

RANGE EXPANSION OF *PACHYCHILON MACEDONICUM* (ACTINOPTERYGII: CYPRINIFORMES: CYPRINIDAE) IN NORTHERN GREECE

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Abstract. The cyprinid freshwater fish, *Pachychilon macedonicum* (Steindachner, 1892), is an endemic species in the Balkan Peninsula and has a restricted distribution in Greece. Here, we report new records of the species out of its known natural range, namely at the Mpogdanas Stream (drainage area of lakes Koronia-Volvi, northern Greece), which now constitute a new eastern limit for the distribution of the species in southern Balkans. It appears that the new record is related to a human-mediated translocation.

Keywords: endemics, south Balkan Peninsula, freshwater fish distribution, eastern limit

The cyprinid freshwater fish, *Pachychilon macedonicum* (Steindachner, 1892), endemic to the south Balkan Peninsula, is recognized as a rare species, locally ‘vulnerable’ (Oikonomidis 1991). It represents a Danubian cyprinid species that dispersed during the upper Pliocene and Pleistocene following three main corridors, including the direct route through the Morava-Axios valley (Economidis and Banarescu 1991). The taxonomic position of the species is rather complex (for a synopsis see Ráb et al. 2000). However, osteological (Šorić 1992) and genetic (Ráb et al. 2000) studies confirm that *P. macedonicum* is clearly distinct from *Rutilus*, where Karaman (1972) had initially placed *Pachychilon* as a subgenus.

Pachychilon macedonicum has a restricted distribution (for a review see Kottelat and Freyhof 2007). It occurs to the Axios River basin in Greece and FYROM (see synopsis of Ráb et al. 2000, Georgiev 2004, Economou et al. 2007), including the transboundary Lake Doirani (Oikonomidis 1991, Economou et al. 2007, Bobori and Salvarina 2010, Vavalidis et al. 2010, Kostov et al. 2011). In Greece it has also been reported in rivers Loudias and Mavroneri (Economidis et al. 1981, Froese and Pauly 2014), the lower parts of the Aliakmon and Pinios Rivers, as well as to the Lake Karla basin (Oikonomidis 1991, Economou et al. 2007, Economidis and Bobori unpublished**, Kottelat and Freyhof 2007).

It is a small bodied species, with maximum total length of 14.5 cm (Vavalidis et al. 2010), easily recognized by having a broad black stripe from the tip of the snout to the middle of the caudal fin base and a vertically elongated black blotch at the caudal base (Kottelat and Freyhof 2007). The species occurs in marshlands, lakes, and watercourses on the low plains, with little current (Froese and Pauly 2014). The biology and ecology of the species is very little known. Typically, it lives in small groups, moving during the winter in sheltered places. It preys mainly on chironomids and its trophic level has been estimated as 3.2 ± 0.4 (Vavalidis et al. 2010). It is threatened mainly by water extraction and pollution, as well as habitat alteration (Oikonomidis 1991).

In the present work we report the expansion and settlement of the endemic species *Pachychilon macedonicum* in the Mpogdanas Stream, which flows into Lake Koronia (Fig. 1) (northern Greece, south Balkans). The area constitutes part of the national park of lakes Koronia-Volvi and it is protected under the Ramsar Convention as a wetland site of international importance, the Habitats’ Directive (92/43/EU), and it is an Important Area for birds (79/409/EU).

A total of 25 specimens of *Pachychilon macedonicum* (total length TL: 3.4–9.2 cm, total weight TW: 0.5–14.4 g) were collected during the fish monitoring surveys carried

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** Economidis P.S. [Οικονομίδης Π.Σ.], Bobori D.C. [Μπόμπορη Δ.Χ.] 2003. Ιχθυολογική διερεύνηση της ευρύτερης περιοχής της τέως λίμνης Κάρλας. [Ichthyological study in the area of the former Lake Karla.] Technical report. [In Greek.]

out in two periods of low flow (LF; October 2012) and high flow (HF; April 2013). Specimens were captured by electrofishing (Anonymous 2003) at 4 out of the 9 sampling stations, located at the upper part of the Mpodanas Stream (Fig. 1, Table 1), since it usually dries out at its lower parts during most of the year, under the permission of the Management Body of Lakes Koronia-Volvi. The

majority of specimens (10) were captured at station MP4 during the HF period. This station has permanent flow and receives the treated wastewaters of a landfill located upstream. Moreover, at this station the highest diversity was recorded since seven more species were also captured: *Barbus strumicae* Karaman, 1955; *Squalius orpheus* Kottelat et Economidis, 2006; *Cobitis strumicae*

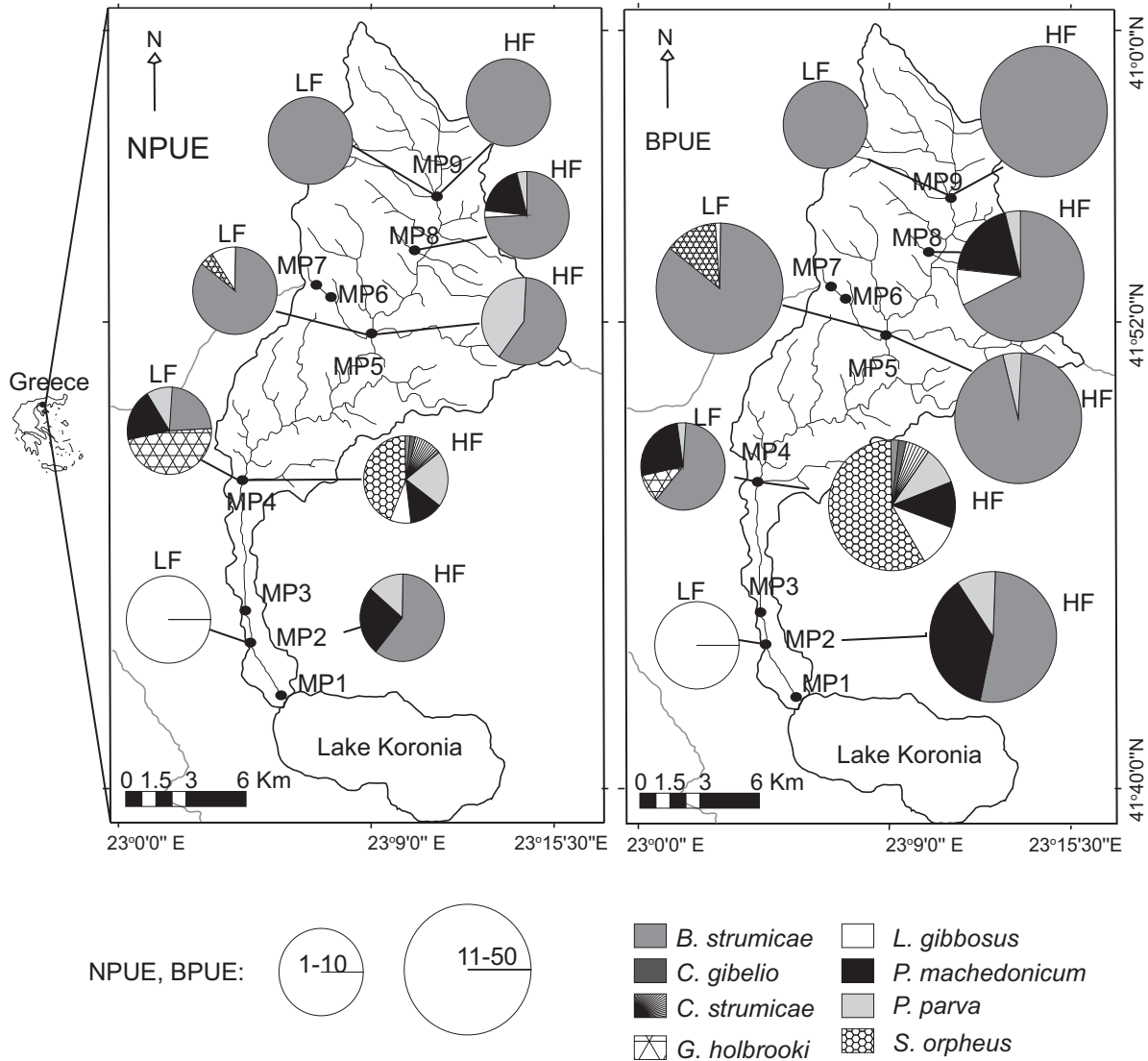


Fig 1. The drainage basin of Mpodanas stream with the sampling stations (MP1 – MP9); The abundances of all fish species caught are provided in terms of NPUE (number of *Pachychilon macedonicum* individuals per 100 m² of sampling area) and BPUE (g per 100 m² of sampling area) for both sampling periods of low (LF) and high (HF) flow

Table 1
Sampling location and descriptive characteristics of *Pachychilon macedonicum* specimens caught in the Mpodanas Stream (northern Greece), during the low flow (October 2012) and high flow (April 2013) periods

Station	Flow	Altitude [m]	Coordinates	Total length [cm]	Total weight [g]	<i>n</i>	NPUE	BPUE [g]
MP4	Low	143	40°48'2"N, 23°3'23"E	4.94 ± 0.78	2.02 ± 1.17	5	0.91	2.30
MP2	High	97	40°43'45"N, 23°3'47"E	8.10 ± 0.40	8.98 ± 2.09	4	0.44	3.98
MP4	High	143	40°48'2"N, 23°3'23"E	6.10 ± 0.50	4.29 ± 1.11	10	1.08	4.64
MP8	High	450	40°53'48"N, 23°53'48"E	5.50 ± 0.70	3.07 ± 1.10	6	1.55	4.76

Length and weight values are mean ± standard error; *n* = number of fish individuals, NPUE = number of individuals caught per 100 m² of sampling area, BPUE = weight of individuals caught per 100 m² of sampling area.

Karaman, 1955; *Lepomis gibbosus* (Linnaeus, 1758); *Pseudorasbora parva* (Temminck et Schlegel, 1846); *Carassius gibelio* (Bloch, 1782); and *Gambusia holbrooki* Girard, 1859 (Fig. 1). Furthermore, *P. macedonicum* was found at station MP2, during the HF period, which also receives the same treated wastewaters. However, the species appeared more abundant in terms of number (NPUE: 1.55 individuals per 100 m² of sampling area) and weight (WPUE: 4.76 g per 100 m² of sampling area) at station MP8 (Fig. 1, Table 1), which considered unpolluted. It seems that *P. macedonicum* can adapt to several environments and tolerate, such as many cyprinids (Karr 1981), unfavourable environments.

The presence of *Pachychilon macedonicum* in the area cannot easily be explained, since the Mpogdanas Stream is not linked to the River Axios basin, which is the closest aquatic ecosystem where the species had hitherto been reported. It is also worth mentioning that the species was not found during an intensive previous study carried out in the area (Kokkinakis et al. unpublished*). Thus, we can hypothesize that the species has accidentally been introduced to the system, possibly during a transportation of other species of commercial importance (e.g., perch). However, the existence of the species in different locations provides evidence for its successful adaptation.

In conclusion, our findings confirm the existence of *Pachychilon macedonicum* eastward of its native distribution area, with the Mpogdanas Stream been now the eastern limit of its distribution. Furthermore, due to the inflow of the Mpogdanas Stream into Lake Koronia, a wider distribution of the species can be expected, when the hydrological conditions become favourable. The surface running water network in the wider area is quite dense (Fig. 1) and the lake can potentially act as an intermediate route (Muhlfeld et al. 2012) for nourishing streams with *P. macedonicum*. Nonetheless, the available data are not sufficient to support these hypotheses and more studies need to be carried out in the area.

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