

REDESCRIPTION AND SOME ECOLOGICAL CHARACTERISTICS OF *ALBURNUS ARBORELLA* (Bonapartae, 1844)

Vitko M. Šorić

*Faculty of Science, University of Kragujevac, P.O.Box 60,
34000 Kragujevac, Serbia and Montenegro*

(Received March 5, 2001)

ABSTRACT. The present diagnosis is based on the external morphological features in combination. The results of the analysing of ecological characteristics of *Alburnus arborella* (Bonapartae, 1844) are given in this study too.

INTRODUCTION

The fish species in question was described by Bonapartae (1841), under the name *Alburnus arborella* [Syn: *Alburnus alborella* De Filippi (1844), *Leuciscus albidus* Costa (1838), *Aspius alburnus* Bonaparte (1838-1841), *Alburnus scoranza* Bonaparte (1845), *Alburnus scoranza* Heckel and Kner (1858), *Alburnus alburnus Scoranza* Karaman (1924), *Alburnus alborella* Heckel and Kner (1957)] on the basis of specimens from Verbano (Lake Maggiore) and Lario (Lake Como) Italy. Syntypes: LU and NMW 55700 (2) from Scutari Lake (Montenegro and Albania). The same synonyms were used by many other authors who researched morphological and ecological characteristics of this species (Ivanović, 1968, 1973; Vuković, 1968; Tortonese, 1970; Dimovski and Grupče (1971); Kažić and Pulević, 1978; Šorić, 1982, 1990; Bianco and Baldoni, 1989; Bianco, 1995; Marić, 1995; and others). This species is also registered in Balkan Peninsula, and therefore it is also called peninsula bleak

MATERIAL AND METHOD

The material is analysed by usual methods (Holčik, 1998) based on meristic characters: unbranched and branched rays of unpaired and paired fins (Du, Db, Au Ab, Vu, Vb, Pu, Pb) scales in lateral line (ll), scales rows above (Squ. sup.) and below lateral line (squ.inf.), branchials spines (Sp. br.), Vertebrae (Vert.) and pharyngeal teeth (D. ph). The next morphometric characters were analysed: Tl – total length, Sl – standard length, lc – length of head, hc – depth of head, H – maximum of body depth, h – minimum of body depth, lpc- length of caudal peduncle, length unpaired (lD, lA) and paired fins (lV, lP), depth fins (hD, hA), prO – preorbital distance, poO – postorbital distance, io – interorbital distance and Oh – diameter of oculi.

The analysis of some ecological characteristics (habitat, feeding habits, growth populations dynamics and reproductive biology) is made on the specimens from Skadar Lake (Montenegro) and Beli Drim (Serbia). Material was fixed in 8% solution of formaldehyde and deposited in the collection of Institute of Biology on the Faculty of Science at Kragujevac

RESULTS AND DISCUSSION

Description

Du (II) III (IV), Db 7-9, Au (II) III, Ab 10-17, Vu II, Vb 7-8, Pu I, Pb 13-17, Squ. sup. 7-11, ll 42-56, Squ. inf. 3-4 (5), Sp. br. 17-25, Vert. 37-45, D. ph. 2.5 – 5.2 (4.2, 5.3). Body is elongate, laterally compressed, with maximal length 160 to 180mm, rarely 200mm. Along the body side is stretched dark-brown line. Mouth superior a horizontal line from the lip of premaxillary reaches the upper part of eye. These data were compiled from Tortoneze (1970), Karaman (1924, 1928), Oliva (1950), Poljakov *et al.* (1958), Dimovski and Grupče (1971), Ivanović (1973), Šorić (1980, 1990 and data from this study), Rakaj (1995).

Meristic characters in populations of this species from different localities essentially are not different (Tab. 1). The biggest number of specimens has got 49 to 52 (77%) scales in ll, with usual 8 to 9 (80%) horizontal scales rows above and 3 to 4 (95%) scales rows below. Dorsal fin with 8 (82%) and anal fin 13 to 14 (85%) branched rays. The first gill arch has 17 to 22 branchial spines in specimens from typical oligotrophic Ohrid Lake, 17 to 23 in Beli Drim, and 21 to 25 in specific carst Skadar Lake. Number of vertebrae in largest specimens varies from 38 to 42.

The morphometric characters of populations from Ohrid – Drim – Skadar basin demonstrate considerably variable. The length of head amounts from 18.6 to 24.6% of Sl. Diametar oculi is 21.4 to 31.7% of cl. Greater body depth 17.8 to 22.5% and minimum body depth 6.5 to 9.8% of Sl. Dept of anal fin 9.6 to 14.8% of standard length. Detailed morphometric characters are given in Tab. 2.

Table 1. Meristic characters of *Alburnus alborella* from various localities

Character	Locality					
	Po river system		Ohrid Lake			
	Ranges	Ranges	Ranges	Ranges	\bar{x}	Ranges
Du	3 ¹⁾	3 ²⁾	3 ³⁾	3-4 ⁴⁾		3 ⁵⁾
Db	7-8	8	8	8-9	7.97	7-8
Au	3	3	3	2-3		3
Ab	13-17	13-14	12-15	11-14	13.24	12-15
Vu		2	2	2		2
Vb		8	7-8	7-8	7.95	7-8
Pu		1	1			1
Pb		15-16	13-15		15.09	14-17
ll	42-51	46-50	48-52		50.68	47-55
Squ. sup.	7-9	8-9	8-9		8.81	7-10
Squ. inf.	3-4	3	3-4		3.16	3-4
Vert.	37-41	-			-	-
Sp. br.	-	-			19.92	17-22

Table 1 (cont.)

Character	Locality						
	Skadar Lake			Beli Drim			
	\bar{x}	Ranges	\bar{x}	Ranges	Ranges	\bar{x}	Ranges
Du		3 ⁶⁾		3 ⁷⁾	2 ⁸⁾		3 ⁷⁾
Db	7.98	7-8	8.03	8-9	8-9	7.98	7-9
Au		3		3	3		3
Ab	13.6	12-15	13.70	11-16	14-15	13.42	10-17
Vb					8		
Pu					1		
Pb					14-15		
LI	50.3	45-56	49.34	46-54	51-52	49.69	49-56
Squ. sup.	8.8	8-9	9.72	9-11		9.81	8-11
Squ. inf.		3	3.95	3-5		4.11	3-5
Sp. br.				21-25			17-23
Vert.	39.83	38-42	40.39	39-42	44-45	40.82	39-42
D.ph.	5.2-2.5				5.2-2.5 (4.2, 5.3)		5.2-2.5

¹⁾ Tortonese 1970; ²⁾ Karaman 1924; ³⁾ Oliva 1950; ⁴⁾ Poljakov et al. 1958; ⁵⁾ Dimovski and Grupče 1971; ⁶⁾ Ivanović 1973; ⁷⁾ Šorić 1980, 1990 and data of this study; ⁸⁾ Rakaj 1995

Karyotype

$2n = 50$, with 19 couples mostly metacentric and submetacentric. Except it exist two more chromosomes (one metacentric and one submetacentric) which morphology do not belongs neither one of couples (Fontana *et al.*, 1970)

The females are generally larger than males. Mature females, in contrast to males have length distance between pectoral fin base and ventral fin base. In remaining proportions body of males and females do not show essential distinction.

The morphometric proportions of population from Ohrid Lake in considerably measurement are different from the same in populations from Skadar Lake and Beli Drim. Samples from Ohrid Lake have great proportions of body and head, while their absolute length is less than of specimens from Skadar Lake and Beli Drim. Samples from Beli Drim in contrast to the samples from Skadar Lake have larger longitudo capitis, diameter oculi, depth D and A fin and length P fins, but the maximum body depth, P-V and post ocular distance are greater in samples from Skadar Lake.

Some proportions of body show positive, respectively negative allometric growth with the body size and years old. Thus cl , Oh , hD , IP and IC show tend to decrease with increase of body length, while H , h , ch , prO , poO and io increase with body size.

The large number of hybrids has been registered between *A. arborella* and others Cyprinids. Neretva river is recognized by the natural hybrid *Rutilus rubilio* x *Alburnus alburnus arborella* (Luković, 1968). There is artificial hybrid *Pachychilon pictum* x *Alburnus alburnus arborella*, which lives only 40 days (Guzina *et al.*, 1979). Bianco and Baldoni (1989) have identified hybrid *Alburnus a. arborella* x *Leuciscus cephalus* in Esino River.

Distribution

Peninsula bleak distribution in Adriatic basin is represented on Fig. 1. Inhabited are Po river system to Isonca (Italy), Soča and Mirna rivers (Slovenia), Zrmanja river (Dalmatia, Croatia), Narentana river with tributaries (Bosna and Hercegovina), Skadar Lake, Morača river, Zeta river, Cijevna river, Šaško Lake (Montenegro), Beli Drim and its tributaries (Metohia, Serbia), Drim River, Ohrid Lake, Globočica Lake (Macedonia and

Albania). (Bianco, 1987; Knežević, 1984; Karaman, 1924-1928; Ivanović, 1968; Dimovski and Grupče, 1971; Povež *et al.*, 1990; Šorić, 1990; Rakaj, 1995).

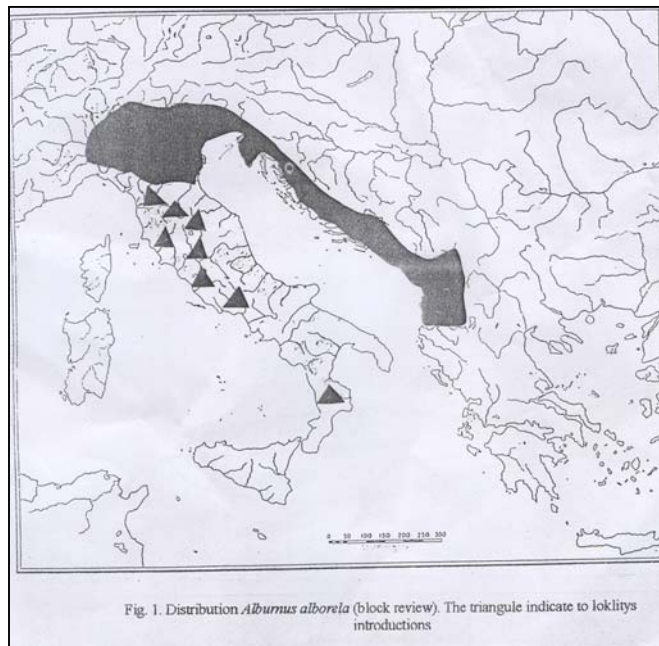


Figure 1. Distribution of *Alburnus arborella* (block review).
The triangles indicate localities of introductions

Table 2. Some morphometric characteristics of *Alburnus arborella*

Character	Locality					
	Ohrid Lake (n = 100)		Skadar Lake (n = 100)		Beli Drim (n = 100)	
	\bar{x}	Ranges	\bar{x}	Ranges	\bar{x}	Ranges
Tl (mm)		98.0-150.0		120.0-150.0		120.0-150.0
Sl (mm)	105.7		112.0		118.0	
In % of Sl						
cl	22.95	21.2-24.6	19.59	18.7-22.3	20.19	18.6-22.3
H	20.15	17.8-23.9	21.56	18.5-22.5	20.02	16.4-22.1
h	8.97	8.1-9.8	7.69	6.5-8.5	7.74	6.8-8.9
Lpc	21.24	18.6-23.7	18.90	17.0-21.2	18.52	15.8-22.5
PV	22.86	20.2-25.8	17.17	14.6-19.6	16.70	13.8-18.6
ID	10.51	8.6-12.0	8.78	7.6-10.0	9.09	7.6-10.4
hD	17.31	15.3-18.9	14.39	13.0-15.6	15.16	13.6-17.8
IA	15.87	13.9-17.7	12.68	11.1-14.2	12.70	9.4-15.4
hA	13.09	11.0-14.8	11.44	9.6-11.8	12.00	10.5-13.4
IP	18.62	16.7-22.2	15.20	14.4-18.6	16.03	14.2-18.6
IV	14.25	12.4-15.5				
In % of cl						
hc	68.36	61.2-74.2	65.60	59.2-74.1	65.78	59.3-73.1
prO	31.40	28.3-33.9	28.25	25.9-32.1	28.82	25.0-33.3
poO	48.18	44.6-51.9	45.83	45.8-51.8	45.68	39.3-50.0
Io	31.66	27.5-34.6	31.0	25.9-35.4	32.06	26.9-38.5
Oh	29.15	25.4-31.7	23.60	21.4-25.9	25.38	21.4-28.6
Authors	Dimovski & Grupče (1971)			Šorić (1980) and data of this study		

The peninsula bleak is introduced in some waters of middle and southern Italy (Bianco, 1987). (Fig. 1)

Ecology

The peninsula bleak is reophilic and limnophilic fish, which inhabits both, the lakes' littoral as well as middle and lower zone of rivers.

Detailed information of the migrations is unknown, except the fact that in the spring this fish migrates to the spawning places, and disperse in the lakes and rivers for intensive feeding. In Skadar Lake this fish always in wintertime migrates in large schools into the sublacustrine springs where it could be easily caught by fishing nets. (Ivanović, 1968)

Nutrition of the larvae and young fish consists from the Rotatoria (*Trihocerca* sp., *Brachionus* sp. and other) which are present in water in great quantity, while Cladocera especially *Bosmina* sp., copepods *Cyclops* sp. are less numerous. From the algae *Desmidiaceae* (*Cosmarium* sp.), *Chlorophyceae*, *Cyanophyceae* and *Diatomeae* are dominant. In older fish feeding *Cladocera* and *Copepoda* are dominant in the spring and summer, while the animal component of bottom they take in March. (Točko, 1987; Ivanović, 1968)

The maximum age reported is five years (Ivanović, 1971; Šorić, 1980; Vitali and Braghieri, 1981). The body's growth in different waters is shown in Tab. 3. The absolute lengths and weights in Beli Drim and Skadar Lake are larger than in the course of Po River, and Ohrid and Globočica lakes. This could be explained by the fact that Ohrid and Globočica lakes are typical oligotrophyc. With slight differences among localities this fish attains about 50% of the body in first year. In the middle course of Po river females in contrast to males have tendency to conceal later 2+ years (Vitali and Braghieri, 1981).

Table 3. The results of the growth in length and weight of *Alburnus arborella*

The direct measured total body length and weight									
Age	Locality								
	Po river¹⁾		Beli Drim²⁾		Ohrid Lake³⁾		Skadar Lake³⁾		Ohrid Lake⁵⁾
	L (mm)	W (g)	L (mm)	L (mm)	W (g)	L (mm)	W (g)	W (g)	W (g)
0 ⁺	51.20	1.01				112.0	16.0		
1 ⁺	67.09	2.35	90.95	10.0	10.7	122.2	20.9		
2 ⁺	90.34	6.36	128.47	113.0	16.4	133.0	27.5	9.5	9.9
3 ⁺	102.35	9.80	153.77	126.0	22.6	152.0	42.7	14.2	13.0
4 ⁺	116.67	15.49	171.80					17.7	17.8

Tab. 3 (cont)

Calculated body growth for previous years of life								
Years		1	2	3	4	5	longW=long a+b long l	
Beli Drim²⁾	Tl (mm)	85.83	125.83	151.35	169.20		a	b
	W (g)	4.05	16.24	34.71	52.95			
Skadar Lake⁴⁾	Tl (mm)	68.8	113.5	144.6	168.0			
Skadar Lake³⁾	Tl (mm)	89.0	110.0	125.0				
Ohrid Lake³⁾	Tl (mm)	63.0	83.0	93.0				
Ohrid Lake⁵⁾	Tl (mm)	42.0	77.0	110.0	117.0			
Globočica Lk⁵⁾	Tl (mm)	40.04	79.3	93.7	103.3	110.0		
Beli Drim²⁾							3.78494	- 2.92565

¹⁾Vitali and Braghieri (1981); ²⁾Šorić (1982); ³⁾Jovanović (1972); ⁴⁾Ivanović (1968); ⁵⁾Točko (1975)

In the middle course of Po river females are dominate over males in number - 785 (57.92%) females and 574 (42.08%) males. In this locality predominate exemplars in first year of age; two to four years old fishes are rare. Also in Skadar Lake the number of older fishes is small. Females in 1⁺ and 2⁺ years classis are numerous, while in 3⁺ to 4⁺ classes males are in majority (Ivanović, 1968; Vitali and Baghieri, 1981; Rakaj, 1995).

Sexual differentiation begins when fishes are two months old and they achieve sexual maturity at the end of first year (Ivanović, 1968).

Peninsula bleak first sexual maturity reaches at the end of the first year, while large maturity in second year. Ivanović (1968) is established that ovaries in May attain to 6g and testis to 2g. However Ivanović (1968) concluded males fecundity $1^+ \bar{x} = 2.412$, $2^+ \bar{x} = 6.432$, $3^+ \bar{x} = 8.274$ and $4^+ \bar{x} = 10.122$ eggs. Maturation of the eggs is asynchronous. Size of mature eggs varies from 0.9 to 1.7mm, and of fertilized is 5.4 x 5.4 mm.

This fish spawning occurs in spring, from March to July, at temperatures of 17 to 23°C in Skadar Lake, and in April to May in Beli Drim. The spawning period in Ohrid Lake begins in the second half of May and last until the middle of August. Eggs depositing is in 2 to 3 portions (Ivanović, 1968, Točko, 1987, Rakaj, 1995).

The females in Skadar Lake deposit the eggs on sand, gravel and rocky bottom, at a depth of about 30cm, rarely 1.5m. In the Ohrid Lake they deposit the eggs on muddy bottom and hidden sites (but less on the gravel), at a depth of 0 to 3m. (Ivanović, 1968, Točko, 1987). In Skadar Lake the fertilized eggs are about 5.4mm in diameter and are adhesive. Hatching occurs within 106 hours at water temperatures of 18 to 22°C. In Ohrid Lake fertilized eggs developed faster at the temperatures 18 to 20°C and the process of furrowing and gastrulation ends during the first day after fertilization. The larval stage of this fish lasts until the end of the second month after fertilization, when the length of the body is 15 to 19mm (Ivanović, 1968, Točko, 1987).

Important parasites and diseases

Kažić and Pulević (1978) write of negative influence cestodes, nematodes and trematodes. In *Cestoda* dominate: *Caryophyllaeides fennica*, *Lingula intestinalis*, *Proteocephalus* sp., *Cystileros paradilepis*. In *Nematoda*: *Raphidascaris* sp., *Contracaecum squalii* and *Rhabdochona denudata*, while in *Trematoda* dominate: *Croweroacaecum skrjabeni*, *Allocreadium isoporum*, *Phyllodistomum elongatum*, *Catoptroides angulatus*, *Asymphylogora markewitschi*, *A. tincae* and *Pseudochetosoma salmonicola*.

Economic importance

Alburnus arborella has got economic importance, because it can be canned. Local inhabitants use it as fresh and dried.

References

- [1] Bianco, G. P., (1987): Damage caused by man induced changes from the zoogeographic frame of Italian freshwater fishes. – *Biol. e gestione del' ittiofauna autoctona. Atti Il Conv. Alad*, 41–65 pp.
- [2] Bianco, G. P., (1991): Sui pesci d'acqua dolce del fiume Esino (Marche, Italia centrale Atti della Societa Italiana di Sciere Naturali a del Museo Covico di Storia Naturale di Milano **132**: 49-60.

- [3] Bianco, G. P. (1995): Mediterranean endemic freshwater fishes of Italy. *Biol. conserv.* **72** (2): 159-170.
- [4] Bonaparte, C. L. (1841): *Aspius alburnus* (*Aspius alborella*). – In *Iconografia della fauna italica. Pesci*, Salvucci, Roma **3**: 1832-1941.
- [5] Costa, O. G., (1829-1850): *Fauna del regno di Napoli. Pesci, parte prima*. Azolino, Napoli.
- [6] De Filippi, F., (1844): Pesci finora osservati in Lombardia. – In *Notizie naturali e civili in Lombardia*, Milano, **1**: 839 – 406.
- [7] Dimovski, S. A. and Grupče, K. R. (1971): Sur quelques problèmes de la Systemique chez les ablettes (*Alburnus*) de Macédoine. *Mus.Maced. Sci. nat.* **12** (4): 61-76 (in Macedonian).
- [8] Heckel, J. and Kner, R., (1958): *Die Süswasserfische der Österreichischen Monarchie*, Leipzig.
- [9] Holčík, J. (1998): List of symbols and abbreviations. In: Ed. Juraj Holčík: The Freshwaters Fishes of Europe. AULA-Verlag, Wiesbaden. Vol. 1, Part II: 15-17.
- [10] Ivanović, M. B., (1968): Ecology *Alburnus alburnus alborella* (Filippi). *God. Biol. Inst. Sarajevo* **20**: 5-69. (In Serbocroatian)
- [11] Ivanović, M. B., (1973): Ichthyofauna of Skadar Lake. *Biol. Station*, Titograd, 100-102 pp.
- [12] Jovanović, V., 1972 (1973): The rate of individual growth in bleak (*Alburnus* sp.) in the lakes of Ohrid, Prespa, Doyran and Skutari. *Glas rep. Zavod – prirod. Muz.*, **5**: 115-125.
- [13] Karaman, S., (1924): *Pisces Macedoniae*. Split.
- [14] Karaman, S., (1928): Beiträge zur ichthyologi von Jugoslawien. *Glasnik skopskog naučnog društva*, **6**: 152.
- [15] Kažić, D., Pulević, R., (1978): Contribution to know invasion bleak (*A. a. alborella* Filippi 1884) trematodes in genus *Phyllodistomum* in Skadar Lake. *Zavod za zaštitu prirode – Muz. Titograd.* **1**: 31-45 (In Serbocroatian)
- [16] Kottelat, M. and P.G. Bianco, (2005): On the valid name of the alborella, *Alburnus arborella* (Teleostei: Cyprinidae). *Ichthyol. Explor. Freshwat.* **16**(2):179-182.
- [17] Marić, D. (1995): Endemic fishes of Montenegro. *Biol. conserve.* **72**: 187-194.
- [18] Oliva, O., (1950): Notes on Collection Fisches obtained by Professor J. Comarek in Macédoine. *Vest. Č. S. Zool. Spol.* **14**: 229-269.
- [19] Poljakov, G. D., Filippi, N. D. and Kozma Basho, (1958): *Peshquit e Shoiprise. Universiteit Shteteror i Tirans*, Tirana.
- [20] Povež, M., Leiner, S., Mraković, M. and Popović, J. (1990): Rare and endangered fishes from Yugoslavian Adriatic rivers. *Journal of Fish Biology*, **37** (A): 247-149.
- [21] Rakaj, N., (1995): Iktiofauna e Shqipërisë. *Libery Universitar, Tirana*, 241 – 264 pp.
- [22] Točko, M., (1987): Development and nutrition of the Young Cyprinids of Lake Ohrid. *Hydrob. Institute Ohrid*, **1**: 43-47, 105-107.

- [23] Tortonese, E., (1970): *Fauna D' Italia; Osteichthyes*. Calderoni, Bologna, **10**: 262-264.
- [24] Šorić, M.V., (1980): Comparative analysis of the morphological characters in *Alburnus alburnus alborella* (De Filippi, 1844) from the Beli Drim and Lake Skadar. *Collection of Scientific papers of the faculty of Sci. Kragujevac*, **1**: 171-180 (In Serbocroatian).
- [25] Šorić, M. V., (1982): Growth of bleak – *Alburnus alburnus alborella*. *Coll of Sci. pap. of the Faculty of Sci. Kragujvac* **3**: 155-163 (In Serbocroatian).
- [26] Šorić, M. V., (1990): Ichthyofauna of the Ohrid – Drim – Skadar system. *Ichthyologia*, **22 (1)**: 31 – 43.
- [27] Vitali, R. and Braghieri, L., (1981): Caratteristiche strutturali e Dinamiche del popolamento ittico del medio Po nela zona de caorso. *Riv. Idrobiol.*, **20 (1)**: 269-299.
- [28] Vuković, T., (1968): A finding of the hybrid *Rutilus rubilio* (Bonaparte) x *Alburnus alburnus alborella* (Filippi) in the drainage bassin of the river Neretva. *Wissenschaft. Mitt. des Bosna and Hercegovina*, **1**: 243-298.