Journal of Applied Ichthyology

J. Appl. Ichthyol. 27 (2011), 1031–1032

ISSN 0175–8659

Received: June 25, 2010
Accepted: November 5, 2010
doi: 10.1111/j.1439-0426.2011.01741.x

Short communication

Meristic and morphometric characteristics of endemic Neretva chub, *Squalius svallize* from the Neretva River area, Bosnia and Herzegovina

By P. Ivanković[1], M. Piria[2], T. Treer[2] and Z. Knezović[1]

[1]*Faculty of Agriculture, University of Mostar, Mostar, Bosnia and Herzegovina;* [2]*Department of Fisheries, Beekeeping and Special Zoology, Faculty of Agriculture, University of Zagreb, Zagreb, Croatia*

Introduction

The Neretva chub, *Squalius svallize* (Heckel & Kner, 1858) is an endemic species, which according to Kottelat and Freyhof (2007) lives only in the Neretva, Trebišnjica and Ljuta drainages of the Adriatic basin in Croatia and Bosnia and Herzegovina. A few papers cover its basic biology (Kaćanski et al., 1977; Ivanković et al., 2010), whereas data on its morphology are limited. The older key for determination of fish species from the former Yugoslavia is presented primarily by the number of rays in fins and scales in the lateral line (Vuković and Ivanović, 1971). Kottelat and Freyhof (2007) presented some additional data, which are also given in FishBase (Froese and Pauly, 2010). Doadrio and Carmona (2006) in their extensive work on the genus *Squalius* stated that *S. svallize* belongs to species that 'have hardly been studied.' Dominant food items of the specimens presented were insect larvae and gastropods, maximal asymptotic length was 35.3 cm, cubic condition factor 0.98 and *b* value of length-weight relationship 3.47 (Ivanković, 2010). Thus, the aim of the present work was to provide more detailed information on the morphology of the Neretva chub.

Materials and methods

Altogether 60 specimens were caught by anchored gill nets (28–72 mm) from Lake Deran and the rivers Bregava and Krupa, all from the Neretva River area. All locations were studied seasonally (October 2006; February, May and August 2007). Total length range of the fish was between 15.6 and 28.0 cm, while age varied between 3 and 7 years. The fish were measured for 23 body lengths (including gut lengths) to the nearest 0.1 cm. Lengths on the head are counted in percent of head length, while others in percent of total length. Furthermore, the number of spines (unforked rays) and branched (forked) rays in dorsal, anal and pectoral fins were counted, together with the number of scales on, above and below the lateral line. All data were analyzed for sexes combined.

Results

Morphometric and meristic characteristics of Neretva chub are presented in Table 1. The morphometric characteristics on the head express greater variation (SD between 4.15 and 6.84) than those from the body (SD between 0.61 and 2.97). As expected, the meristic features that have much greater heritabilities (Tave, 1993) are very stabile (SD between 0.00 and 0.66). Although the values of correlation coefficient *r* vary between 0.684 (minimum body width) and 0.989 (fork length), they are all strongly significant ($P < 0.01$).

Discussion

The distribution and taxonomic status of *S. svallize* is still not completely defined (Mrakovčić et al., 2006). Some data mention the presence of this species as far north as Istria in Croatia (Leiner, 1984; Mrakovčić et al., 2006) and as far south as western Greece (Economou et al., 1991; Bobori et al., 2006). However, it has only been recently confirmed in a restricted area of the Neretva River and in the drainages of two small rivers to the south (Kottelat and Freyhof, 2007). Leiner and Popović (1984) studied comparative geological and ichthyological data and confirmed earlier findings that many fish species in the karst of Dalmatia and Bosnia and Herzegovina (including *S. svallize*) spend part of their lives in underground waters, thus shifting from one river to another. Consequently, it could also be expected to find *S. svallize* sporadically in some other rivers as well.

Most of the characteristic values from this research (e.g. number of scales in the lateral line and soft rays in the anal fin) fit into limited existing data (Vuković and Ivanović, 1971; Kottelat and Freyhof, 2007). However, the variation obtained in the number of scales in the lateral line (47–49) is much narrower than that (44–51) of Kottelat and Freyhof (2007), while adequately corresponding to the data (48–49) presented by Vuković and Ivanović (1971). The maximum total length of fish caught (28 cm) is also significantly higher than those presented from these two sources and by Muus and Dahlström (1968), particularly considering its predicted maximal length of 35 cm according to the von Bertalanffy growth function (Ivanković, 2010). The correlation analysis (Table 1) shows that all morphometric traits change proportionally with the growth of the total length between 15.6 and 28.0 cm.

The extensive investigations of *Squalius* species stress small morphological variability among them. The multivariate analysis of *S. cephalus* by Turan et al. (2007) showed no morphological differentiation of samples from all over Turkey, and hence, complete lack of clearly defined, discrete taxa within this species. Doadrio and Carmona (2006) stated that the absence of high variability in the principal meristic characteristics used in taxonomic studies has hindered an accurate estimation of the true diversity of the *Squalius* genus on the Iberian Peninsula. Only molecular approaches applied

Table 1
Morphometric and meristic characters of *S. svallize* from the Neretva River area and correlation (r) of morphometric traits with total lengths between 15.6 and 28.0 cm

Variable	$\bar{x} \pm$ SD	Min	Max	r
In % of total length				
Standard length	84.91 ± 2.54	77.42	90.50	0.980**
Fork length	92.79 ± 2.13	88.76	96.89	0.989**
Preanal distance	60.35 ± 1.84	56.26	71.94	0.986**
Length of base of anal fin	7.63 ± 1.10	3.70	10.52	0.988**
Height of ventral fin	11.02 ± 0.93	8.33	13.08	0.980**
Preventral distance	42.79 ± 2.85	38.55	56.33	0.945**
Length of base of pelvic fin	2.55 ± 0.61	1.27	3.68	0.952**
Predorsal distance	44.72 ± 1.81	41.95	47.94	0.978**
Length of base of dorsal fin	9.52 ± 0.80	8.33	11.46	0.988**
Height of dorsal fin	16.17 ± 2.97	10.90	23.97	0.706**
Prepectoral length	19.92 ± 0.98	17.31	22.05	0.959**
Length of base of pectoral fin	2.23 ± 0.75	1.01	3.96	0.952**
Caudal peduncle length	17.04 ± 2.19	10.75	24.91	0.980**
Maximum body height	21.01 ± 1.20	18.18	23.97	0.977**
Minimum body height	9.15 ± 0.61	8.06	11.18	0.923**
Maximum body width	16.17 ± 2.97	10.90	23.97	0.936**
Minimum body width	5.37 ± 0.85	3.53	7.47	0.684**
Head length	15.43 ± 1.11	12.82	18.00	0.920**
Gut length	103.00 ± 9.00	82.00	130.00	0.830**
In % of head length				
Head height	86.27 ± 6.84	71.88	104.55	0.962**
Preorbital length	43.52 ± 6.32	31.43	63.33	0.807**
Eye diameter horizontal	26.36 ± 4.38	13.33	38.10	0.882**
Interorbital distance	57.23 ± 4.15	45.16	65.22	0.960**
Number				
Soft rays in dorsal fin	9.70 ± 0.50	8	10	–
Spines in dorsal fin	3.05 ± 0.22	3	4	–
Soft rays in anal fin	10.55 ± 0.53	9	11	–
Spines in anal fin	3.00	3	3	–
Soft rays in pectoral fin	16.22 ± 0.42	16	17	–
Spines in pectoral fin	1.00	1	1	–
Scales in lateral line	48.07 ± 0.66	47	49	–
Scales above lateral line	7.92 ± 0.28	7	8	–
Scales below lateral line	3.13 ± 0.34	3	4	–

**$P < 0.01$

parallel to morphological analyses showed the diversity, even enabling the find of new species. Thus, such an approach would be necessary for a thorough study of the *Squalius* species in Mediterranean Croatia as well as Bosnia and Herzegovina.

Acknowledgements

We are very grateful to Prof. Dr. H. Rosenthal and other referees for their help and critiques in the preparation of the manuscript.

References

Bobori, D. C.; Tsikliras, A. C.; Economidis, N. I., 2006: Some morphological and biological characteristics of fishes from Tavropos reservoir (western Greece). Folia Zool. **55**, 199–210.

Doadrio, I.; Carmona, J. A., 2006: Phylogenetic overview of the genus *Squalius* (Actinopterygii, Cyprinidae) in the Iberian Peninsula, with description of two new species. Cybium **30**, 199–214.

Economou, A. N.; Daoulas, Ch.; Economidis, P., 1991: Observations on the biology of *Leuciscus* 'svallize' in the Kremasta reservoir (Greece). Hydrobiologia **213**, 99–111.

R. Froese and D. Pauly (Eds). 2010: FishBase. Available at: http://www.fishbase.org (accessed on 15 October 2010).

Ivanković, P.; Treer, T.; Piria, M.; Knezović, Z., 2010: Diet and growth of endemic Neretva chub, *Squalius svallize* from the Neretva river area, Bosnia and Herzegovina. Folia Zool. **59**, 51–56.

Kaćanski, D.; Kosorić, Đ; Čepić, V., 1977: On nutrition of some fish species in the Neretva river confluence (from Ulog to Mostar). Ichthyologia **9**, 31–45. (in Croatian with English summary)

Kottelat, M.; Freyhof, J., 2007: Handbook of European freshwater fishes. Kottelat, Cornol, Switzerland and Freyhof, Berlin, Germany. 646 pp.

Leiner, S., 1984: Preliminary investigations of freshwater ichthyofauna of Istria (Preliminarna istraživanja ihtiofaune kopnenih voda Istre). 3rd Congress of Ecologists of Yugoslavia, Book 2, Sarajevo. (in Croatian).

Leiner, S.; Popović, J., 1984: Genus Leuciscus (Cyprinidae, Pisces) in waters of the Adriatic river basin regarding the L. svallize find (Heckel & Kner, 1858) and L. souffia Risso, 1826 in Cetina / Rod Leuciscus (Cyprinidae, Pisces) u vodama Jadranskog sliva s osvrtom na nalaz L. svallize (Heckel & Kner, 1858) i L. souffia Risso, 1826 u Cetini / . Ichthyologia **16**, 111–120 (in Croatian with English summary).

Mrakovčić, M.; Brigić, A.; Buj, I.; Ćaleta, M.; Mustafić, P.; Zanella, D., 2006: Red book of freshwater fish of Croatia (Crvena knjiga slatkovodnih riba Hrvatske). Ministry of Culture, State Institute for Nature Protection, Republic of Croatia, Zagreb, 253 pp. (in Croatian with English Introduction).

Muus, B. J.; Dahlström, P., 1968: Süßwasserfische. BLV Verlagsgesellschaft, München. 224 pp.

Tave, D., 1993: Genetics for fish hatchery managers. AVI, New York. 415 pp.

Turan, D.; Tomovic, L.; Pešić, V., 2007: Morphological variation in a common Turkish cyprinid, *Squalius cephalus*, across Turkish water catchment areas. Zool. Middle East **40**, 63–70.

Vuković, T.; Ivanović, B., 1971: Freshwater fishes of Yugoslavia (Slatkovodne ribe Jugoslavije). Zemaljski muzej BIH, Sarajevo, 268 pp. (in Serbian).

Author's address: Marina Piria, Department of Fisheries, Beekeeping and Special Zoology, Faculty of Agriculture, University of Zagreb, Croatia.
E-mail: mpiria@agr.hr