

Rapid Communication

First record of the round goby *Neogobius melanostomus* (Pallas, 1814) in the lower River Oder, Germany

Christian Schomaker* and Christian Wolter

Leibniz-Institute of Freshwater Ecology and Inland Fisheries, Müggelseedamm 310, 12587 Berlin, Germany

E-mail: schomaker@igb-berlin.de (CS), wolter@igb-berlin.de (CW)

*Corresponding author

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Abstract

In September 2013, the non-native round goby *Neogobius melanostomus* was found for the first time in the River Oder, Germany, about 58 km upstream of the Szczecin Lagoon (Zalew Szczeciński). Seven specimens were caught at river kilometre 703.5 near Friedrichsthal (53°08'24.29"N, 14°23'03.59"E) during the regular fish monitoring program for the Water Framework Directive. This record is especially important because i) it represents a very early stage of the invasion process, a round goby invasion front, and ii) it potentially reflects the natural dispersal ability of the species. The latter was concluded from the time lag of about 15 years between the first occurrence of round goby in the Baltic Sea in front of the River Oder estuary in 1998, in the German part of the Szczecin Lagoon (River Oder estuary) in 2003, its subsequent establishment in the Szczecin Lagoon in 2006, and its upstream migration observed in 2013. The slow average migration speed of 3.9 km per year might correspond to natural dispersal.

Key words: *Neogobius melanostomus*, round goby, Gobiidae, invasive species, natural dispersal, Oder River, Germany

Introduction

The round goby *Neogobius melanostomus* (Pallas, 1814) is one of the most widespread invasive gobiid species in Europe. Originating from the Ponto-Caspian region (Black Sea, Azov Sea and Caspian Sea), the round goby is now well established in several European rivers (Wiesner et al. 2010; Wolter and Röhr 2010) and has even reached North America (Jude et al. 1992).

In Germany, round goby was recorded for the first time in 1998 near the Zicker peninsula (Rugia) (Winkler 2006). In 2002, an adult individual was found further west, at the Darß peninsula (Darßer Ort) (Corkum et al. 2004; Winkler 2006). Two years later, in 2004, round goby were first discovered in the Rhine Delta, in the River Lek near the village of Schoonhoven (van Beek 2006). Only four years later, in 2008, the species had become established and abundant along the lower Rhine at Zons near Dormagen (Borcherding et al. 2011). Further records of round goby include those from the Nord-Ostsee canal in 2007 (Borcherding et

al. 2011), the River Elbe in 2008 (Hempel and Thiel 2013), the Scheldt and Albert Canals in Belgium in 2010 (Verreycken et al. 2011), and the River Weser in 2012 (Brunken et al. 2012).

A second introduction pathway was detected with the first records of round goby in the Austrian stretch of the River Danube, close to Vienna, in 2000 (Wiesner et al. 2010) and in the German stretch at Passau and Straubing in 2004 (Zauner and Ratschan 2004; Painter and Seifert 2006). From there, the round gobies might have colonised also the River Rhine. However, it remains unresolved whether the middle and lower River Rhine were primarily colonised by gobies from upstream, i.e. from the River Danube (Painter and Seifert 2006) or from the downstream Rhine Delta (van Beek 2006). In contrast, it appears rather obvious that the River Oder was colonised via the Baltic pathway.

The first specimens of round goby from the Gulf of Gdańsk (Zatoka Gdańska) were reported near the harbours Hel and Gdynia in the eastern Baltic Sea in 1990 (Figure 1). Following their initial colonisation and establishment at Puck Bay

Figure 1. Records of round goby in the eastern Baltic Sea and in the River Oder catchment. White dots indicate sites surveyed in 2013 without recording round goby (for details refer to Figure 2 and Appendix 1).

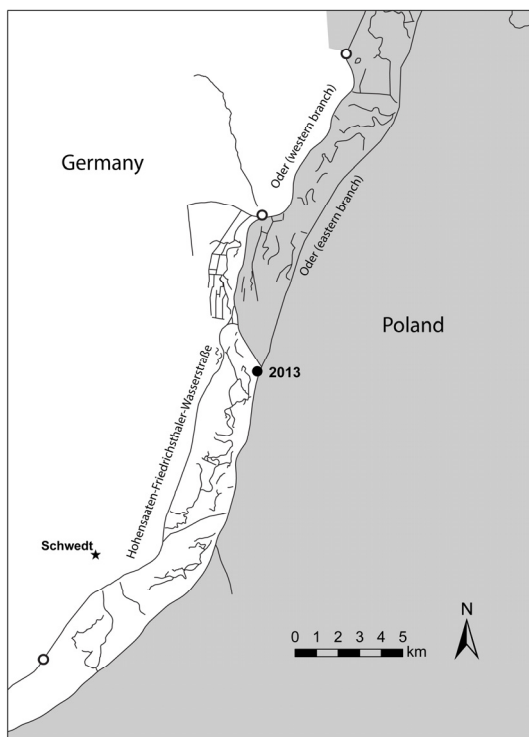
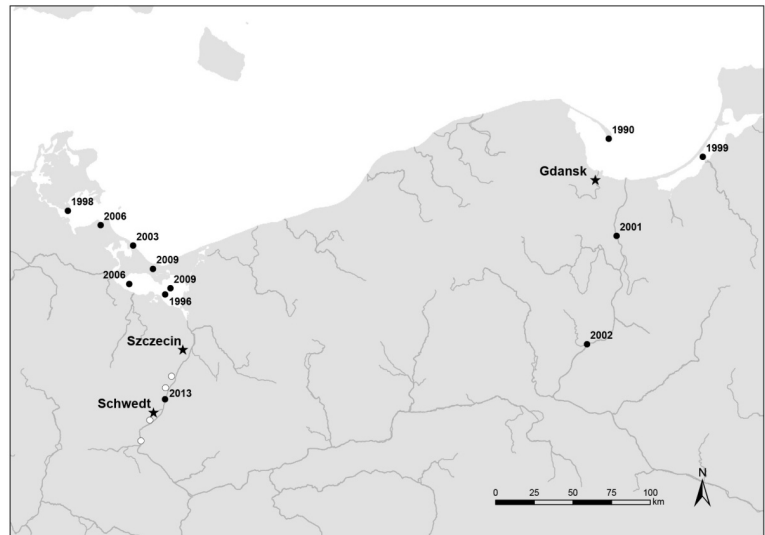


Figure 2. Detailed map of the sampling sites in the lower River Oder surveyed in 2013; the black dot indicates the new record of *Neogobius melanostomus*, white dots sites surveyed without recording round goby.

(Zatoka Pucka), the population rapidly increased in abundance and spread to nearby locations. Between 1995 and 1999, round gobies had colonised the estuary of the River Vistula and the Vistula Lagoon (Sapota 2004; Sapota and Skóra 2005).

The population in the Gulf of Gdańsk is considered the founder population for invaders of the western Baltic Sea and the Oder estuary. In the Oder estuary, an early, unfortunately unverified, occurrence of round goby was recorded in 1996 (Czugała and Wozniczka 2010). The first verified catches of round goby were recorded in 2003 with the first juvenile gobies collected in Pomeranian Bay (Winkler 2006). In 2006, round goby was considered as established in the Oder estuary when mature specimens were caught in the German part of the Szczecin Lagoon (western part of the Kleines Haff) and in the River Peene (Corkum et al. 2004; Winkler 2006). Interestingly, by 2008 no or only insecure observations of round goby had been made in the Polish part of the Szczecin Lagoon (Czugała and Wozniczka 2010). This situation changed abruptly in 2009, when anglers frequently caught round goby as by-catch in the Swinoujście port canals. Local commercial fishermen confirmed regular catches of round goby in 2009, especially in the northern part of the Szczecin Lagoon and in the Kamiński Lagoon (Zalew Kamiński) (Czugała and Wozniczka 2010). No records of round goby were obtained upstream of the Szczecin Lagoon until 2013 (Figure 1).

Methods

Since 2006, there has been a requirement to undertake fish surveys on all larger European surface waters as a means of assessing ecological status under the European Water Framework Directive (2000/60/EEC). Consequently, the German stretch of the River Oder is surveyed by electric fishing at ten survey sites along its entire length biannually (Wolter and Schomaker 2011). Single pass electrofishing is routinely performed using a generator-powered electric fishing unit (7 kW, EFKO Leutkirch, Germany) with a handheld ring anode of 40 cm diameter (effective field of about 3 m diameter) from a boat (no block nets used). This configuration is well suited to catching fish of 4 cm or more total length along the banks at depths up to 1.5 m.

At least 400 m of bank is fished at each survey site. All stunned fish are immediately collected by a second operator using a separate dip-net and stored alive. After fishing, the whole catch is identified to species and the total length of each fish measured before releasing back to the water.

Results and discussion

Seven specimens of round goby (five female and two male, Table 1, Figure 3) were caught during routine sampling of the left bank of the River Oder at the furthest downstream survey site at river kilometre (r.km.) 703.5 (53°08'24.29"N, 14°23'03.59"E) near the village Friedrichsthal on September 10, 2013 (Figures 1 and 2). The site is located approximately 58 km upstream of the Papenwasser (Roztoka Odrzanska), the southernmost bay of the Szczecin Lagoon. The bank is protected against navigation-induced wake-wash by coarse rip-rap, which was covered by a narrow strip of reed (*Phragmites* spp.) in its upper part.

Round goby were never caught in previous fish surveys, either at the newly discovered site of occurrence or at other survey sites fished along the German stretch of the River Oder (Wolter and Schomaker 2010, 2011, 2012). Furthermore, round goby were also lacking in catches at nearby sites surveyed in 2013 (Figure 2): in the canal Hohensaaten-Friedrichsthaler-Wasserstraße, in the River Oder at Hohensaathen (about 35 km upstream) and in the western branch of the River Oder near the villages Gartz and Staffelde (about 8 km and 16 km downstream).

Therefore, it appeared highly likely, that the invasion of round goby into the lower Oder Valley



Figure 3. Parental male (black colouration) round goby captured in the lower River Oder at river kilometre 703.5 on September 10, 2013. Photograph by C. Schomaker.

Table 1. Round gobies *Neogobius melanostomus* caught in the lower River Oder at stream km 703.5 (53°08'24.29"N, 14°23'03.59"E) on September 10, 2013.

Individual #	Total length (cm)	Sex
1	4.6	female
2	9.2	male
3	9.7	female
4	10.5	female
5	11.0	female
6	12.0	female
7	13.0	male

is a very recent event. This was further underlined by the dominance of big specimens in the catch which is considered characteristic for an invasion front (Brandner et al. 2013). Further, the lack of round gobies along the western branch of the River Oder indicates that immigration most probably took place along the eastern branch, i.e. along the main navigation route. However, freight transport by inland navigation is rather equally distributed between both branches of River Oder and in total relatively low (about 475,000 t of goods transported in 2012, compared to 25 million t along the Elbe and 199 million t along the Rhine). Therefore, inland navigation was considered less effective vector for distributing non-native species compared to the River Rhine. This provides at least a fair chance that the observed upstream distribution of round goby reflects natural dispersal and allows for studying species-specific dispersal ability.

Conclusion

If the very recent invasion of round goby in the lower River Oder is considered as a natural immigration process, it will allow not only for

assessing the natural dispersal abilities of this species but also for developing empirical studies of its invasiveness and its potential establishment within a diverse native freshwater fish community.

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Appendix 1. Records of *Neogobius melanostomus* from the eastern Baltic Sea and the River Oder catchment. Coordinates (WGS 84) estimated based on the site description provided by the reference.

Location	Record coordinates		Year of record	Reference
	Latitude N	Longitude E		
Gulf of Gdansk, Poland	54°35'36"	18°47'60"	1990	Skóra and Stolarski 1993
Oder estuary, Poland	53°44'53"	14°22'33"	1996	Czugała and Wozniczka 2010
Zicker Peninsula, Germany	54°13'28"	13°24'17"	1998	Corkum et al. 2004
Vistula Lagoon, Poland	54°27'20"	19°43'32"	1999	Sapota 2004
River Vistula, Poland	54°01'44"	18°49'39"	2001	Sapota 2004
River Vistula, Poland	53°24'36"	18°28'56"	2002	Kostrzewa and Grabowski 2003
Pomeranian Bay, Germany	54°01'47"	14°03'21"	2003	Winkler 2006
Kleines Haff, Germany	53°48'22"	14°01'24"	2006	Winkler 2006
River Peene, Germany	54°08'42"	13°43'55"	2006	Winkler 2006
Świnoujście, Poland	53°53'44"	14°15'15"	2009	Czugała and Wozniczka 2010
Szczecin Lagoon, Poland	53°47'02"	14°25'38"	2009	Czugała and Wozniczka 2010
River Oder, Germany	53°08'24"	14°23'04"	2013	Present study