *Rutilus albus* – scales.

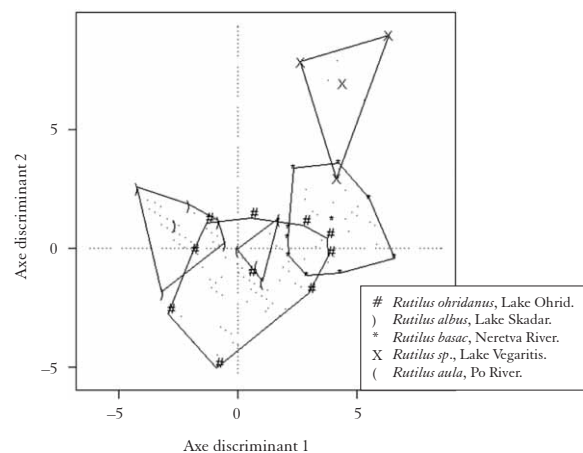


Figure 6. Principal Component analysis of meristic characters of five *Rutilus* sp. from different localities.

TABLE 3

Meristic characters of some species of genus *Rutilus* from various localities.

Characters	<i>R. ohridanus</i> Lake Ohrid	<i>R. basak</i> Neretva River	<i>R. aula</i> Po River	<i>Rutilus</i> sp. Lake Vegaritis
	range (mean)	range (mean)	range (mean)	range (mean)
Branched (soft) rays of D	8–9 (8.6)	8–9 (8.7)	9	9–10 (9.6)
Branched (soft) rays of A	7–8 (7.8)	7–9 (8.5)	9	9–10 (9.7)
Branched (soft) rays of P	13–16 (14.3)	14–17 (15.5)	14–16 (15.2)	12–16 (14.0)
Branched (soft) rays of V	8	7–9 (8.0)	8–9 (8.1)	8–9 (8.2)
Lateral line scales – l.l.	37–40 (39.3)	36–41 (39.5)	38–40 (38.9)	42–45 (43.5)
Scale between l.l. and D origin.	7–8 (7.1)	7–8 (7.7)	7–8 (7.5)	7–8 (7.8)
Scale between l.l. and V origin.	3–4 (3.8)	3–4 (3.8)	3–4 (3.7)	4
Gill rakers-ext. series	8–10 (9.1)	9–10 (9.5)		
Gill rakers-int. series	10–14 (12.1)	11–13 (11.7)		

as cited by Marić & Radujković (15). Consequently the data on *R. ohridanus* from Kottelat & Freyhof (13) and partially data from Bogutskaya & Ilidou (12) are in fact the data for *R. albus* sp. n. Also, owing to lower abundance of *R. albus* than *R. ohridanus* = *R. karamani*, all the data published so far about the species from Lake Skadar, previously cited as *R. rubilio* (5, 6, 14, 18, etc.), probably relate exclusively to *R. ohridanus*.

Comparison material

For comparison purposes – Discriminant Analysis (graphs), and for calculating the average value of scale size, the following have been meristically treated:

- *Rutilus* sp. UMFSP 0033, 6, 84.4–172.0 SL; Greece: Lake Vegaritis; leg PS. Economidis.
- *Rutilus ohridanus* UMFSP 0037, 28, 64.0–118.0 SL; FYROM: Lake Ohrid; leg. D. Marić, 26 July 2002.
- *Rutilus aula* UMFSP 0032, 12, 93.0–132.0 SL; Italy: Po River; leg. P. G. Bianco.
- *Rutilus basak* UMFSP 0036, 38, 82.7–142.5 SL; Bosnia and Herzegovina: Neretva River; leg. Lj. Bukvić, June 2002.

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