

NEW DATA ON RANGE EXPANSION OF ROUND GOBY  
*NEOGOBIUS MELANOSTOMUS* (PISCES: GOBIDAE) IN THE  
BULGARIAN TRIBUTARIES OF LOWER DANUBE RIVER

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**Abstract:** The round goby *Neogobius melanostomus* (Pallas, 1814) is a fish species native to the Ponto-Caspian region and invasive for most of European rivers, performing rapid expansions upstream of the Danube River. The aim of the current study was to investigate the distribution of the species in Bulgarian tributaries of the Danube River. A total of 12 rivers were surveyed. Fish presence was detected by electrofishing.

The present study found that within five years the round goby had expanded its range in upstream direction with 9 km in Vit River, 28 km in Iskar River and 43 km in Yantra River. For the first time the species was found in the rivers Osam and Rositsa. Large obstructions, such as HPPs and dams seem to be the main limiting factor of round goby's upstream expansion.

## INTRODUCTION

The round goby *Neogobius melanostomus* (Pallas, 1814) is a small bottom-dwelling fish usually found in shallow coastal waters. Round goby belongs to the Gobiidae family and is a native species for the Ponto-Caspian basin and its adjacent coastal wetlands (Berg, 1949; Kottelat & Freyhof, 2007). According to Vassilev et al. (2012) the round goby is one of the most common species along the Bulgarian Black Sea coast. For the last two decades the round goby has managed

to successfully invade the Danube-Rhine corridor (Roche et al., 2013; Brandner et al., 2013) and were accidentally introduced to the Baltic Sea (Kornis et al., 2012) and the North American Great Lakes via ballast water (Jude et al., 1992). Obviously, the successful invasion is still ongoing and the species spreads in the tributaries of previously invaded rivers (Copp et al., 2005; Jakovlić et al., 2015). The negative effects of these invasive populations are well listed in an overview by Hirsch et al. (2015). The same trend of upstream expansion was recorded for some tributaries of the lower sector of the Danube River, although the invasion potential of the round goby is still debatable (Vassilev et al., 2008; Trichkova et al., 2009; Zarev et al., 2013). In order to determine the speed of the expansion, it is necessary to conduct constant monitoring in the newly invaded areas. Therefore, the aim of the present study was to collect new data about the distribution range of this species in tributaries of the Lower Danube River.

## MATERIAL AND METHODS

Fish sampling was conducted during the low water period (August - September, 2017). A total of 27 sites located in 12 Danube tributaries were surveyed (Table 1). Sampling sites were chosen following previously studied ones (Zarev et al., 2013) with additional sites upstream of the known records. The studied rivers showed typical lowland river features (river type R7 of the national typology) with slow to moderate current, coarse to fine substratum and well-presented macrophyte communities. The locations of the round goby was determined through electrofishing with transects ranging between 20 and 100 m. The length of transect was chosen according to the specific river conditions of a single site. A electrofishing device SAMUS-725G (30 cm diameter ring anode, average voltage of 200 - 350 V, operating at an average of 3 - 8 A depending on water conductivity) was used. We choose three descriptive categories to evaluate the relative abundance of the round goby along the studied river sections: low abundance (between 1 and 3 specimens per site); medium abundance (between 4 and 10 specimens per site) and high abundance (more than 10 specimens per site).

The species was identified *in situ* using the atlas of Vassilev et al. (2012).

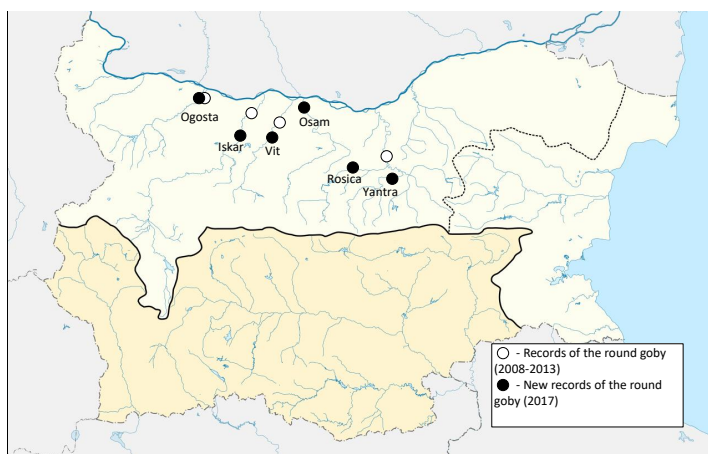
**Table 1** List of studied sites with description and geographic coordinates.

Site No	River	Site description	Geographic coordinates -		Altitude [m]	Distance from mouth [km]
			longitude, latitude			
1	Voynishka	At Bukovets village	43.92846°	22.75887°	51	7,2
2	Vitbol	At Sinagovets village	43.9022611°	22.7627444°	56	7,7
3	Archar	At Archar village*	43.812500°	22.918888°	36	1,1
4	Archar	Downstream of Darzhanitsa village	43.8098167°	22.8595639°	53	7,2
5	Lom	At Asparuhovo village	43.72085°	23.15774°	53	17,1
6	Tsibritsa	Upstream of Valchedram town	43.67274°	23.45141°	66	21,6
7	Ogosta	At Mizia town*	43.6918500°	23.8262250°	29	7,4
8	Ogosta	Near Sofronievo village	43.6454083°	23.7757056°	40	20,3
9	Ogosta	At Manastirishte village	43.5751528°	23.6360611°	57	37,7
10	Skat	At Krushovitsa village	43.6169000°	23.8476611°	50	23,4
11	Osam	Upstream of Musalievo village**	43.6287500°	24.8500611°	28	9,2
12	Osam	At Sanadinovo village	43.52908°	25.02283°	34	26,3
13	Rositsa	Downstream of Polikraishte village**	43.21680°	25.63913°	57	117,48
14	Rositsa	At Resen village**	43.20940°	25.55462°	62	130
15	Rositsa	At Lesichene village**	43.2086306°	25.4227000°	82	145,4
16	Rositsa	Upstream of Krasno Gradishte	43.1785361°	25.2116583°	123	180,7
17	Yantra	Downstream of Petko Karavelovo*	43.0759611°	25.551158°	39	100
18	Yantra	At Gorski Dolen Trambesh village	43.2030222°	25.8243694°	56	125,44
19	Yantra	At Pisarevo village	43.1529361°	25.798753°	66	135,12
20	Yantra	At Dolna Oryahovitsa town**	43.1536361°	25.7297694°	79	143
21	Yantra	Upstream of Pravda village	43.1537417°	25.6821306°	86	147,8
22	Yantra	At Ledenik village	43.0759611°	25.5511583°	156	182,8
23	Iskar	At Dolni Lukovit village**	43.5186500°	24.2250194°	51	41
24	Iskar	upstream of the town of Iskar**	43.4523667°	24.2261972°	58	54
25	Iskar	At Chomakovtsi village	43.3225722°	24.0693778°	90	81,3
26	Vit	At Yasen village**	43.4021944°	24.5133889°	63	40,9
27	Vit	At Toros village	43.0947222°	24.2845389°	217	98,7

\* Sites where *N. melanostomus* was previously reported; \*\* new records of *N. melanostomus*; sites where the species was not found are without distinctive symbols.

## RESULTS AND DISCUSSIONS

The round goby was found in 6 of the surveyed 12 rivers. In five cases an extension of the occupied territory of the species was found (Figure 1). The river habitat gain varied from 8.9 to 45.4 km (Table 2). For the Osam and Rositsa Rivers the round goby is reported for the first time. In most of the smaller rivers as Archar, Tsibritza, Vitbol, Voynishka, Lom and Skat the fish was not found. This may indicate fish's preference to habitats of larger rivers, but additional data is needed to confirm this assumption.



**Fig. 1** Map of round goby distribution in Bulgarian Lower Danube tributaries.

For some rivers like Archar the species has been reported in the past in area near to the river mouth (1 km upstream) (Trichkova et al., 2009). Probably some individuals from Danube occasionally enter Archar River but several transversal obstructions (weirs) located at 7.2 km above of the mouth, limit the upstream migration of the round goby. Retaining the upstream expansion of round goby was also observed for the Ogosta River.

For the last five years the round goby has expand its range with 28 river kilometers for Iskar River (Table 2). It is possible that the species ranges extends several more kilometers upstream, but Koynare HPP located 16 km upstream of site 24 limits the species spread. For the Vit River, the spread of round goby is with 9 river kilometers. River canalization and several obstructions upstream of Tarnene village probably limit the round goby spread.

**Table 2** Range of expansion of the round goby *N. melanostomus* upstream of the Danube tributaries, with previous and new records, river habitat gain. Relative abundance is given as categories: Low abundance is marked with “+”; Medium abundance– “++” and High abundance – “+++”.

River	Previous records of the round goby (Vassilev et al., 2008; Zarev et al., 2013) shown as distance from the mouth [km]	New records of the round goby shown as distance from the mouth [km]	River habitat gain [km]	Relative abundance in the uppermost site
Ogosta	7	7	0	+
Iskar	26	54	28	+++
Vit	32	40.9	8.9	+++
Osam	not recorded	9.2	9.2	+
Yantra	100	143	43	++
Rositsa	not recorded	145.4	45.4	+++

The most significant increase in the area inhabited by the round goby was observed in the Yantra River and its tributary Rositsa River – with 43 and 45.4 km, respectively. In a previous study Vassilev et al. (2008) didn't find the species in Rositsa River, nor upstream of site 17 in Yantra River. It is known that the member of the Gobiidae family have low probability of capture via electrofishing (Brandner et al., 2013) and failure to detect fish in sites 18 and 19 sites could be due to the very low abundance of species in this stretch of the river. Further spread in the upper reaches of the Rositsa and Yantra Rivers will most likely be limited due to the presence of hydro power plants in the Rositsa River (“Rositsa 3” HPP) and the highly modified stream bed of the Yantra River in the region of the town of Veliko Tarnovo and adjacent towns and villages.

The round goby was most abundant in those river sections with gravel substratum and macrophytes (*Myriophyllum* spp., *Potamogeton* spp., *Stuckenia pectinata* (L.) Börner *Najas minor* All. etc.). In sites near the Danube the round goby showed low relative abundance, opposed to sites situated more upstream from the mouth (Table 2).

In conclusion, the round goby continues its successful colonization in recent years as it enters in new tributaries and reaches higher stretches of rivers. Large obstructions, such as HPP seem to be the main limiting factor of this expansion. Considering the clear tendency of the round goby to spread upstream in the Danube tributaries we believe that more studies on the species ecology and invasive potential are crucial for a timely implementation of management measures.

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