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The River Odra estuary – another Baltic Sea area colonized by the round goby *Neogobius melanostomus* Pallas, 1811

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Abstract

The round goby (*Neogobius melanostomus* Pallas, 1811) has been present, since the 1990s, in the Gulf of Gdańsk where it forms a strong population and where the species is locally the most important fish in shallow inshore areas. No similarly large, independent round goby population in the Baltic Sea area has been found beyond the Gulf of Gdańsk and the adjacent Vistula Lagoon. As shown by the research carried out in 2009, the round goby is abundant also in the River Odra estuary, which may provide evidence of the presence of a local, reproducing population.

Key words: invasive species, Szczecin lagoon, Pomeranian Bay, *Neogobius melanostomus*

Introduction

The round goby (*Neogobius melanostomus* Pallas, 1811) is a Pontocaspian species which, since the early 1990s, has been encountered in the Baltic Sea and off North America (Skóra and Stolarski 1993; Corcum et al. 2004; Sapota and Skóra 2005; Ojaveer 2006). Since 2004 it is present also in the North Sea (Netherlands) as well (van Beek 2006). The round goby invasion in the Baltic is thought to have begun in the Gulf of Gdańsk; the first specimens were spotted there in 1990 (Skóra and Stolarski 1993). In 1994, the species was present throughout the entire Polish part of the Gulf, and expanded into further-off parts in subsequent years (Kuczyński 1995; Sapota and Skóra 2005). At present, *N. melanostomus* occurs abundantly in the Gulf of Gdańsk; in the coastal zone, particularly in Puck Bay, where it locally dominates the demersal ichthyofauna (Sapota 2005; Sapota and Skóra 2005; Wandzel 2003). Since 1999, *N. melanostomus* has been occurring also in the Vistula Lagoon (Borowski 1999), where – since 2001 – it has been regularly found in fyke nets as by-catch (Wandzel 2003; Psuty-Lipska 2005).

Since the beginning of the 21st century, theround goby has been regularly recorded in ports and river mouths along the entire Polish coast, from Władysławowo to Dziwnów and Świnoujście (Skóra, Woźniewska, unpublished data at www.hel.univ.gda.pl). Single specimens of *N. melanostomus* have been also collected off the eastern and northern coasts of the Baltic (Ojaveer 2006). However, no round goby population similar in-size to that dwelling in the Gulf of Gdańsk and off the Vistula mouth has been found in the Baltic (Sapota 2005). The River Odra mouth area has been regarded as another potential site amenable for colonization by *N. melanostomus*.

Materials and methods

The Odra estuary includes, as its major part, the brackish Szczecin Lagoon which consists of two parts: the Kleines Haff (located in Germany) and the Wielki Zalew located in Poland (Figure 1). The Lagoon receives the River Odra water supplied from the south; prior to being discharged into the Lagoon, part of the Odra flow passes through Lake Dąbie. In its northern part, the Lagoon connects – via three straits (the Peene, Świna, and Dziwna) - with the Pomeranian Bay, a Baltic embayment. The Pomeranian

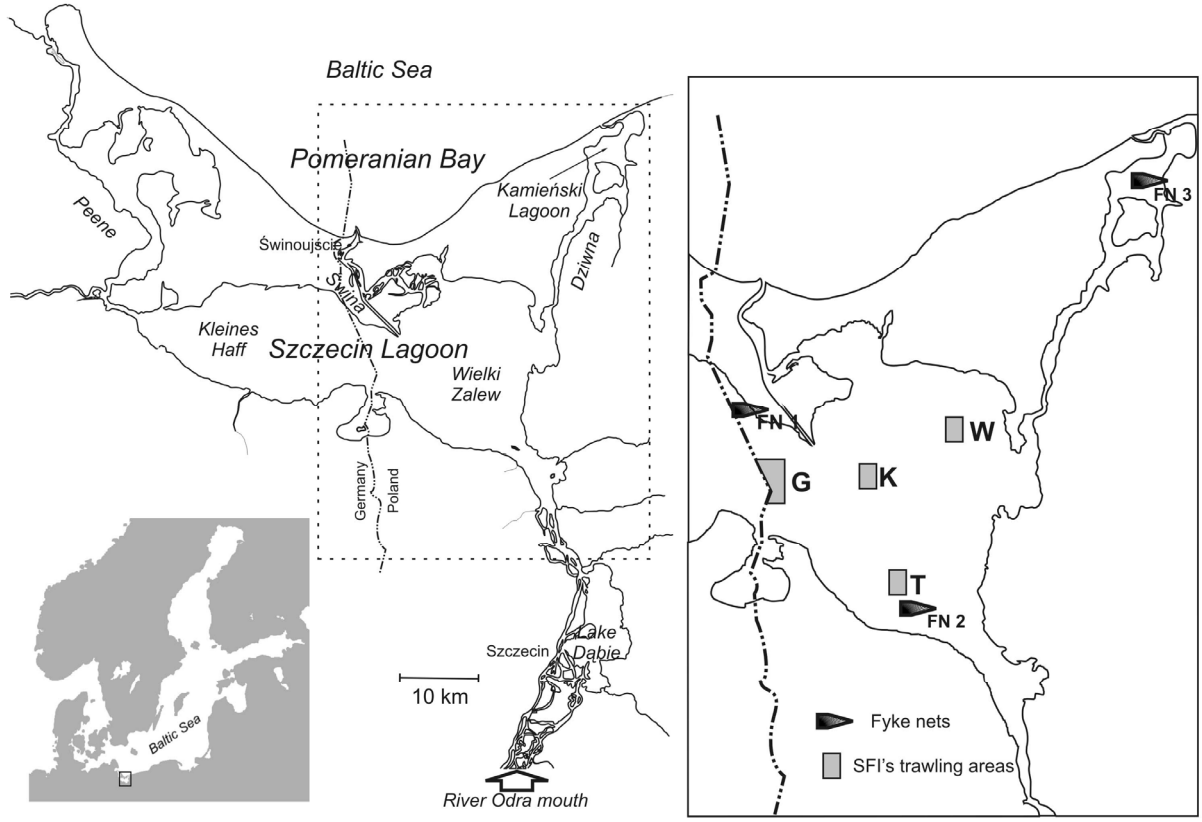

Figure 1. River Odra estuary and sampling sites location.

Bay's salinity does not deviate from that prevailing in the southern Baltic surface water (~7 psu), the freshening effect being visible only in the inshore zone as a result of discharges from the Szczecin Lagoon. The Lagoon is a typical transient brackish water reservoir, its salinity varying from 0.3 to 4.5 psu (mean salinity 1.4 psu) (Radziejewska and Schernewski 2008). In its southern part, the Lagoon – affected by the Odra discharge – is filled with fresh water, intrusions of the Baltic water in the northern part creating more brackish, estuarine conditions. The average and maximum depths of the Lagoon are 3.8 and 8.5 m, respectively (10.5 m being the depth of an artificially dredged channel cutting across the Lagoon and leading to the port of Szczecin) (Radziejewska and Schernewski 2008). The central part of the Wielki Zalew and also, to a smaller extent, of the Kleines Haff is covered by mud occurring usually at depths exceeding 4.5 m. The shallower bottoms and the areas adjacent to the shores feature sandy-muddy and sandy sediments, usually featuring numerous banks of the zebra mussel (*Dreissena polymorpha* Pallas, 1771) and/or covered by deposits consisting mainly of empty zebra mussel shells.

The Odra estuary is subjected to strong anthropogenic pressure manifested as a high level of eutrophication, with all its adverse effects (Radziejewska and Schernewski 2008). The Lagoon is also intensively used as a shipping route to and from Szczecin and Świnoujście, major Baltic ports connected by the already mentioned shipping channel leading across the Wielki Zalew. A network of channels connects the Odra river with the system of European waterways: direct connections exist with the Vistula and Elbe catchments, indirect connections being with the Rhein and Danube catchments. Due to the location of the Lagoon and intensive shipping within it, the Lagoon's biota features a high proportion of alien species (Gruszka 1999, Radziejewska and Schernewski 2008) which expand into the Baltic basin via the Odra estuary (Gruszka 1999).

The Szczecin Lagoon is an area of intensive fishing; the landings are dominated by freshwater fish (roach *Rutilus rutilus* Linnaeus 1758, bream *Abramis brama* Linnaeus 1758, perch *Perca fluviatilis* Linnaeus 1758, zander *Sander lucioperca* Linnaeus 1758, eel *Anguilla anguilla* Linnaeus 1758, and whitefish *Coregonus lavaretus* Linnaeus 1758) which are caught mainly with fyke and gill nets.

Results and discussion

Single round goby specimens have been intermittently encountered in the Odra estuary since the beginning of the 21st century, although the first record, albeit not a documented one, was said to have been made in 1996 (Anonymous, http://www.hel.univ.gda.pl). In the adjacent German waters, the first round goby was caught in 1998 off the Island of Rügen (Corcum et al. 2004; Winkler 2006), followed by catches in 2002 off Darss (Winkler 2006). Subsequently, single specimens were recorded along the German Baltic coast (Corcum et al. 2004), and information on the species' purported presence in the Pomeranian Bay was also circulating (Sapota 2004). In 2003, juveniles of *N. melanostomus* were caught in the Kleines Haff, while in 2006, adult round gobies appeared in fishermen's landings from the area (Winkler 2006).

Until this time, knowledge on the presence of *N. melanostomus* in the Polish part of the Odra estuary was limited to undocumented, sparse sightings of specimens caught mainly by anglers. Before the end of 2008, no round goby had been found during fisheries-oriented research carried out in the Polish part of the Szczecin Lagoon by the Research Station of the Sea Fisheries Institute in Gdynia. The research mentioned is a component of a long-term project involving regular (summer-autumn) trawling operations effected with a fine-mesh (6 mm mesh size in the codend) demersal trawl. Location of the operations is shown in Figure 1; the fishing ground G has been used regularly for many years, the remaining fishing grounds being exploited intermittently. In addition, until 2007, the research also involved analyses of fyke net catches obtained by professional fishermen. Before the end of 2008, none of those fishing operations had revealed the presence of *N. melanostomus*.

In 2009, reports on "gobies" caught by anglers from the Świnoujście port canals became significantly more frequent, which prompted us to interview the fishermen operating in the Szczecin Lagoon and Pomeranian Bay. The information obtained indicated a regular and large by-catch of "large gobies" in fyke nets set in the northern part of the Szczecin Lagoon and in the Kamieński Lagoon constituting a fragment of the Dziwna strait. On the other hand, records of gobies in the southern part of the Lagoon were sporadic only.

The first gobies, identified as *Neogobius melanostomus*, were retrieved from the Sea Fisheries Institute's research catches (effected with a small-mesh trawl): two individuals were caught in July and August 2009 at site G (Figure 1, Table 1). In the subsequent months, the round goby was found in each research catch. During the entire catch series, a total of 17 individuals measuring 5-12 cm were retrieved (Table 1). In September and October 2009, fishermen operating in the Szczecin and Kamieński lagoons provided round gobies found as by-catch in fyke nets. Two fyke net sites (FN1 and FN2, Figure 1) were situated in the Szczecin Lagoon, a single site (FN3) being set up in the Kamieński Lagoon. A total of four round goby samples were examined: two from FN1 and one each from the remaining sites (Table 2). A total of 281 *N. melanostomus* individuals were examined and measured (total length, longitudo totalis). These measurements made it possible to group the gobies into 1-cm length classes (Table 2). In addition, gobies – identified as *N. melanostomus* - caught by anglers in the Świnoujście harbour were also examined.

On the other hand, no round goby could be caught in the Pomeranian Bay, although – according to the fishermen – they are abundant there, too. The failure to catch round gobies in the Bay resulted from the fishing gear selectivity: the round goby occurs as by-catch only in spring, when the fishermen fish for herring. In the remaining seasons, nets with larger meshes are used, hence by-catch consisting of small fish is negligible. However, judging by fishermen's and anglers' reports and by analogy to other coastal areas, *N. melanostomus* may be assumed to be common and abundant in the Pomeranian Bay as well. In spring 2009, the species was spotted in the closest vicinity of the seabridge at Międzyzdroje, a holiday resort on the Pomeranian Bay (T.Radziejewska, pers. comm.).

When and how the round goby got into the Szczecin Lagoon remains an open question, particularly since the rapid increase of the species' abundance (as evidenced by, e.g., trawl

Table 1. Round gobies caught during SFI's research trawlings in 2009.

Date	Trawl site	No of round gobies	Size class
28.07.2009	G	1	9,
26.08.2009	G	1	10,
22.09.2009	K	2	10,12,
23.09.2009	G	3	9,9,9,
28.09.2009	W	1	11,
20.10.2009	K	1	8,
21.10.2009	G	3	5,9,12,
26.11.2009	G	5	6,7,7,8,9,

Table 2. Number and length of round gobies caught as by-catch in fyke nets in 2009.

Length classes	Sep 11 FN1	Sep 18 FN1	Sep 18 FN2	Oct 02 FN3
8		1		
9		5		1
10	2	9		4
11	1	22		2
12	5	43	3	2
13	17	58	1	8
14	30	29	2	9
15	10	9		4
16	2			1
17				
18	1			
Total	68	176	6	31

catches: 17 individuals in 2009, none in previous years) suggests that the invasion and establishment of a population occurred very quickly. Initially, the population could have been latent, as the round goby prefers hard bottoms replete with hide-outs (e.g., mussel banks) (Sapota and Skóra 2005). Such habitats in the Szczecin Lagoon are found in the shallows, areas not exploited by the fishermen. It is only when the full potential of an available habitat is used up by the round goby, a species prone to territorial behaviour, that the population disperses to search for other suitable biotopes (Sapota and Skóra 2005). In the Szczecin Lagoon, the population expanding from the shallows could have colonized adjacent areas exploited by the fyke net fishery. Sets of fyke nets, deployed for the entire fishing season and attached to wooden poles driven into the bottom, provide additional refuges for the round goby. *N. melanostomus* would occur less readily on a refuge-free bottom; in the Szczecin Lagoon, which would mean the presence of the round goby near the muddy bottom of the central part of the area, amenable to trawl fishing. Consequently, *N. melanostomus* appears in catches, particularly those affected by trawls, with a "time lag" relative to its appearance in the most suitable habitats (Sapota and Skóra 2005). It is worth remembering that the round gobies found in trawl catches were distinctly smaller than those retrieved from fyke nets. On the one hand, it could have been an effects of "selectivity" on the part of the fishermen (they would naturally retrieve large fish first), but, on the other hand, smaller individuals – chased away by the large, territorial fish – may emigrate only to appear near the muddy bottom of the open basin of the Lagoon (Sapota and Skóra 2005).

As shown by the preliminary observations made in 2009 in the Odra estuary as well as by examination of individuals collected, the round goby (*N. melanostomus*) has become a permanent and abundant component of the fish fauna in the northern part of the Szczecin Lagoon. The species forms a substantial by-catch; the fishermen report removing several, tens, or even hundreds of individuals from fyke net sets serviced by a single boat. The round goby is at times so abundant that the fishermen do not throw out the individuals found overboard, but bring them back to shore, to be destroyed there as undesirable "pests". The abundance of the round goby and its wide size range (all the length classes previously recorded in the Baltic were present) provide supporting evidence that, in the Odra estuary, the round goby has formed a local, strong, and reproducing population.

A subsequent comprehensive study will examine the population's characteristics and its ecological role in the Odra estuary.

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