



**RUTILUS OHRIDANUS (KARAMAN, 1924) (TELEOSTEI: CYPRINIDAE)  
FROM OHRID, PRESPA AND SKADAR LAKES**

**Drago MARIĆ\* & Branko RADUJKOVIĆ**

\*Corresponding author: University of Montenegro, Faculty of Sciences, Department of Biology, P.O. Box 211, 20000 Podgorica, Crna Gora (Montenegro).

E-mail: dragomrc@yahoo.com, brradujkovic@yahoo.com

**SYNOPSIS**

**Key words:**

*Rutilus ohridanus*  
(Karaman, 1924),  
redescription,  
morphology,  
Prespa Lake,  
Ohrid Lake,  
Skadar Lake.

Redescription of morphological characteristics of populations of *Rutilus* sp. from Ohrid, Skadar and Prespa Lakes is presented in this paper. Results show that the Lake Skadar population described as *R. prespensis vukovici*, is significantly more similar to the population of Lake Ohrid than to *Rutilus basak ohridanus* described from Skadar Lake by (Marić, 1989). Taxa as *Rutilus prespensis* (Karaman, 1924); *Rutilus karamani* Folwer, 1977; *Rutilus vukovici* Marić, 1989 are junior synonyms of the species *Rutilus ohridanus* (Karaman, 1924). The main characteristics of *R. ohridanus* (Karaman, 1924) are: mouth terminal, snout short pointed, D III 8-9 (often 9), A III 7-9 (often 8), P I 13-17 (often 14-15), I.I. 36-42 (often 38-40), vertebrae 35-38 (often 36-37), teeth 5-5, 4-5, 5-4, 6-5 (often 5-5), gill rakers 8-10.

**INTRODUCTION**

The taxonomic status of many endemic fish species from the waters of Balkan Peninsula is still not clear, and one of them is the status of *Rutilus* sp. from the Ohrid, Prespa and Skadar Lakes.

The species of *Rutilus* described by Karaman (1924) from Ohrid Lake as *Leucos aula* v. *ohridana* with diagnostic characteristics (D 3/10-11, A 3/11, I.I. 44 and spinal vertebrae 42) which was significantly different from the related species in Italy and Western Balkans. Vladikov and Petit (1930) on the material from the Albanian part of Ohrid Lake (loc. Podgradec) described a population of *Rutilus aula* natio *karamani*, which Fowler (1977) reported as *Rutilus rubella karamani*. The

characteristics given by Vladikov and Petit (1930), and later also Šorić (1983), Georgijev (1998) and Rakaj (1995) for the population from Ohrid Lake, are significantly different from the diagnosis given by Karaman (1924). On the basis of the analyses of extensive materials of *Rutilus* we can provide a redescription of taxa living in these Lakes. All these descriptions make confusion and one may conclude that more than one species exist in Ohrid Lake. The recently published papers, by Bogutskaya and Iliadou (2006) and Kottelat & Freyhof (2007), bring even more confusion.

## MATERIAL AND METHODS

Examined material:

### ***From Prespa Lake***

2 specimens (Mikri Prespa, Greece) leg P.Economidis - University of Thessaloniki, uncat.

6 specimens Macedonian Museum of Natural History Skopje, uncat. (data from the collections of D. Marić)

### ***From Ohrid Lake***

On the locality the City of Ohrid (FYROM) 173 specimens were determined, and 27 specimens were analysed in detail, leg. D. Marić - University of Montenegro, Faculty of Sciences, Podgorica, uncat.

On the locality Podgradec around 1,000 specimens (30 kg) were determined and in 73 specimens the radii of D and A fins were counted, as well as the number of scales in I.I and number of spinal vertebra, leg. D.Marić.

### ***From Skadar Lake***

20 specimens leg. D. Marić - University of Montenegro, Faculty of Sciences, Podgorica, uncat.

In total, 30 morphometric and 9 meristic characters were measured according to Holčík (1998). All morphometric measurements are expressed in % of Standard Length and were taken by one person and taken to the nearest 0.1 mm, using dial callipers.

### **Comparison material**

For comparison purposes – Discriminant Analysis (making graphs) the following have been meristically (soft rays D,A,P,V and scales I.I.) treated:

- 6 specimens of *Rutilus* sp from the Lake Vegoritis – Greece; leg P.S. Economidis, – University of Montenegro, Faculty of Sciences, Podgorica, uncat.
- 20 specimens of *Rutilus* sp from Skadar Lake; leg. D. Maric, Jan, Feb.1993. – University of Montenegro, Faculty of Sciences, Podgorica, uncat.
- 38 specimens of *Rutilus basak* from the Neretva River; leg. Lj. Bukvic, June 2002 –University of Montenegro, Faculty of Sciences, Podgorica, uncat.
- 16 specimens *Rutilus* sp. From Sasko lake; leg. D. Maric, – University of Montenegro, Faculty of Sciences, Podgorica, uncat.

**Additional material**, specimens from Naturhistorisches Museum Wien - N<sup>o</sup> 50653

Abbreviations used: LL- number in lateral line; SL- standard length; TL- total length; D, A, V, P, and C – pine dorsalis, analis, ventralis, pectoralis, and caudalis;  $\bar{x} \pm SE$  = mean and error of mean; SD = standard deviation, CV = coefficient of variance.

## RESULTS AND DISSCUSION

*Rutilus ohridanus* (Karaman, 1924)

Synonyms: *Leucos aula v. ohridana* Karaman,1924;  
*Leucos aula v. prespensis* Karaman, 1924  
*Rutilus aula natio karamani* Vladykov et Petit, 1930;  
*Rutilus rubella karamani* Fowler, 1977;  
*Rutilus prespensis vukovici* Marić, 1989;

**Distribution:** Type locality Ohrid Lake. Its range incudes Prespa, Ohrid and Skadar Lakes and their tributaries (Fig 1). It was introduced into the Mavrovo reservoir (the Drim River drainage basin) (FYROM) and in the Vlasina Lake in the drainage basin of the Danube (Vladikov and Petit 1930, Poljakov *et al.* 1958, Šorić 1983, Marić 1989, Rakaj 1995, Georgijev 1998, Simonović 2001).

### Diagnosis and description:

The main characteristics of *R. ohridanus* are: mouth terminal, snout short pointed, dorsal and ventral fins are concave, D III 8-9 (often 9), A III 7-9 (often 8), P I 13-17 (often 14-15), I.I. 36-42 (often 38-40), vertebrae 35-38 (often 36-37), teeth 5-5, 4-5, 5-4, 6-5 (often 5-5), gill rakers 8-10. All the fins are coloured (red or orange), particulary in spawning period. Morphological characteristics presented in tables 1-7.

**Table 1. Meristics data of *Rutilus ohridanus* from Ohrid Lake (n=27).**

Characters	Range	$\bar{x} \pm SE$	SD	CV
Branched (soft) rays of D	8-9	8.6±0.15	0.78	5.8
Branched (soft) rays of P	13-16	14.3±0.23	1.18	5.4
Branched (soft) rays of V	8	8		
Branched (soft) rays of A	7-8	7.8±0.12	0.40	5.1
Lateral line scales - I.I.	37-40	39.3±0.27	0.90	2.3
No of scales above I.I.	7-8	7.1±0.09	0.30	4.2
No of scales below I.I.	3-4	3.8±0.08	0.42	11.0
No. of gill rakers in ext. series	8-10	9.0±0.12	0.40	3.0
No. of gill rakers in int.series	10-14	12.1±0.25	1.18	9.7

**Table 2. Meristics data of *Rutilus ohridanus* from Skadar Lake (n=20).**

Characters	Range	$\bar{x} \pm SE$	SD	CV
Branched (soft) rays of D	8-9	8.9±0.19	0.85	9.5
Branched (soft) rays of A	8-9	8.2±0.09	0.40	4.9
Branched (soft) rays of V	8	8		
Branched (soft) rays of P	14-16	15.1±0.26	1.16	7.7
Lateral line scales - I.I.	39-42	40.4±0.22	0.99	2.4
No. of scales above I.I.	7-8	7.7±0.09	0.44	5.7
No. of scales below I.I.	3-4	3.6±0.10	0.49	13.6
No. of gill rakers in ext.series	8-10	9.2±0.25	0.79	0.56
No. of gill rakers in int. series	14-16	15.2±0.25	0.79	0.56

**Table 3. Morphometrics data of *Rutilus ohridanus* from Ohrid Lake (n=27).**

Characters	Range	$\bar{x} \pm SE$	SD	CV
Body total length in mm	77.0-136.6	113.6±4.34	22.6	83.7
Standard length in mm	64.0-118.0	99.4±2.77	14.4	14.5
In % of standard length				
Total length	120.3-124.2	121.8±0.41	1.36	1.1
Length of Smitt	108.9-112.7	110.2±0.38	1.29	1.2
Body depth	26.7-31.7	28.5±0.46	1.53	0.1
Minimal body depth	9.3-10.7	10.0±0.44	0.47	4.6
Body width	13.2-17.0	15.1±0.41	1.36	9.0
Head depth at occiput	20.0-22.3	20.8±0.18	0.63	3.0
Head depth (at centre of eye)	13.8-17.3	15.1±0.29	0.99	6.5
Head length	25.1-27.4	26.3±0.22	0.75	2.8

Head width	13.3-15.3	14.3±0.21	0.72	5.0
Ante eye distance	6.0-8.3	7.0±0.26	0.89	12.6
Distance between the eyes	9.3-10.8	10.0±0.14	0.48	4.7
Diameter of eye	6.1-7.7	7.0±0.11	0.39	5.5
Post eye distance	12.0-13.3	12.5±0.13	0.45	3.6
Ante dorsal distance	52.0-55.0	53.7±0.28	0.96	1.8
Post dorsal distance	35.5-37.8	36.5±0.21	0.71	1.9
Ante ventral distance	48.8-56.2	50.4±0.60	2.02	4.0
Post ventral distance	48.4-54.0	51.8±0.59	1.98	3.8
Ante anal distance	70.7-73.7	71.6±0.29	0.98	1.4
Length of caudal peduncle	17.1-21.4	19.8±0.43	1.44	7.3
Length of base D	13.2-15.4	14.3±0.25	0.84	5.8
Depth of D	16.0-21.5	19.9±0.48	1.62	8.1
Length of caudal fin	20.3-23.4	21.9±0.29	0.97	4.4
Length of base A	9.1-10.9	9.7±0.16	0.54	5.5
Depth of A	11.2-15	13.2±0.33	1.11	8.4
Length of P	17.7-19.2	18.4±0.15	0.52	2.8
Length of V	15.9-17.9	17.1±0.15	0.53	3.1
Distance P-V	22.6-26.1	24.3±0.31	1.01	4.1
Distance P-A	45.0-49.2	47.2±0.37	1.23	2.6
Distance V-A	21.6-24.7	23.3±0.33	1.06	4.5
Distance A-C	20.6-31.6	29.7±1.12	3.72	12.5

**Table 4. Morphometrics data of *Rutilus ohridanus* from Skadar Lake (n=20).**

Characters	Range	$\bar{x} \pm SE$	SD	CV
Body total length in mm	107.4-219.4	153.1±8.0	35.8	2.3
Standard length in mm	88.5-184.3	128.7±6.9	31.3	2.4
in % of standard length				
Total length	115.5-122.8	119.3±0.42	1.91	1.6
Length of Smitt	107.5-112.1	108.7±0.22	1.01	0.9
Body depth	24.0-30.8	27.7±0.40	1.78	6.4
Minimal body depth	9.7-11.7	10.4±0.11	0.53	5.1
Body width	13.5-18.7	16.0±0.33	1.60	10.0
Head depth at occiput	18.3-21.4	19.4±0.17	0.77	3.9
Head depth (at centre of eye)	12.4-15.0	13.3±0.15	0.60	4.5
Head length	24.0-26.3	24.9±0.15	0.71	2.8
Head width	11.9-14.0	12.9±0.11	0.50	3.8
Ante eye distance	6.3-9.0	7.2±0.13	0.61	8.5

Distance between the eyes	9.3-10.3	9.8±0.08	0.38	3.8
Diameter of eye	5.2-6.8	6.5±0.13	0.62	9.5
Post eye distance	11.3-14.1	12.7±0.14	0.63	4.9
Ante dorsal distance	50.9-53.8	52.6±0.21	0.96	1.8
Post dorsal distance	36.2-39.2	37.5±0.18	0.81	2.2
Ante ventral distance	47.6-52.5	49.7±0.25	1.16	2.3
Post ventral distance	53.2-56.5	54.8±0.20	0.93	1.7
Ante anal distance	67.8-73.9	71.7±0.30	1.37	1.9
Length of caudal peduncle	19.2-22.2	20.7±0.20	0.92	4.4
Length of base D	12.7-17.0	14.4±0.21	0.95	6.6
Depth of D	18.9-21.7	20.7±0.19	0.86	4.1
Length of caudal fin	15.7-21.6	18.8±0.33	1.52	8.1
Length of base A	7.6-11.3	9.9±0.22	0.99	10.0
Depth of A	11.6-14.2	13.0±0.14	0.63	4.8
Length of P	16.0-18.6	17.5±0.14	0.65	3.7
Length of V	15.1-18.3	16.1±0.18	0.83	5.1
Distance P-V	23.5-27.9	25.3±0.26	1.18	4.6
Distance P-A	45.5-54.0	48.8±0.39	1.77	3.6
Distance V-A	22.0-26.8	23.7±0.27	1.23	5.2
Distance A-C	29.4-33.9	31.1±0.25	1.12	3.6

**Table 5. Morphometrics data two specimens of *Rutilus ohridanus* from Prespa Lake.**

Characters	1. specimen	2. specimen
Body total length in mm	186.1	215.7
Standard length in mm	158.3	184.0
In % standard length		
Total length	117.5	117.2
Length of Smitt	107.4	108.1
Body depth	29.8	28.1
Minimal body depth	10.1	10.0
Body width	15.9	15.5
Head depth at occipit	18.9	19.2
Head depth (at centre of eye)	12.6	13.0
Head length	24.6	24.8
Head width	12.9	13.1
Ante eye distance	8.3	7.6
Distance between the eyes	8.9	9.4
Diameter of eye	5.1	4.6

Posteye distance	12.6	13.5
Ante dorsal distance	53.5	51.2
Post dorsal distance	38.8	39.7
Ante ventral distance	50.5	49.4
Post ventral distance	51.8	50.5
Ante anal distance	72.9	71.8
Length of caudal peduncle	21.1	21.2
Length of base D	14.6	14.1
Depth of D	15.6	16.8
Length of caudal fin	18.9	17.9
Length of base A	10.3	8.5
Depth of A	11.5	10.8
Length of P	15.9	14.8
Length of V	15.8	15.2
Distance P-V	25.5	24.1
Distance P-A	49.1	48.5
Distance V-A	24.9	24.7
Distance A-C	30.7	29.5

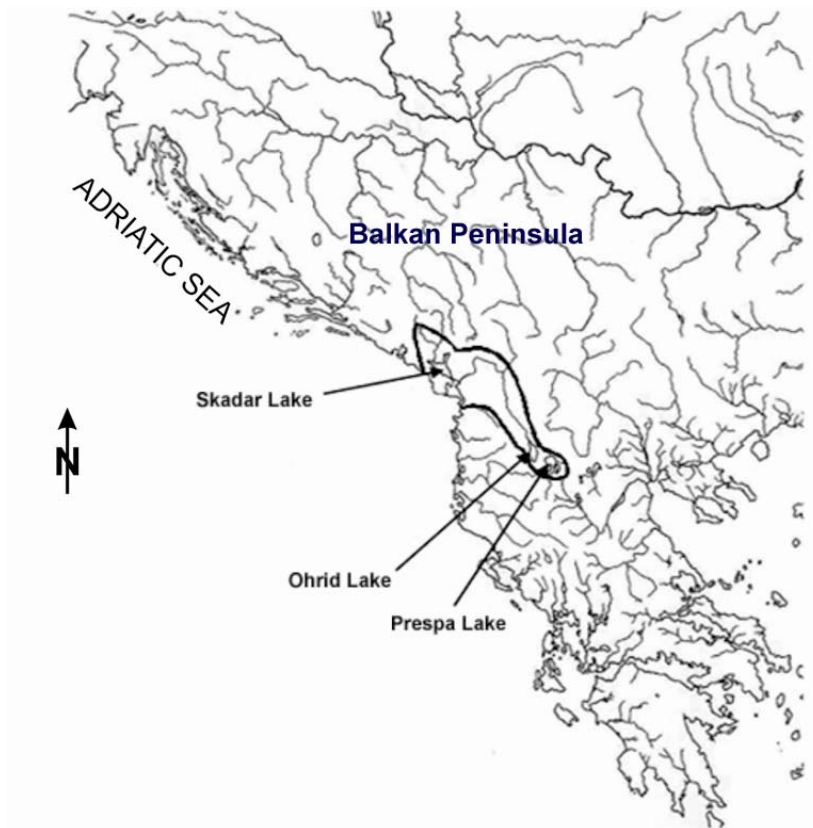
**Table 6. Meristic characters two specimens of *Rutilus ohridanus* from Prespa Lake.**

Characters	1 specimen	2. specimen
Branched (soft) rays of D	9	9
Branched (soft) rays of A	8	8
Branched (soft) rays of V	8	8
Branched (soft) rays of P	14	14
Lateral line scales - I.I.	42	42
No. of scales above I.I.	8	8
No. of scales below I.I.	3	4

**Table 7. Meristic data of *Rutilus ohridanus* from diferent locality.**

Locality	Characteristics							Auhtors
	D	A	P	V	C	L.L.	Vert.	
Prespa	9	8	16	8	19	38-40	38	Karaman 1924
	9	8	16	8		40-42		Marić 1989
	9	8 (9)	15 (14-16)	8	19	38-40	36-38	Rakaj 1995
	9	8	14	8		42		Original
Ohrid	10-11	8	16-17	8	19	44	42	Karaman1924
	8 (9)	(7) 8	14-15	8		37-38 (40)	-	Vladikov & Petti 1930
	8-9	7-8	14-16	8		37-40	-	Šorić 1983
	8-9	7-8	13-16	8		37-40		Original (Ohrid-town)
	8-9	8-9				37-40	36-38	Original (Podgradec)
Drim	7-9	7-8	13-17	6-8		36-42		Šorić, 1983
Skadar	8-9	8	12-14	8		37-42		Vuković & Ivanović, 1970
	8	8	-	-		36-43	33-38	Ivanović 1973 <sup>#</sup>
	8-9	7-10	14-17	7-8		36-44	-	Šorić 1983 <sup>#</sup>
	8-9	7-9	13-17	7-8		37-41	35-38	Marić 1989
	8-9	8-9	14-16	8		39-42	-	Original
Ohrid-Skadar	8-9	7 (8-10)		7-8		38-41 (43)		Poljakov et al. 1958
	9 1/2	8 1/2				36-41	37-38 (39)	Bogutskaya & Iliadou 2006

# Specimens possibly composed of two species ?



**Figure 1:**  
Map of natural  
distribution of *Rutilus  
ohridanus*

During the last several decades the prevailing opinion concerning the species *Rutilus rubilio* (Bonaparte, 1837) was that it is present in the drainage waters of the Adriatic and Ionian sea, with a number of subspecies or varieties. Bianco and Taraborelli (1985) stated that in waters of the Italian Peninsula exist two species (*Rutilus rubilio* and *Rutilus aula*) and in the waters of Central Dalmatia the species *Rutilus basak*. Several years later, Marić (1989) recorded that in Lake Skadar the two species exist sympatrically, that one of them is present in Prespa Lake and he assumed that they are both present in Lake Ohrid. Georgiev (1998) for Prespa and Ohrid Lake reports one species and that the same species was introduced into the Mavrovo reservoir. According to Rakaj (1995) in Prespa, Ohrid and Skadar Lake exists one species with three subspecies, but that the two of them are present in Ohrid and Skadar Lake (?).

In order to find out the number of species (or subspecies) in these lakes and define their taxonomic-systematic status, it is firstly necessary to know what Karaman (1924) found and described in Ohrid Lake. Than, it is necessary to know which species were found and described by later authors in this lake, as well as in the neighbouring ecosystems. There are many difficulties to overcome. Firstly, the specimens (12) on the basis of which Karaman (1924) gave the first description were lost (destroyed due to the counting of spinal vertebrae). The second problem is

Karaman's diagnosis of meristic characters which differs significantly from the subsequent investigations (Vladikov and Petit 1930, Poljakov et al. 1958, Šorić 1983). From his comparison with Prespa and Dalmatian population from the text it is obvious that there is a mistake in the diagnosis and that instead of 3/11 it should read 3/8-9. Bearing in mind the above mistake in diagnosis, than the discrepancies in values of other meristic characters in subsequent investigations with Karaman's diagnosis (Table 7), one may derive two conclusions. The first one is that the diagnosis mentioned is entirely the result of an error, and the other, that the difference in meristic characters is a consequence of different aprocah to their counting. Several authors, many years later (Rakaj, 1995; Georgijev, 1998) have repeated the erroneous values given by Karaman (1924), which resulted that Ohrid Lake population has a great variability of all characters. Finally, one of the problems is also the probability that earlier authors (prior to 1989), when analysing the morphological characteristics of *Rutilus* from Skadar Lake, treated the two *Rutilus* species together. This is especially indicated by the number of scales in lateral line (l.l.).

Field investigations and the morphological analysis of collected material from all the localities (Tables 1-6) show a great similarity from which one may conclude that they belong to a single species. Specimens analysed from Ohrid (Fig.2) Prespa (Fig. 3), and Skadar Lake (Fig. 4) have the same position of mouth (terminal), similar colour pattern, outer appearance, peritoneum colour, appearance of scales.

According to our results, two species of *Rutilus* coexist in Skadar Lake: *R. ohridanus* (reported by Marić, 1989 as *R. vukovici*) and another one (reported by same author as *R. basak ohridanus*) with sub terminal mouth and dark peritoneum, the characteristics differing it from the species described by Karaman (1924) in Ohrid Lake.

The population of *Rutilus* examined and described by Karaman (1924) in Ohrid Lake lives along the shore in the littoral. The specimens we examined from the locality City of Ohrid and Podgradec (Albania) were caught in shallow littoral, too.



Figure 2:  
*Rutilus ohridanus*  
from Ohrid Lake



**Figure 3:**  
*Rutilus  
ohridanus* from  
Skadar Lake

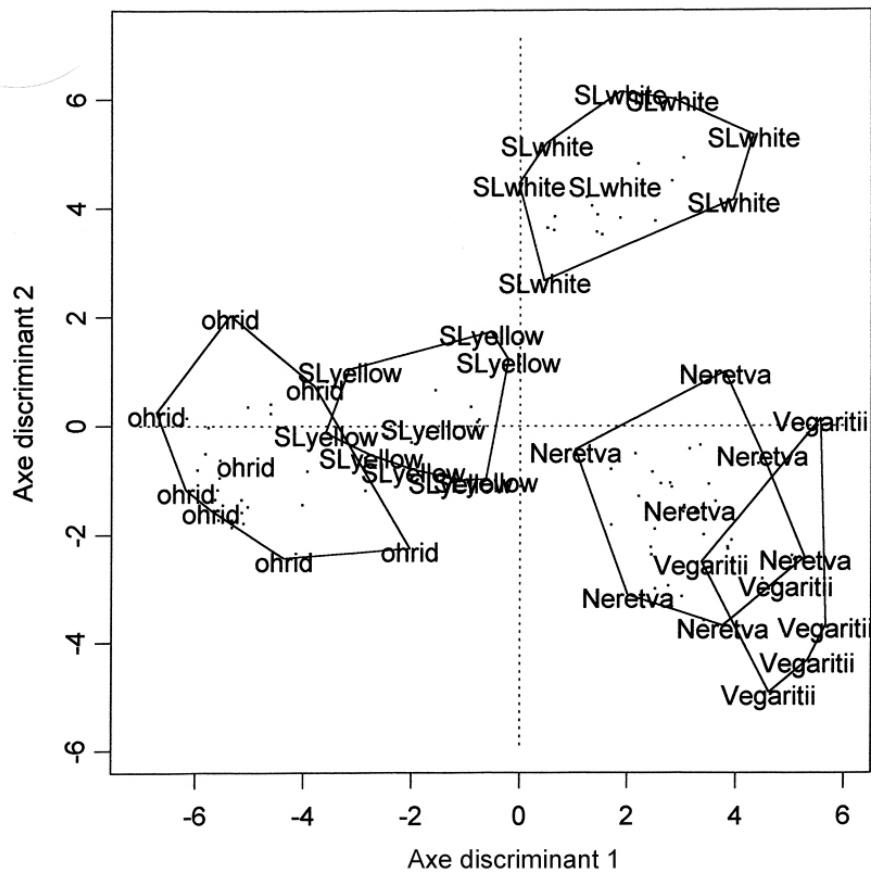


**Figure 4:**  
*Rutilus  
ohridanus* from  
Prespa Lake

All available original data lead to the conclusion that only one species of *Rutilus* lives in Ohrid Lake, *Rutilus ohridanus*. Accordingly, Bogutskaya and Iliadou (2006) made an error, too. These authors believe that both *R. karamani* and *R. ohridanus* coexist in Ohrid and Skadar Lake (erroneous identifications of specimens from Naturhistorisches Museum Wien - N° 50653). We are of the opinion that their data on *R. karamani* meristic characters correspond to those of *R. ohridanus*. Their data, from specimens of *R. ohridanus* originating from Skadar Lake, correspond to one undescribed species (Fig. 5, 6).



**Figure 5:**  
Undescribed  
species (White  
roach)



**Figure 6. Discriminant Analysis of morphometric characters**  
(soft rays D, A, P, V and scales I.I.) of five *Rutilus* spp.

**Legend:** **Ohrid** = *Rutilus ohridanus*, Ohrid Lake (n=27); **SLwhite** = *Rutilus* sp., Skadar Lake (n=20); **Neretva** = *Rutilus basak*, Neretva River (n=38); **Vegoritii** = *Rutilus* sp., Vegoritii Lake (n=6); **SLyellow** = *Rutilus ohridanus*, Skadar Lake (n=20).

On the basis of all data, (without Karaman's errors ?), the population of *Rutilus ohridanus* from Ohrid Lake has the following meristic characters: D. III 8-9, A III 7-9, V II 8, P I 12-16, I.I. 37-40, no. of branchiostephan 8-10/10-14, verteb. 36-38; and meristic characters of the species (from all studied localities) are: D. III 8-9, A III 7-9, V II 6-8, P I 12-16, I.I. 36-42, teeth 5-5, 4-5, 5-4, 6-5 (often 5-5), no of gill rakers 8-12/9-15, verteb. 35-38.

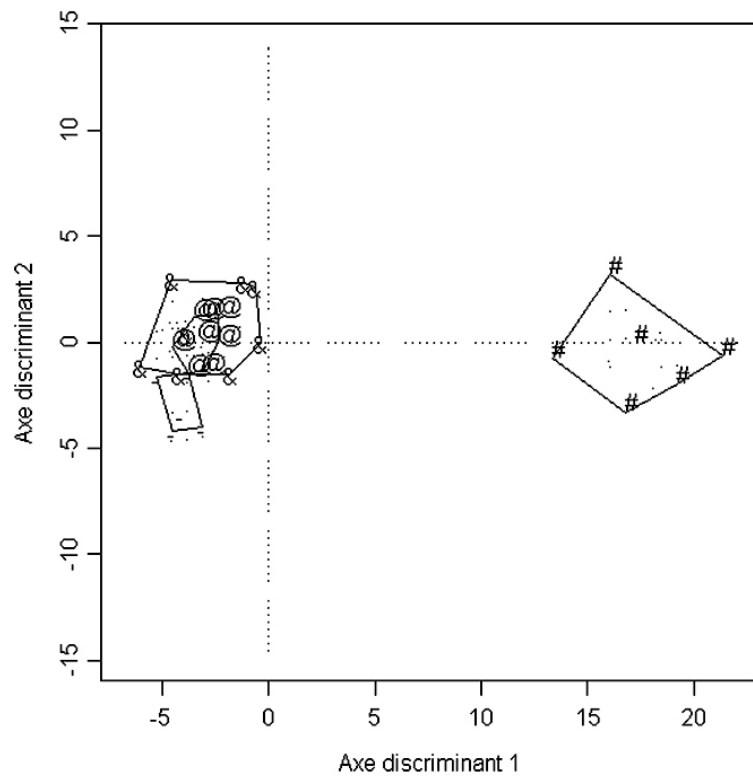
Also, from all these data it is obvious that certain morphological differences exist among the studied populations from Prespa, Ohrid and Skadar Lakes (Tab. 1-7, fig. 6, 7). In the past these populations, by some authors, were described as three subspecies under different names. Should such an approach be accepted, respectively the status, the subspecies from these lakes are:

*Rutilus ohridanus ohridanus* (Karaman, 1924) from Ohrid Lake

*Rutilus ohridanus prespensis* (Karaman, 1924) from Prespa Lake

*Rutilus ohridanus vukovici* Marić, 1989 from Skadar Lake drainage basin.

What is the level of the sub species, respectively populations, from these lakes it is to be established by future detailed investigations.



**Figure. 7. Discriminant Analysis of meristic character (soft rays D, A, P, V and scales I.I.) of *Rutilus ohridanus* from four different populations.**  
**Legend: & = Skadar Lake (n=20); @ = Šasko Lake (n=16); # = Ohrid Lake (n=27); - = Prespa Lake (n=6)**

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