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THREE NEW RECORDS OF FISHES AND THEIR PARASITE FAUNA FROM POMERANIAN BAY, BALTIC SEA

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Abstract. This paper reports the occurrence of three new fish species, extremely rare in the Baltic Sea, and provides new data on their parasite fauna. The fish collected were *Barbus barbus* (Linnaeus, 1758), *Salvelinus fontinalis* (Mitchill, 1814), and *Scophthalmus rhombus* (Linnaeus, 1758). Their taxonomic identity was confirmed through genetic analyses using DNA extracted from fin clips. The stomach contents were examined, and age was determined by otolith or scale readings. Parasitological examinations focused on the skin, vitreous humour, eye lenses, mouth and nasal cavities, gills, gonads, viscera, and muscles. Furthermore, the changes of fish species composition over 20 years in Pomeranian Bay were analysed. The sequence comparisons against GenBank records revealed that sequences obtained for *B. barbus* and *S. rhombus* from Pomeranian Bay represent new rhodopsin barcodes. Record of the juvenile *B. barbus* in this study is the first in the Baltic Sea. *Scophthalmus rhombus* is a new host for the ciliate *Trichodina jadranica*, while *Neogobius melanostomus* (Pallas, 1814) is a new food item in the diet of *S. rhombus* in the Baltic Sea. Acanthocephalan *Pomphorhynchus laevis* found in the adult specimen of *B. barbus* and myxozoan *Myxobolus musculi*, noted in the juvenile specimen, have not been recorded previously in this fish species in Polish waters. Species collected as bycatch can potentially be used for monitoring potential changes in the overall fish community structure and biodiversity.

Keywords: *Neogobius melanostomus*, *Salvelinus fontinalis*, *Barbus barbus*, *Scophthalmus rhombus*, ichthyofauna, Pomeranian Bay, parasite fauna

INTRODUCTION

Since the mid-1990s, the Baltic Marine Biologists (BMB) has encouraged research on non-commercial coastal fishes with regard to the occurrence, distribution, and the overall ecological status (Winkler et al. 2000, Więcaszek et al. 2015).

Pomeranian Bay (Bornholm Basin; ICES division IIId, subdivision SD 24), a highly dynamic environment, is a large, shallow basin off the Polish and German coasts, with the depth not exceeding 30 m. The salinity at the bottom layers ranges from 7.2‰** to 7.6‰ (mean 7.4‰), while at the surface layers it is 3.9‰–7.3‰ (mean 6.2‰). The water temperature at the bottom layers ranges from 7.0 to 22.3°C (mean 16.0°C), while at the surface layers it is 7.8–23.4°C (mean 16.4°C) (Abbas et al. 2015). Pomeranian Bay is a water-mixing region with two important factors: riverine water input and water exchange with adjacent open seawaters that influence the hydrological conditions of the area (Beszczyńska-Möller 1999). Data on the fish species composition of Pomeranian Bay quite recent, but the monitoring surveys in 2007–2008 and 2011–2015 conducted by Dudko et al. (2015) focused on commercial species, mainly *Clupea harengus* Linnaeus, 1758, *Sprattus sprattus* (Linnaeus, 1758), *Gadus morhua* Linnaeus, 1758, *Platichthys flesus* (Linnaeus, 1758), *Sander lucioperca* (Linnaeus, 1758), and *Perca fluviatilis* Linnaeus, 1758. However, since surveys usually collect many other species as bycatch, they can potentially be used to monitor changes in the overall fish community structure and biodiversity (Ojaveer et al. 2010). Generally, the information concerning fish species that are caught sporadically or are commercially insignificant is not available (Psuty-Lipska

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** In the wake of the growing criticism of the Practical Salinity Scale concept (and especially "PSU" as a "unit"), Acta Ichthyologica et Piscatoria is in favour of expressing salinity in parts per thousand (‰), regardless if a direct or indirect method was employed to determine the water salinity.

and Garbacik-Wesołowska 1998). In recent years, only Keszka and Raczyński (2002), Czerniejewski et al. 2008, Więcaszek et al. (2011, 2015), and Panicz and Keszka (2016) have presented results of studies on endangered, non-commercial, new, or visiting fish species recorded as bycatch during monitoring surveys in Pomeranian Bay. Next to nothing is known about the relations between the age and length, the diet, and the parasite fauna of the bycatch fishes from Pomeranian Bay.

The main objectives of the presently reported study were to

- Report on the occurrence of three new fish species captured as bycatch during monitoring surveys in 2014 and 2015.
- Provide the relevant biological data, especially concerning their parasite fauna.
- Present a checklist of the fish species recorded in Pomeranian Bay, thus contributing to the knowledge on the Pomeranian Bay biodiversity.

MATERIALS AND METHODS

The study material was collected in May 2014 and in May 2015 as bycatch during monitoring surveys focusing on commercial fish species. The survey was carried out in Pomeranian Bay from the research vessel *SNB-AR-1* (depicted on the back inner cover of this journal) with trawls (mesh size of 10–20 mm), at the depth of 9.8–14.6 m, over the sandy bottom (Table 1).

The fish collected were one juvenile and one adult specimen each of common barbel, *Barbus barbus* (Linnaeus, 1758) (Cyprinidae), one specimen of brook trout, *Salvelinus fontinalis* (Mitchill, 1814) (Salmonidae), and two specimens of brill, *Scophthalmus rhombus* (Linnaeus, 1758) (Scophthalmidae). All fish specimens collected were measured and weighed. The basic metric measurements and meristic counts of taxonomical significance were taken of each fish specimen and were used to identify the specimens to the species level according to taxonomical keys (Nielsen 1986, Kottelat and Freyhof 2007). The taxonomic identity of the specimens collected was confirmed through genetic analyses using DNA extracted from fin clips collected from frozen specimens. DNA was isolated using DNeasy Blood and Tissue Kit (Qiagen) following the manufacturer's instructions. The qualitative and quantitative assessments of the extracted DNA were conducted by measuring absorbance with a NanoDrop 2000 UV-VIS spectrophotometer (ThermoScientific). The DNA isolates were separated electrophoretically on 1.5% agarose gel. Subsequently, partial sequences of the rhodopsin gene (RH1) were amplified using Rod-F2W and Rod-R4n primers described in the paper by Sevilla et al. (2007). All PCRs were performed with REDTaq ReadyMix PCR Reaction Mix (Sigma-Aldrich) on a GeneAmp PCR System 9700 (Applied Biosystems), and PCR products separated on 1.5% agarose gel. Sequencing of the RH1 PCR products obtained was ordered from Genomed (Warsaw, Poland). Processing the raw sequence reads and further alignments against GenBank nucleotide records was performed using BioEdit and BLAST software, respectively (Altschul et al. 1990, Hall 1999).

The stomach contents were examined following commonly accepted methods, and age was determined by otolith or scale readings. Parasitological examinations focused on the skin, vitreous humour of the eye, eye lenses, mouth and nasal cavities, gills, gonads, gastrointestinal tract, kidneys, swim bladder, urinary bladder, gall bladder, peritoneum, and muscles. The parasites found were prepared for species determination by examining specimens in fresh mounts or after immersion in glycerin under transient light.

RESULTS

The meristic and metric characters of the taxonomic significance of the specimens examined are presented in Table 2.

The smaller specimen of *Barbus barbus* was a juvenile (aged 0+) measuring 7.23 cm SL (the caudal fin was destroyed), while the second specimen was a female (aged 4+) measuring 23.3 cm SL and 29.0 cm TL. Figure 1 shows the characteristic structure of the last dorsal fin (spinous, serrated along the entire posterior edge), which distinguished this common barbel from other *Barbus* species in Europe.

Only undetermined ingested remains were found in the barbel stomachs. Parasitological studies of the muscles of the juvenile specimen indicated the presence of spores of the myxozoan, *Myxobolus musculi*. In the anterior intestine of the adult barbel 17 specimens of *Pomphorhynchus laevis* were found. Additionally, there were four specimens of the nematode *Rhabdochona hellichi* in the mucus from the middle part of the intestine (Table 2).

The collected specimen of *Salvelinus fontinalis* was a female (4+) measuring 34.6 cm SL and 38.0 cm TL. The

Table 1

Characteristics of fish specimens collected as bycatch in 2014 and 2015 from Pomeranian Bay

Species	CS	Depth [m]	Date	SL [cm]	TL [cm]	Weight [g]	Age
Barbus barbus	A	9.8–11.9	6 May 2014	7.23		7.31	0+ S
Barbus barbus	B	9.8–14.6	18 May 2015	23.3	29.0	183.5	4+ S
Salvelinus fontinalis	B	9.8–14.6	18 May 2015	34.6	38.0	855.0	4+ O
Scophthalmus rhombus	A	9.8–11.9	6 May 2014		17.0	69.6	4+ O
Scophthalmus rhombus	A	9.8–11.9	6 May 2014		21.5	90.6	5+ O

CS = collection site, SL = standard length, TL = total length, A = 54°00′–54°01′N, 014°30′–014°35′E, B = 54°00′– 54°08′N, 014°20′–14°35′E, S = scale reading, O = otolith reading.

sagitta with annual rings (with lapilla and astriscus) from the specimen are presented in Fig. 2. The stomach was empty and no parasites were found.

The two specimens of *Scophthalmus rhombus* were males aged 4+ and 5+ that measured 17.0 and 21.5 cm TL, respectively. The sagitta with annual rings from the smaller specimen is presented in Fig. 3. Two invasive round gobies, *Neogobius melanostomus* (Pallas, 1814), (3.0 cm SL each) were noted in the stomach of this specimen. A single specimen of the ciliate *Trichodina*

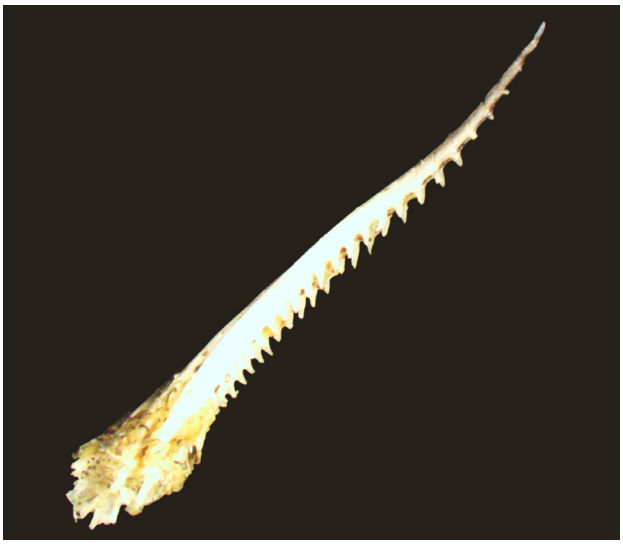

Fig. 1. Structure of the last dorsal fin ray (spinous, serrated along the entire posterior edge) of *Barbus barbus*, collected as bycatch in 2014 from Pomeranian Bay

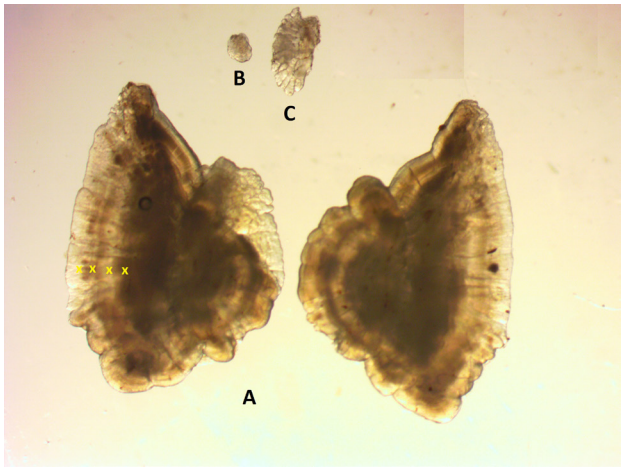

Fig. 2. Sagitta (**A**) with annual rings, lapillus (**B**) and asteriscus (**C**) of the specimen of *Salvelinus fontinalis*, collected as bycatch in 2015 from Pomeranian Bay

Table 2

Meristic and metric characters of taxonomical significance of *Barbus barbus*, *Salvelinus fontinalis*, and *Scophthalmus rhombus* specimens, collected as bycatch in 2014 and 2015 from Pomeranian Bay

Character	*Barbus barbus*	*Barbus barbus*	*Salvelinus fontinalis*	*Scophthalmus rhombus*
	6 May 2014	18 May 2015	18 May 2015	6 May 2014
Meristic characters				
Dorsal rays	IV, 8	III, 9	3/10	78
Anal rays	III, 5	III, 6	3/10	57
Pectoral rays	I, 17	I, 17	1/12	12
Ventral rays	II, 8	II, 8	1/7	6
Caudal rays	—	—	—	16
LL	56	56	—	—
Gill rakers	—	—	18	—
Pharyngeal teeth	5.3.1–1.3.5	5.3.1–1.3.5	—	—
Metric characters expressed as % of SL				
TL	—	—	—	123.19
HL	29.74	24.02	28.36	32.61
Maximum body depth	21.16	21.50	26.92	—
Minimum body depth	10.10	9.86	11.00	—
Head height	—	—	19.90	—
Body width	13.86	12.70	—	—
Metric characters expressed as % of HL				
Length of lower jaw	29.77	29.80	74.99	16.67
Length of upper jaw	—	—	69.48	—
Eye diameter	17.67	15.30	15.61	—
Interocular distance	25.58	30.27	—	—
Head height	56.74	60.91	67.35	27.54
Head width	43.26	49.26	—	—

LL = number of lateral line scales, TL = total length, HL = head length, SL = standard length.

jadranica, was found on the gills of the smaller fish (Table 2). The morphometric characteristics of the unfixed parasite showed that the adhesive disc diameter was of 35 µm, and had 24 denticles. The stomach of the larger specimen was empty, and no parasites were found.

Genetic analyses confirmed the taxonomic identity of the common barbel, brook trout, and brill specimens collected in Pomeranian Bay. Sequence alignments revealed that the RH1 sequences of *B. barbus* and *S. rhombus* did not match records in the GenBank sequence database; therefore, they were submitted under accession numbers KX980421 and KX980422, respectively. BLAST search revealed that RH1 sequence of *B. barbus* and *S. rhombus* differed by 5 bp and 1 bp from the most similar sequences (99%) found in the GenBank submitted under FJ197049.1 and EU638005.1 accession numbers, respectively. Both sequences obtained in this study are the first error-free records of RH1 gene available in GenBank for these species.

DISCUSSION

Three species described in this paper, *Barbus barbus*, *Salvelinus fontinalis*, and *Scophthalmus rhombus*, were noted for the first time in Pomeranian Bay. Values of the morphological characters of the specimens were consistent with the ranges provided by Nielsen (1986) and Kottelat and Freyhof (2007).

We prepared a checklist with 56 fish and two lamprey species reported from Pomeranian Bay, and among these 58 species, 35 species are marine, 13 are freshwater, and 10 are diadromous. Dudko et al. (2015) reported the occurrence of 41 fish and one lamprey species in Pomeranian Bay, with *Sprattus sprattus*, *Osmerus eperlanus* (Linnaeus, 1758), and *Platichthys flesus* dominating the catches (jointly 66% in terms of numbers). Psuty-Lipska and Garbacik-Wesołowska (1998) and Dudko et al. (2015) reported different fish species composition in Pomeranian Bay, which probably depended on the season and the distance from land. The checklist of fish and lamprey species in Pomeranian Bay, is presented in Table 3. Dudko et al. (2015) listed two species of the Gobiidae as permanent residents of Pomeranian Bay: *Pomatoschistus minutus* (Pallas, 1770) and *Neogobius melanostomus*. The abundance of the latter species has increased markedly since 2007–2008. First catches of this species were recorded in the area in 2003 (Winkler 2006), confirmed by our own study in 2006 (authors' unpublished data). In this study *Neogobius melanostomus* was found as a new food item in the diet of *Scophthalmus rhombus*, thus becoming a new and important link in the trophic structure of Pomeranian Bay. It was previously reported as a new prey for predatory fish like *Gadus morhua*, *Perca fluviatilis*, *Sander lucioperca* in Pomeranian Bay (Dąbrowski et al. 2017).

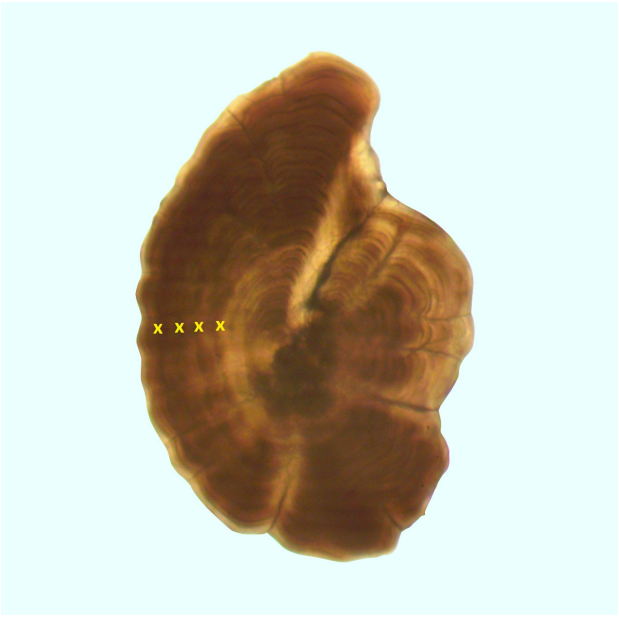

Fig. 3. Sagitta with annual rings of the smaller specimen of *Scophthalmus rhombus*, collected as bycatch in 2014 from Pomeranian Bay

Two of the three new species, *Barbus barbus* and *Salvelinus fontinalis*, are freshwater fishes. The natural habitat of *B. barbus* are the upper and middle sections of fast flowing streams. This fish occurs in some Pomeranian rivers and lakes that are linked to the Baltic Sea. There is no evidence that barbel reproduces in the Baltic Sea. It only occurs intermittently in estuaries and brackish waters, e.g., in the Curonian Lagoon (Ådjers et al. 2006) or in the Gulf of Gdańsk (Skóra 1996). According to Thiel et al. (2013), adult *B. barbus* are encountered occasionally in the Baltic Sea coastal zone, but they do not occur in the coastal zones of the North Sea. *Barbus barbus* is considered a typical stenohaline freshwater species (Calin Sandu and Oprea 2013). This can be explained by a strong, permanent input of riverine waters to the coastal waters of Pomeranian Bay (Beszczyńska-Möller 1999).

Salvelinus fontinalis is an indigenous species of the north-eastern United States and Canada. It has also been released (intentionally or not) into different bodies of water (including brackish water) worldwide, where it is usually regarded as an invasive species. Some individuals commonly referred to as salters, move to the sea in the spring as stream temperatures rise, and they inhabit areas close to river mouths (Beitinger and Bennett 2000). In Europe, only non-anadromous populations are recorded (Kottelat and Freyhoff 2007), however, the non-migratory forms, when introduced directly into seawater, well adapt to salinity changes (Besner and Pelletier 1991). It is classified as a non-native species that was intentionally introduced for fishing and angling in the late nineteenth century in Baltic Sea drainage basin countries (Leppäkoski and Olenin 2000). Since then, escapees from hatcheries and aquaculture facilities located along the coast of the Baltic have been reported (Welcomme 1992).

Scophthalmus rhombus is a marine species, distributed from Norway to the Black Sea. According to Nielsen (1986) and Anonymous (2014), in the Baltic Sea, *S. rhombus* is distributed primarily in the western part, however, Heessen et al. (2015) noted its regular occurrence off Cape Arkona and around Bornholm. The eastern limit of its range has yet to be clearly defined. Skóra (1996) reported its presence in the Gulf of Gdańsk, but he categorized it as an extremely rare species. Grygiel (2009) described a

Table 3

A checklist of fishes and lampreys recorded in Pomeranian Bay

Family	Species	Reference
Petromyzontidae	*Lampetra fluviatilis* (Linnaeus, 1758)	Dudko et al. 2015
		Więcaszek et al. 2015
	Petromyzon marinus Linnaeus, 1758	Więcaszek et al. 2015
Etmopteridae	*Etmopterus spinax* (Linnaeus, 1758)	Więcaszek et al. 2018
Acipenseridae	*Acipenser gueldenstaedtii* Brandt et Ratzeburg, 1833	Keszka and Heese 2003
Anguillidae	*Anguilla anguilla* (Linnaeus, 1758)	Dudko et al. 2015
Engraulidae	*Engraulis encrasicolus* (Linnaeus, 1758)	Dudko et al. 2015
Clupeidae	*Alosa fallax* (Lacepède, 1803)	Krzykawski et at. 2001
	Clupea harengus Linnaeus, 1758	Dudko et al. 2015
	Sprattus sprattus (Linnaeus, 1758)	Dudko et al. 2015
Cyprinidae	*Abramis brama* (Linnaeus, 1758)	Dudko et al. 2015
	Alburnus alburnus (Linnaeus, 1758)	Dudko et al. 2015
	Ballerus ballerus (Linnaeus, 1758)	Dudko et al. 2015
	Barbus barbus (Linnaeus, 1758)	This study
	Blicca bjoerkna (Linnaeus, 1758)	Dudko et al. 2015
	Rutilus rutilus (Linnaeus, 1758)	Dudko et al. 2015
	Scardinius erythrophthalmus (Linnaeus, 1758)	Dudko et al. 2015
	Vimba vimba (Linnaeus, 1758)	Dudko et al. 2015
	Osmerus eperlanus (Linnaeus, 1758)	Dudko et al. 2015
Salmonidae	*Coregonus maraena* (Bloch, 1779)	Dudko et al. 2015
	Salmo trutta Linnaeus, 1758	Dudko et al. 2015
	Salvelinus fontinalis (Mitchill, 1814)	This study
Esocidae	*Esox lucius* Linnaeus, 1758	Dudko et al. 2015
Gadidae	*Gadus morhua* Linnaeus, 1758	Dudko et al. 2015
	Merlangius merlangus (Linnaeus, 1758)	Dudko et al. 2015
	Pollachius virens (Linnaeus, 1758)	Krzykawski et at. 2001
Lotidae	*Enchelyopus cimbrius* (Linnaeus, 1766)	Więcaszek et al. 2015
	Lota lota (Linnaeus, 1758)	Dudko et al. 2015
Mugilidae	*Chelon labrosus* (Risso, 1827)	Czerniejewski et al. 2008
		Więcaszek et al. 2011
	Chelon ramada (=*Liza ramada*) (Risso, 1827)	Panicz and Keszka 2016
Belonidae	*Belone belone* (Linnaeus, 1760)	Dudko et al. 2015
Gasterosteidae	*Gastereosteus aculeatus* Linnaeus, 1758	Dudko et al. 2015
	Spinachia spinachia (Linnaeus, 1758)	Więcaszek et al. 2015
Syngnathidae	*Nerophis ophidion* (Linnaeus, 1758)	Więcaszek et al. 2015
	Syngnathus typhle Linnaeus, 1758	Więcaszek et al. 2015
Triglidae	*Chelidonichthys lucerna* (Linnaeus, 1758)	Krzykawski et at. 2001
		Więcaszek et al. 2011
Cottidae	*Myoxocephalus scorpius* (Linnaeus, 1758)	Dudko et al. 2015
Agonidae	*Agonus cataphractus* (Linnaeus, 1758)	Więcaszek et al. 2015
Cyclopteridae	*Cyclopterus lumpus* Linnaeus, 1758	Dudko et al. 2015
		Więcaszek et al. 2015
Moronidae	*Dicentrarchus labrax* (Linnaeus, 1758)	Krzykawski et at. 2001
Percidae	*Gymnocephalus cernua* (Linnaeus, 1758)	Dudko et al. 2015
	Perca fluviatilis Linnaeus, 1758	Dudko et al. 2015
	Sander lucioperca (Linnaeus, 1758)	Dudko et al. 2015
Carangidae	*Trachurus trachurus* (Linnaeus, 1758)	Więcaszek et al. 2011
Mullidae	*Mullus surmuletus* Linnaeus, 1758	Więcaszek et al.2011
Labridae	*Labrus bergylta* Ascanius, 1767	Keszka and Raczyński 2002
Zoarcidae	*Zoarces viviparus* (Linnaeus, 1758)	Dudko et al. 2015
Pholidae	*Pholis gunnellus* (Linnaeus, 1758)	Więcaszek et al. 2015
Ammodytidae	*Ammodytes tobianus* Linnaeus, 1758	Dudko et al. 2015
	Hyperoplus lanceolatus (Le Sauvage, 1824)	Dudko et al. 2015

Table continues on next page.

Table 1 cont.

Family	Species	Reference
Trachinidae	*Trachinus draco* Linnaeus, 1758	Krzykawski et at. 2001
Gobiidae	*Neogobius melanostomus* (Pallas, 1814)	Dudko et al. 2015
	Pomatoschistus minutus (Pallas, 1770)	Dudko et al. 2015
Scombridae	*Scomber scombrus* Linnaeus, 1758	Dudko et al. 2015
Xiphiidae	*Xiphias gladius* Linnaeus, 1758	Krzykawski et at. 2001
Scophthalmidae	*Scophthalmus maximus* (Linnaeus, 1758)	Dudko et al. 2015
	Scophthalmus rhombus (Linnaeus, 1758)	This study
Pleuronectidae	*Platichthys flesus* (Linnaeus, 1758)	Dudko et al. 2015
	Pleuronectes platessa Linnaeus, 1758	Dudko et al. 2015

single specimen of *S. rhombus* from the mid-Polish coast, caught in 2008. Plikšs and Aleksejevs (1998) reported single occurrences of *S. rhombus* in Latvian waters in the 1960s. There have been only scarce published records on length–weight relations, age, and the reproductive biology of *S. rhombus* carried out in the Atlantic Ocean and the Adriatic Sea (Turan et al. 2016).

Scophthalmus rhombus is a commercially exploited species, but not in the Baltic Sea where it usually appears as bycatch, and its stocks are currently not regulated by the Total Allowable Catch (TAC) quotas. In 2012–2015 the landings in SD 24–32 were null while in 2016 they amounted to 1 t. Swedish and Danish landings for the period of 2012–2016 were null in SD 24–32, while German landings in SD 22 (Kiel Bight and Mecklenburg Bay) amounted to 2 t (no data for SD 24) (Anonymous 2017). It is unclear whether more than one stock of *S. rhombus* exists in the Baltic Sea, or if the Baltic population of *S. rhombus* is a part of a larger stock complex (Anonymous 2013). According to Blanquer et al. (1992), the weak geographic structure of brill seems to result from rapid re-colonization following the last ice age.

The growth rates of *S. rhombus* are slower in the northern parts of its distribution, and maturation is attained at shorter lengths; however, no precise data are available in the literature. In this study, the male specimens were aged 4+ and 5+ (17 and 21.5 cm TL), while in the Adriatic Sea males aged 4+ and 5+ attained from 38 to 40 cm TL (Arneri et al. 2001). ICES categorizes the brill stock as 'data limited' in the Baltic Sea, where the detailed information from ICES stakeholders is not available (Anonymous 2017).

Parasites were recorded in alimentary tracts of *B. barbus* and *S. rhombus*. Results of only a few studies on the parasites of wild *B. barbus* in Europe have been published. The following species were reported: monogeneans *Dactylogyrus carpathicus*, *D. malleus* (see Grabda-Kazubska and Pilecka-Rapacz 1987), *Diplozoon paradoxum*, *Gyrodactylus* sp. (see Malanowski 1951, Ergens 1976), the leech *Cystobranchus respirans* (see Bielecki et al. 2011), glochidia larvae of the bivalve *Sinanodonta woodiana* (see Douda et al. 2012), the intestinal fluke *Aspidogaster limacoides* (see Schludermann et al. 2005), intestinal cestodes *Caryophyllaeus brachycollis*, *C. laticeps*, *Khawia baltica*, acanthocephalans *Acanthocephalus lucii*, *Pomphorhynchus laevis* (see Djikanovic et al. 2010), *Neoechinorhynchus rutili* (see Moravec and Scholz 1994), *Acanthocephalus anguillae* (see Herlyn and Ehlers 2001), and the microsporean *Pleistophora longifilis* (see Bauer 1984). In the presently reported study, only one intramuscular parasite (*Myxobolus musculi*) was noted in the juvenile *B. barbus* specimen. *Myxobolus musculi* has been reported in barbel specimens from the Danube River (Molnár et al. 2012), but has not previously been recorded in this fish species in Poland, where *Myxobolus pfeifferi*, *M. cordis*, and *Eimeria carpelli* are known from cultured fish (Malanowski 1951). *Rhabdochona hellichi* presently found in the adult *B. barbus* specimen is a nematode that was reported from Polish waters in two host species, *Barbus barbus* and *Barbus peloponnesius* Valenciennes, 1842. Described by Janiszewska (1955) as *Rhabdochonoides barbi*, it was detected in rivers of southern Poland and since then it has probably not been observed. This is a stenoxenic nematode that requires an obligatory intermediate host such as the caddisfly larvae of the genus *Hydropsyche* (see Okulewicz et al. 2008) that inhabits only rivers and streams. Specimens of the acanthocephalan *P. laevis* penetrated the intestinal wall of the adult barbel. This parasite has not been recorded previously in this fish species in Poland, however, it is a common parasite of flounder in the brackish waters of the Baltic Sea (Chibani and Rokicki 2004).

There have been only few studies on parasitic fauna of *Scophthalmus rhombus*. The parasites recovered from this fish include a myxozoan intestinal parasite *Enteromyxum scophthalmi* (see Losada et al. 2014), tapeworms *Bothriocephalus scorpii* (see Renaud et al. 1984), and *B. andresi*, the trypanorhynch mesenteric cestode *Nybelinia lingualis*, the digenean *Derogenes varicus*, the acantocephalan *Acanthocephaloides propinquus* (see Eiras 2016), and two species of copepods, *Lepeophtheirus hippoglossi* (see Hayward and Ryland 2003) and *L. europaensis* (see Dawson et al. 2000). However, data from the Baltic Sea are lacking. The ciliate *Trichodina jadranica* noted in this study has not yet been recorded nor in this host neither in other fishes from the Pomeranian Bay area. This parasite is typical for *Platichthys flesus* recorded in the Kiel Bight (Dobberstein and Palm 2000), in the Gulf of Riga (Kirjušina and Vismanis 2007), and also in Danish eel farms on *Anguilla anguilla* (see Madsen et al. 2000). The diameter of the adhesive discs differs slightly among specimens from *P. flesus* and *A. anguilla*, and they also differ among individuals, but the differences are recognized as intraspecific variations. In Pomeranian Bay another species of *Trichodina* was found, namely

T. borealis in *P. flesus* (see Korlatowicz and Piasecki 2001), similarly like in the Gulf of Gdańsk (Chibani and Rokicki 2004). No ectoparasites were noted in this study, but they could have died because of their sensitivity to environmental changes from fresh to marine water.

The occurrence of *Barbus barbus* in Pomeranian Bay might have resulted from restocking activities and may represent the Oder River population. In recent years the density and the biomass of many rheophilous cyprinids have decreased considerably in many component river subsystems of the Oder River basin (Witkowski et al. 2007). In order to support the barbel population for over the past 15 years, a stocking program has been carried out by the Polish Angling Association in the West Pomeranian area*. In turn, the specimen of *Salvelinus fontinalis*, collected in this study, might have escaped from an aquaculture facility in Pomerania (Inter-boundary region of Poland and Germany). This could have happened, for example, when ponds were damaged during a severe thunderstorm, such as that reported in August 2017, when dozens of brook trout and sturgeon escaped into the Baltic Sea through the Pomeranian Grabowa River. Similarly, Keszka and Heese (2003) described two specimens of *Acipenser gueldenstaedtii* Brandt et Ratzeburg, 1833 in Pomeranian Bay that were likely escapees from fish farming facilities.

The occurrence of *Scophthalmus rhombus* specimens in Pomeranian Bay might be a result of its active migration from the Arkona or Bornholm areas or a passive translocation with inflows of higher-salinity waters from the western Baltic. A weak Major Baltic Inflow from the North Sea occurred in March 2014. Previously, two smaller inflow events in November 2013 and February 2014 affected the Bornholm Basin (Naumann et al. 2018). The presently reported occurrence of the fish specimens recorded for the first time in Pomeranian Bay can be related to stocking (*B. barbel*), aquaculture activities (*S. fontinalis*), the migratory behaviour of species, or inflows of higher-salinity waters from the western Baltic (*S. rhombus*).

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