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A check-list of parasites of percid fishes (Actinopterygii: Percidae) from the estuaries of the Polish coastal zone

J. MOROZINSKA-GOGOL

Department of Aquatic Ecology, Pomeranian Academy, ul. Arciszewskiego 22 b, 76-200 Słupsk, Poland,
E-mail: jolamorozinska@poczta.onet.pl

Summary

The present paper summarized data on parasites of percid fishes (Actinopterygii: Percidae), such as pike-perch, European perch and ruffe from estuaries of the Polish coastal zone are listed, based on published records and long-term surveys carried out by the author. Parasites are listed alphabetically, separately for each host and for each parasite group with notes on their location on the host and geographical distribution (with references). A total of 41 species (taxa) of parasites were recorded on pike-perch *Sander lucioperca* (6 Ciliophora, 1 Myxozoa, 1 Monogenea, 11 Digenea, 4 Cestoda, 6 Nematoda, 5 Acanthocephala, 1 Mollusca, 1 Hirudinea, 4 Copepoda and 1 Branchiura). European perch, *Perca fluviatilis*, harboured 60 parasites (6 Ciliophora, 4 Myxozoa, 1 Monogenea, 18 Digenea, 9 Cestoda, 10 Nematoda, 5 Acanthocephala, 1 Mollusca, 1 Hirudinea, 4 Copepoda and 1 Branchiura). Ruffe *Gymnocephalus cernuus* featured 43 parasites (1 Microsporidia, 7 Ciliophora, 3 Myxozoa, 1 Monogenea, 13 Digenea, 5 Cestoda, 8 Nematoda, 2 Acanthocephala, 1 Mollusca and 2 Copepoda).

Key words: parasites, Percidae, estuaries, Poland.

Introduction

There are two major estuaries at the Polish Baltic coast, namely the Oder River estuary emptying to the Pomeranian Bay and the Vistula River estuary associated with the Gulf of Gdańsk. The latter contains an inner shallow basin, known as - the Puck Bay. The Oder River estuary covers also the Szczecin Lagoon – and the Dąbie Lake. The major inland body of water within the Vistula River estuary in the Vistula Lagoon. A number of small estuaries, distributed along the Polish Baltic coast line include coastal lakes such as Koprowo, Liwia Łuża, Resko Przymorskie, Jamno, Bukowo, Kopań, Wicko, Gardno, Łebsko, Sarbsko, Żarnowieckie, and Drużno (Paturej, 2006). Two coastal

lakes, Łebsko and Gardno, are situated within the Słowiński National Park (Trojanowski *et al.*, 1991). Despite of similar origin, the estuaries on the Polish coast are characterised by different hydrological and hydrochemical conditions (Paturej, 2006; Trojanowski *et al.*, 1991). All Polish estuaries are located as mixo-mesohaline waters (Paturej, 2006). The organisms, including fish and parasites, inhabiting those bodies of water, exhibit a broad tolerance to frequently changing conditions, especially salinity and temperature.

The aim of this study was to present the parasite fauna of Percidae from the Polish coastal zone and complete knowledge on the distribution of parasites affecting percids.

Materials and Methods

The present checklist of fish parasites was prepared based on the data published from 1933 to 2006 and covering the Polish coastal zone (with great emphasis on the Szczecin Lagoon, Vistula Lagoon, Lake Drużno, and Gulf of Gdańsk) and based on the present author's own survey of the coastal lakes (Middle Coast). In 1945 Polish borders (including coastline) substantially changed. Length of the Polish coastline before 1945 was about 140 km, whereas 770 km is now (Figure 1).

European perch and pike-perch, studied by the present author, were collected from 2001 to 2006, from the coastal lakes Bukowo, Kopań, and Łebsko (unpublished data marked as JM-G in the text). The fish were purchased from commercial fishermen and examined for ectoparasites and endoparasites under a dissecting microscope. The examination included the skin, fins, gills, eyes (lens and vitreous humour), body cavity, and visceral organs (stomach, intestine, liver and gonads). The collected parasites were subjected to standard parasitological procedures (Bylund *et al.*, 1980).

Identification of metazoan parasites was aided by taxonomic keys (Gusev, 1985; Bauer, 1987; Pojmańska, 1991; Niewiadomska, 2003; Grabda-Kazubska & Okulewicz, 2005). Because of the high morphological similarity between metacercariae within the genus *Diplostomum* (cf. Niewiadomska, 1996, 2003), only the generic name is used. *Apatemon annuligerum* was regarded as a synonym of *A. gracilis* following the morphological and molecular evidence provided by Bell & Sommerville (2002) and Bell *et al.* (2002). Others authors, cited in the present check-list, identified their parasites based on morphological characters, except Kempster *et al.* (2006), who examined parasites morphologically, biometrically, and genetically. Parasites recorded on pike-perch, European perch and ruffe are listed with notes about their location on the host and distribution with references.

Results

1. Parasites of pike-perch, ("zander"), *Sander lucioperca* (Linnaeus, 1758)

Ciliophora

Aplosoma campanulata (Timofeev, 1962); location: gills, skin; distribution: Szczecin Lagoon (Pilecka-Rapacz, 1980).

Capriniana piscium (Bütschli, 1858); ("*Trichophrya piscium*") location: gills, distribution: Szczecin Lagoon (Pilecka-Rapacz, 1980).

Epistylis lwoffi Fauré-Fremiet, 1943; location: gills, distribution: Szczecin Lagoon (Pilecka-Rapacz, 1980).

Trichodina domerguei Wallengreen, 1897; location: gills; distribution: Vistula Lagoon (Grabda, 1971), Lake Drużno (Kozicka, 1959).

Trichodina nigra Lom, 1960; location: gills, skin, nostrils; distribution: Szczecin Lagoon (Pilecka-Rapacz, 1980).

Trichodinella epizootica (Raabe, 1950); location: gills, skin, nostrils; distribution: Szczecin Lagoon (Pilecka-Rapacz, 1980), Lake Drużno (Kozicka, 1959).

Myxozoa

Henneguya psorospermica Thélohan, 1895; location: gills; distribution: Szczecin Lagoon (Pilecka-Rapacz, 1980).

Monogenea

Ancyrocephalus paradoxus Creplin, 1839; location: gills; distribution: Lake Jamno (Prost, 1966), Lake Łebsko (JM-G), Gulf of Gdańsk (Rolbiecki & Rokicki, 1996), Vistula Lagoon (Rolbiecki, 2003).

Digenea

Apophallus donicus (Skrjabin et Lindtrop, 1919); metacercaria; location: encysted in fins and skin; distribution: Szczecin Lagoon, Lake Dąbie (Wierzbicka & Wierzbicki, 1973).

Azygia lucii (Müller, 1776); location: stomach; distribution: Gulf of Gdańsk (Rolbiecki & Rokicki, 1996).

Brachyphallus crenatus (Rudolphi, 1802); location: sto-

mach, intestine; distribution: Gulf of Gdańsk (Rokicki, 1975; Rolbiecki & Rokicki, 1996), Vistula Lagoon (Rolbiecki, 2003).

Bucephalus polymorphus Baer, 1827; location: intestine, stomach; distribution: Lake Łebsko (JM-G), Gulf of Gdańsk (Rokicki, 1975; Rolbiecki & Rokicki, 1996), Vistula Lagoon (Rolbiecki, 2003), Lake Drużno (Kozicka, 1959).

Bunoderia luciopercae (Müller, 1776); location: intestine, pyloric caeca; distribution: Lake Łebsko (JM-G), Gulf of Gdańsk (Rokicki, 1975; Rolbiecki & Rokicki, 1996), Vistula Lagoon (Rolbiecki, 2003), Lake Drużno (Kozicka, 1959).

Diplostomum spathaceum (Rudolphi, 1819); metacercaria; location: eye lens; distribution: Gulf of Gdańsk (Rolbiecki & Rokicki, 1996), Lake Drużno (Kozicka, 1958).

Diplostomum spp.; metacercaria; location: eye lens; distribution: Lakes Kopań and Łebsko (JM-G), Gulf of Gdańsk (Rolbiecki *et al.*, 1999), Vistula Lagoon (Rolbiecki *et al.*, 1999; Rolbiecki, 2003).

Ichthyocotylurus platycephalus (Creplin, 1825); metacercaria; location: intestine, heart wall, gills; distribution: Gulf of Gdańsk (Rolbiecki & Rokicki, 1996; Rolbiecki *et al.*, 1999), Vistula Lagoon (Rolbiecki *et al.*, 1999; Rolbiecki, 2003).

Rhipidocotyle illense (Ziegler, 1883); metacercaria and adult; location: metacercaria encysted in fins, adults intestine; distribution: Gulf of Gdańsk (Rokicki, 1975), Lake Drużno (Kozicka, 1958, 1959).

Rhipidocotyle campanula (Dujardin, 1845); location: intestine and pyloric caeca; distribution: Vistula Lagoon (Rolbiecki, 2003).

Tylodelphys clavata (von Nordmann, 1932); metacercaria; location: vitreous humour of eye; distribution: Lake Łebsko (JM-G), Gulf of Gdańsk (Rolbiecki & Rokicki, 1996; Rolbiecki *et al.*, 1999), Vistula Lagoon (Rolbiecki *et al.*, 1999; Rolbiecki, 2003), Lake Drużno (Kozicka, 1958, 1959).

Cestoda

Bothriocephalus scorpii Müller, 1776; plerocercoid, adult; location: intestine and pyloric caeca; distribution: Gulf of Gdańsk (Rokicki, 1975; Rolbiecki & Rokicki, 1996), Vistula Lagoon (Rolbiecki, 2003).

Caryophyllaeus laticeps (Pallas, 1781); location: intestine; distribution: Gulf of Gdańsk (Rokicki, 1975).

Eubothrium crassum (Bloch, 1779); plerocercoid; location: intestine; distribution: Vistula Lagoon (Rolbiecki, 2003).

Proteocephalus filicollis (Rudolphi, 1802); location: intestine and pyloric caeca; distribution: Vistula Lagoon (Rolbiecki, 2003).

Nematoda

Anguillicola crassus Kuwahara, Niimi et Itagaki, 1974; larvae; location: intestinal wall, liver, gonads; distribution: Vistula Lagoon (Rolbiecki, 2002, 2003).

Anisakis simplex (Rudolphi, 1809); larvae; location: body cavity; distribution: Vistula Lagoon (Rolbiecki & Rokicki,

2000; Rolbiecki, 2003).

Camallanus lacustris (Zoega, 1776); location: intestine; distribution: Lakes Kopań and Łebsko (JM-G), Gulf of Gdańsk (Rolbiecki & Rokicki, 1996), Vistula Lagoon (Rolbiecki, 2003), Lake Drużno (Kozicka, 1959).

Camallanus truncatus (Rudolphi, 1814); location: intestine and pyloric caeca; distribution: Lakes Bukowo and Łebsko (JM-G), Gulf of Gdańsk (Rokicki, 1975; Rolbiecki & Rokicki, 1996), Vistula Lagoon (Rolbiecki, 2003).

Cystidicoloides ephemericarum (Linstow, 1872); location: intestine; distribution: Vistula Lagoon (Rolbiecki, 2003).

Hysterothylacium aduncum (Rudolphi, 1802); larvae and adult; location: intestine, intestinal wall, peritoneum, liver; distribution: Gulf of Gdańsk (Rolbiecki & Rokicki, 1996), Vistula Lagoon (Rolbiecki, 2003).

Acanthocephala

Acanthocephalus lucii (Müller, 1776); location: intestine; distribution: Lake Łebsko (JM-G), Gulf of Gdańsk (Rokicki, 1975), Vistula Lagoon (Rolbiecki, 2003).

Corynosoma semerme (Forssel, 1904); cystacanth; location: intestinal wall; distribution: Gulf of Gdańsk (Rolbiecki & Rokicki, 1996; Rolbiecki et al., 1999), Vistula Lagoon (Rolbiecki et al., 1999; Rolbiecki, 2003).

Corynosoma strulosum (Rudolphi, 1802); cystacanth; location: intestinal wall; distribution: Gulf of Gdańsk (Rolbiecki et al., 1999), Vistula Lagoon (Rolbiecki et al., 1999; Rolbiecki, 2003).

Neoechinorhynchus rutili (Müller, 1780); location: intestine; distribution: Gulf of Gdańsk (Rolbiecki & Rokicki, 1996), Vistula Lagoon (Rolbiecki, 2003).

Pomphorhynchus laevis (Zoega, 1776); location: intestine; distribution: Gulf of Gdańsk (Rolbiecki & Rokicki, 1996).

Mollusca: Bivalvia

Unionidae gen sp.; glochidia; location: fins; distribution: Vistula Lagoon (Rolbiecki, 2003).

Hirudinea

Piscicola geometra (Linnaeus, 1758); location: skin, mouth cavity, gills; distribution: Vistula Lagoon (Rolbiecki, 2003).

Copepoda

Achtheres sandrae Gadd, 1901; location: gills; distribution: ("A. percarum") Dąbie Lake and Szczecin Lagoon (Piasecki, 1993a), Lake Dąbie (Kempter et al., 2006; Piasecki et al., 2006); ("Achtheres percarum"); location: gills, mouth cavity; distribution: Odra River estuary (Piasecki, 1993b), Lakes Kopań and Łebsko (JM-G), Lake Wicko (Kozikowska, 1957), Gulf of Gdańsk (Rolbiecki & Rokicki, 1996), Vistula Lagoon (Grabda, 1971; Rolbiecki, 2003).

Caligus lacustris Steenstrup et Lütken, 1861; chalimi and adults; location: chalimi on the fins, adults on the skin and in the mouth cavity; distribution: Lake Wicko (Kozikowska, 1957), Szczecin Lagoon (Piasecki, 1993a) Vistula Lagoon (Rolbiecki, 2003).

Ergasilus sieboldi von Nordmann, 1832; location: gills; distribution: Lakes Bukowo, Dąbie Lake and Szczecin Lagoon (Piasecki, 1993a), Kopań and Łebsko (JM-G), Gulf of Gdańsk (Rolbiecki & Rokicki, 1996), Vistula Lagoon (Grabda, 1971; Rolbiecki, 2003), Lake Drużno (Kozicka, 1959).

Branchiura

Argulus foliaceus (Linnaeus, 1758); location: gills; distribution: Dąbie Lake and Szczecin Lagoon (Piasecki, 1993a), Lake Łebsko (JM-G), Gulf of Gdańsk (Rolbiecki & Rokicki, 1996).

2. Parasites of European perch, *Perca fluviatilis* Linnaeus, 1758

Ciliophora

Apiosoma campalunata (Timofeev, 1962); location: gills, skin; distribution: Szczecin Lagoon (Pilecka-Rapacz, 1980).

Trichodina domerguei Wallengreen, 1897; location: gills; distribution: Vistula Lagoon (Grabda, 1971).

Trichodina nigra Lom, 1960; location: gills, skin, nostrils; distribution: Szczecin Lagoon (Pilecka-Rapacz, 1980).

Trichodina urinaria Dogiel, 1940; location: urinary tract; distribution: Szczecin Lagoon (Pilecka-Rapacz, 1980), Lake Resko (Sobecka & Romanowski, 1999), Lake Drużno (Kozicka, 1959).

Trichodina sp.; location: gills; distribution: Lake Resko (Wierzbicka et al., 2005).

Trichodinella epizootica (Raabe, 1950); location: gills, skin, nostrils; distribution: Szczecin Lagoon (Pilecka-Rapacz, 1980), Lake Resko (Wierzbicka et al., 2005).

Myxozoa

Henneguya creplini (Gurley, 1894); location: gills; distribution: Szczecin Lagoon (Romuk-Wodoracki, 1990).

Henneguya psorospermica Thélohan, 1895; location: gills; distribution: Szczecin Lagoon (Pilecka-Rapacz, 1980; Romuk-Wodoracki, 1990; Sobecka & Romanowski, 1999), Vistula Lagoon (Grabda, 1971; Rolbiecki, 2003).

Henneguya wolinenensis Romuk-Wodoracki, 1990; location: epidermis under scales; distribution: Szczecin Lagoon (Romuk-Wodoracki, 1990).

Myxobolus sp.; location: gills; distribution: Szczecin Lagoon (Sobecka & Romanowski, 1999), Vistula Lagoon (Grabda, 1971), Lake Drużno (Kozicka, 1959).

Monogenea

Ancyrocephalus paradoxus Creplin, 1839; location: gills; distribution: Lake Drużno (Kozicka, 1959).

Digenea

Apophallus donicus (Skrjabin et Lindtrop, 1919); metacercaria; location: encysted in fins and skin; distribution: Szczecin Lagoon, Lakes Dąbie and Resko (Wierzbicka & Wierzbicki, 1973).

Apatemon gracilis (Rudolphi, 1819) Szidat 1928;

(“*Apatemon annuligerum*”; “*Tetracotyle annuligerum*”); metacercaria; location: vitreous humour of eye; distribution: Lakes Bukowo, Kopań, and Łebsko (JM-G); (“*Apatemon annuligerum*”); location: vitreous humour of eye, brain, stomach; distribution: Lake Resko and adjacent area of the Baltic Sea (Wierzbicka *et al.*, 2005), Gulf of Gdańsk (Roliecki *et al.*, 1999), Vistula Lagoon (Roliecki *et al.*, 1999; Rolbiecki, 2003); (“*Tetracotyle annuligerum*”); location: vitreous humour of eye, brain; distribution: Lake Drużno (Kozicka, 1958).

Azygia lucii (Müller, 1776); location: intestine, stomach, pharynx; distribution: Lake Resko (Wierzbicka *et al.*, 2005), Lake Łebsko (JM-G), Gulf of Gdańsk (Rokicki, 1975), Lake Drużno (Kozicka, 1959).

Brachyphallus crenatus (Rudolphi, 1802); location: intestine; distribution: Lake Resko and adjacent area of the Baltic Sea (Wierzbicka *et al.*, 2005).

Bucephalus polymorphus Baer, 1827; location: intestine; distribution: Lake Resko (Wierzbicka *et al.*, 2005), Gulf of Gdańsk (Rokicki, 1975), Vistula Lagoon (Roliecki, 2003).

Bunodera luciopercae (Müller, 1776); location: intestine; distribution: Szczecin Lagoon (Sobecka & Romanowski, 1999), Lake Resko and adjacent area of the Baltic Sea (Wierzbicka *et al.*, 2005), Lake Łebsko (JM-G), Gulf of Gdańsk (Rokicki, 1975; Rolbiecki *et al.*, 2002), Vistula River mouth (Roliecki *et al.*, 2002), Vistula Lagoon (Roliecki, 2003), Lake Drużno (Kozicka, 1959).

Diplostomum spathaceum (Rudolphi, 1819); metacercaria; location: lens and vitreous humour of eye; distribution: Lake Drużno (Kozicka, 1958).

Diplostomum spp.; metacercaria; location: eye; distribution: Lake Resko and adjacent area of the Baltic Sea (Wierzbicka *et al.*, 2005), Lakes Kopań and Łebsko (JM-G), Gulf of Gdańsk (Roliecki *et al.*, 1999), Vistula River mouth (Roliecki *et al.*, 2002), Vistula Lagoon (Roliecki *et al.*, 1999; Rolbiecki, 2003).

Ichthyocylurus platycephalus (Creplin, 1825); metacercaria; location: intestine; distribution: Lake Resko (Wierzbicka *et al.*, 2005), Gulf of Gdańsk (Roliecki *et al.*, 1999), Vistula Lagoon (Roliecki *et al.*, 1999; Rolbiecki, 2003).

Ichthyocylurus variegatus (Creplin, 1825); metacercaria; location: peritoneal cavity, peritoneum, intestine; distribution: Lake Resko and adjacent area of the Baltic Sea (Wierzbicka *et al.*, 2005), Vistula Lagoon (Roliecki *et al.*, 1999; Rolbiecki, 2003).

Nicolla skryabini (Ivanitzky, 1928); location: intestine; distribution: Lake Resko (Wierzbicka *et al.*, 2005), Gulf of Gdańsk (Rokicki, 1975).

Phyllodistomum pseudofolium Nybelin, 1926; location: urinary bladder, distribution: Lake Resko (Wierzbicka *et al.*, 2005).

Posthodiplostomum brevicaudatum (von Nordmann, 1832); metacercaria; location: eye; distribution: Lake Łebsko (JM-G), Vistula Lagoon (Roliecki *et al.*, 1999; Rolbiecki, 2003), Lake Drużno (Kozicka, 1958).

Posthodiplostomum cuticola (von Nordmann, 1832);

metacercaria; location: stomach; distribution: Lake Resko and adjacent area of the Baltic Sea (Wierzbicka *et al.*, 2005).

Rhipidocotyle illense (Ziegler, 1883); metacercaria and adult; location: metacercaria encysted in fins, intestine for adult; distribution: Gulf of Gdańsk (Rokicki, 1975), Lake Drużno (Kozicka, 1958, 1959).

Rhipidocotyle campanula (Dujardin, 1845); location: intestine; distribution: Lake Resko and adjacent area of the Baltic Sea (Wierzbicka *et al.*, 2005).

Tylodelphys clavata (von Nordmann, 1932); metacercaria; location: vitreous humour of eye, brain; distribution: Szczecin Lagoon (Sobecka & Romanowski, 1999), Lake Resko and adjacent area of the Baltic Sea (Wierzbicka *et al.*, 2005), Lakes Bukowo, Kopań and Łebsko (JM-G), Gulf of Gdańsk (Roliecki *et al.*, 1999, 2002), Vistula River mouth (Roliecki *et al.*, 2002), Vistula Lagoon (Roliecki *et al.*, 1999; Rolbiecki, 2003), Lake Drużno (Kozicka, 1958).

Tylodelphys podicipina Kozicka et Niewiadomska, 1960; metacercaria; location: vitreous humour of eye; distribution: Lake Drużno (Kozicka & Niewiadomska, 1960).

Cestoda

Bothriocephalus scorpii (Müller, 1776); location: intestine, stomach; distribution: Lake Resko and adjacent area of the Baltic Sea (Wierzbicka *et al.*, 2005), Lake Łebsko (JM-G), Gulf of Gdańsk (Rokicki, 1975).

Diphyllothrium latum (Linnaeus, 1758); plerocercoid; location: liver; distribution: Szczecin Lagoon (Sobecka & Romanowski, 1999), Lake Drużno (Kozicka, 1959).

Eubothrium crassum (Bloch, 1779); plerocercoid; location: intestine; distribution: Szczecin Lagoon (Sobecka & Romanowski, 1999), Vistula River mouth (Roliecki *et al.*, 2002), Vistula Lagoon (Roliecki, 2003).

Ligula sp.; plerocercoid; location: intestine, stomach; distribution: the Baltic Sea near Dźwirzyno (Wierzbicka *et al.*, 2005).

Proteocephalus filicollis (Rudolphi, 1802); location: intestine and pyloric caeca; distribution: Lake Łebsko (JM-G), Vistula Lagoon (Roliecki, 2003).

Proteocephalus percae (Müller, 1780); location: intestine; distribution: Szczecin Lagoon (Sobecka & Romanowski, 1999), Lake Resko and adjacent area of the Baltic Sea (Wierzbicka *et al.*, 2005), Lake Łebsko (JM-G), Baltic Sea near Hel (Markowski, 1933), Gulf of Gdańsk (Rokicki, 1975), Vistula River mouth (Roliecki *et al.*, 2002), Vistula Lagoon (Roliecki, 2003), Lake Drużno (Kozicka, 1959).

Proteocephalus sp.; location: intestine; distribution: Lake Drużno (Kozicka, 1959).

Triaenophorus crassus Forel, 1868; plerocercoid; location: encysted in liver; distribution: Gulf of Gdańsk (Rokicki, 1975).

Triaenophorus nodulosus (Pallas, 1781); plerocercoid and adult; location: liver, body cavity for plerocercoid, intestine for adult; distribution: Szczecin Lagoon (Sobecka

& Romanowski, 1999), Lake Resko and adjacent area of the Baltic Sea (Wierzbicka *et al.*, 2005), Lakes Bukowo and Łebsko (JM-G), Baltic Sea near Hel (Markowski, 1933), Gulf of Gdańsk (Rokicki, 1975; Rolbiecki *et al.*, 2002), Vistula River mouth (Rolbiecki *et al.*, 2002), Vistula Lagoon (Rolbiecki, 2003).

Nematoda

Anguillilcola crassus Kuwahara, Niimi et Itagaki, 1974; larvae; location: intestinal wall, liver, gonads; distribution: Vistula Lagoon (Rolbiecki, 2002, 2003).

Anisakis simplex (Rudolphi, 1809); larvae; location: body cavity; distribution: Vistula Lagoon (Rolbiecki, 2003).

Camallanus lacustris (Zoega, 1776); location: intestine and pyloric caeca; distribution: Lake Resko and adjacent area of the Baltic Sea (Wierzbicka *et al.*, 2005), Lake Gardno (Grabda, 1971), Lake Łebsko (JM-G), Gulf of Gdańsk (Rokicki, 1975), Vistula River mouth (Rolbiecki *et al.*, 2002), Vistula Lagoon (Rolbiecki, 2003), Lake Drużno (Kozicka, 1959).

Camallanus truncatus (Rudolphi, 1814); location: intestine and pyloric caeca; distribution: Lakes Kopań and Łebsko (JM-G), Gulf of Gdańsk, Vistula River mouth (Rolbiecki *et al.*, 2002), Vistula Lagoon (Rolbiecki, 2003).

Cucullanus sp.; location: intestine; distribution: Lake Resko and adjacent area of the Baltic Sea (Wierzbicka *et al.*, 2005).

Cystidicoloides ephemeridarum (Linstow, 1872); location: intestine; distribution: Vistula Lagoon (Rolbiecki, 2003).

Desmidocercella numidica (Seurat, 1920); larvae; location: vitreous humour of eye; distribution: Lake Drużno (Kozicka, 1959).

Eustrongylides excisus Jägerskiöld, 1909; larvae; location: encysted in the intestine; distribution: Lake Resko and adjacent area of the Baltic Sea (Wierzbicka *et al.*, 2005).

Hysterothylacium aduncum (Rudolphi, 1802); larvae and adult; location: intestine, intestinal wall, peritoneum, liver; distribution: Szczecin Lagoon (Sobecka & Romanowski, 1999), Lake Resko and adjacent area of the Baltic Sea (Wierzbicka *et al.*, 2005), Lakes Bukowo and Łebsko (JM-G), Gulf of Gdańsk (Rolbiecki *et al.*, 2002), Vistula River mouth (Rolbiecki *et al.*, 2002), Vistula Lagoon (Rolbiecki, 2003); ("*Contraeaeum aduncum*"); location: intestine; distribution: Baltic Sea near Hel (Markowski, 1933), Gulf of Gdańsk (Rokicki, 1975).

Raphidascaris acus (Bloch, 1779); location: intestine; distribution: Lake Łebsko (JM-G), Vistula Lagoon (Rolbiecki, 2003).

Acanthocephala

Acanthocephalus clavula (Dujardin 1845); location: intestine; distribution: Lake Kopań (JM-G), Gulf of Gdańsk (Rolbiecki *et al.*, 2002),

Acanthocephalus lucii (Müller, 1776); location: intestine and pyloric caeca; distribution: Lake Resko and adjacent area of the Baltic Sea (Wierzbicka *et al.*, 2005), Lake Łebsko (JM-G), Gulf of Gdańsk (Rokicki, 1975; Rolbiecki *et al.*, 2002), Vistula River mouth (Rolbiecki *et al.*, 2002),

Vistula Lagoon (Rolbiecki, 2003), Lake Drużno (Styczyńska, 1958; Wiśniewski, 1958; Kozicka, 1959).

Echinorhynchus gadi (Müller, 1776); location: intestine; distribution: Szczecin Lagoon (Sobecka & Romanowski, 1999), Lake Resko and adjacent area of the Baltic Sea (Wierzbicka *et al.*, 2005).

Neoechinorhynchus rutili (Müller, 1780); location: intestine; distribution: Lake Resko and adjacent area of the Baltic Sea (Wierzbicka *et al.*, 2005), Lake Łebsko (JM-G), Gulf of Gdańsk (Rokicki, 1975).

Pomphorhynchus laevis (Zoega, 1776); location: intestine; distribution: Lake Łebsko (JM-G).

Mollusca: Bivalvia

Unionidae gen sp.; glochidia; location: gills, fins; distribution: Szczecin Lagoon (Sobecka & Romanowski, 1999), Lake Resko and adjacent area of the Baltic Sea (Wierzbicka *et al.*, 2005), Vistula Lagoon (Rolbiecki, 2003).

Hirudinea

Piscicola geometra (Linnaeus, 1758); location: operculum, gills, skin, mouth cavity; distribution: Szczecin Lagoon (Sobecka & Romanowski, 1999), Lake Łebsko (JM-G), Vistula Lagoon (Grabda, 1971; Rolbiecki, 2003).

Copepoda

Achtheres percarum von Nordmann, 1832; location: gills, buccal cavity; distribution: Szczecin Lagoon (Kozikowska, 1957), Lake Dąbie (Kempter *et al.*, 2006; Piasecki *et al.*, 2006; Piasecki & Kuźmińska, 2007), Lake Resko and adjacent area of the Baltic Sea (Wierzbicka *et al.*, 2005), Lake Kopań (JM-G), Mouth of Vistula River (Grabda, 1967; Rolbiecki *et al.*, 2002), Vistula Lagoon (Grabda, 1971), Lake Drużno (Kozicka, 1959).

Caligus lacustris Steenstrup et Lütken, 1861; chalimi and adults; location: chalimi on the fins, adults on the skin and in the mouth cavity; distribution: Vistula Lagoon (Rolbiecki, 2003).

Ergasilus sieboldi von Nordmann, 1832; location: gills; distribution: Lake Wicko (Kozikowska, 1957), Lakes Kopań and Łebsko (JM-G), Vistula Lagoon (Grabda, 1971; Rolbiecki, 2003), Lake Drużno (Kozicka, 1958, 1959).

Ergasilus sp.; location: gills; distribution: Lake Resko and adjacent area of the Baltic Sea (Wierzbicka *et al.*, 2005).

Branchiura

Argulus foliaceus (Linnaeus, 1758); location: skin, gills, mouth; distribution: Lake Resko (Wierzbicka *et al.*, 2005), Lake Wicko (Kozikowska, 1957), Vistula Lagoon (Grabda, 1971), Lake Drużno (Kozicka, 1959).

3. Parasites of ruffe, *Gymnocephalus cernuus* (Linnaeus, 1758)

Microsporidia

Glugea acerinae Jirovec, 1930; location: whitish, intestinal

wall; distribution: Szczecin Lagoon (Wierzbicka et al., 1982), Vistula Lagoon (Roliecki, 2003).

Myxozoa

Henneguya creplini (Gurley, 1894); location: gills; distribution: Vistula Lagoon (Grabda, 1971).

Myxobolus magnus Awerinew, 1913; location: vitreous humour of eye, iris; distribution: Szczecin Lagoon (Wierzbicka et al., 1982).

Myxobolus muelleri Bütschli, 1882; location: kidney; distribution: Szczecin Lagoon (Wierzbicka et al., 1982).

Ciliophora

Apiosoma campalunata (Timofeev, 1962); location: gills, skin; distribution: Szczecin Lagoon (Pilecka-Rapacz, 1980).

Capriniana piscium Bütschli, 1858; ("*Trichophrya piscium*") location: gills, distribution: Szczecin Lagoon (Pilecka-Rapacz, 1980).

Epistylis lwoffi Fauré-Fremiet, 1943; location: gills, distribution: Szczecin Lagoon (Pilecka-Rapacz, 1980).

Trichodina domerguei Wallengreen, 1897; location: gills; distribution: Vistula Lagoon (Grabda, 1971).

Trichodina domerguei f. *esocis* Lom, 1960; location: gills, skin; distribution: Szczecin Lagoon (Pilecka-Rapacz, 1980).

Trichodina nigra Lom, 1960; location: gills, skin, nostrils; distribution: Szczecin Lagoon (Pilecka-Rapacz, 1980).

Trichodinella epizootica (Raabe, 1950); location: gills, skin, nostrils; distribution: Szczecin Lagoon (Pilecka-Rapacz, 1980; Wierzbicka et al., 1982).

Monogenea

Dactylogyrus amphibothrium Wagener, 1857; location: gills; distribution: Szczecin Lagoon (Wierzbicka et al., 1982), Vistula Lagoon (Roliecki, 2003).

Digenea

Apophallus donicus (Skrjabin et Lindtrop, 1919); metacercaria; location: encysted in the caudal fin and on the dorsal side skin; distribution: Szczecin Lagoon (Wierzbicka & Wierzbicki, 1973; Wierzbicka et al., 1982), Lake Dąbie (Wierzbicka & Wierzbicki, 1973).

Bucephalus polymorphus Baer, 1827; metacercaria and adult; location: metacercaria encysted in muscles close to the caudal fin and in the fin, gills and around the urinary bladder, adult in intestine; distribution: Szczecin Lagoon (Wierzbicka et al., 1982).

Bunodera luciopercae (Müller, 1776); location: intestine; distribution: Szczecin Lagoon (Wierzbicka et al., 1982), Gulf of Gdańsk (Rokicki, 1975), Lake Drużno (Kozicka, 1959).

Crepidostomum farionis (Müller, 1784); location: intestine; distribution: Szczecin Lagoon (Wierzbicka et al., 1982).

Diplostomum spathaceum (Rudolphi, 1819); metacercaria; location: lens and sometimes vitreous humour of eye; distribution: Lake Drużno (Kozicka, 1958).

Diplostomum spp.; metacercaria; location: eye lens; distribution: Szczecin Lagoon (Wierzbicka et al., 1982), Vistula Lagoon (Roliecki et al., 1999; Rolbiecki, 2003).

Ichthyocotylurus platycephalus (Creplin, 1825); metacercaria; location: various internal organs, most often in the heart; distribution: Szczecin Lagoon (Wierzbicka et al., 1982), Vistula Lagoon (Roliecki et al., 1999; Rolbiecki, 2003).

Ichthyocotylurus variegatus (Creplin, 1825); metacercaria; location: various internal organs, most often in the swim bladder and peritoneal membrane, also the urinary bladder, liver, intestine, around the heart; distribution: Szczecin Lagoon (Wierzbicka et al., 1982), Vistula Lagoon (Roliecki et al., 1999; Rolbiecki, 2003).

Nicolla skrabini (Ivanitzky, 1928); location: intestine; distribution: Szczecin Lagoon (Wierzbicka et al., 1982), Gulf of Gdańsk (Rokicki, 1975).

Phyllodistomum folium (Olfers, 1816); location: urinary bladder; distribution: Szczecin Lagoon (Wierzbicka et al., 1982).

Phyllodistomum pseudofolium Nybelin, 1926; location: urinary bladder; distribution: Szczecin Lagoon (Wierzbicka et al., 1982).

Rhipidocotyle illense (Ziegler, 1883); metacercaria and adult; location: metacercaria encysted in fins, adult in intestine; distribution: Lake Drużno (Kozicka, 1958, 1959).

Tylocephalys clavata (von Nordmann, 1932); metacercaria; location: vitreous humour of eye; distribution: Szczecin Lagoon (Wierzbicka et al., 1982), Vistula Lagoon (Roliecki et al., 1999; Rolbiecki, 2003), Lake Drużno (Kozicka, 1958).

Cestoda

Bothriocephalus scorpii (Müller, 1776); location: intestine, stomach; distribution: Gulf of Gdańsk (Rokicki, 1975).

Caryophyllaeus laticeps (Pallas, 1781); location: intestine; distribution: Szczecin Lagoon (Wierzbicka et al., 1982), Gulf of Gdańsk (Rokicki, 1975).

Eubothrium crassum (Bloch, 1779); plerocercoid; location: intestine; distribution: Vistula Lagoon (Roliecki, 2003).

Proteocephalus filicollis (Rudolphi, 1802); location: intestine and pyloric caeca; distribution: Vistula Lagoon (Roliecki, 2003).

Proteocephalus sp.; location: intestine; Szczecin Lagoon (Wierzbicka et al., 1982).

Nematoda

Anguillicola crassus Kuwahara, Niimi et Itagaki, 1974; larvae; location: intestinal wall, liver, gonads; distribution: Vistula Lagoon (Roliecki, 2002, 2003).

Camallanus lacustris (Zoega, 1776); location: intestine; distribution: Lake Drużno (Kozicka, 1959).

Camallanus truncatus (Rudolphi, 1814); location: intestine; distribution: Gulf of Gdańsk (Rokicki, 1975).

Eustrongylides mergorum (Rudolphi, 1809); larvae; location: encysted on the intestine; distribution: Vistula Lagoon (Roliecki et al., 1999; Rolbiecki, 2003).

Eustrongylides sp.; larvae; location: encysted on the

external intestinal wall; distribution: Szczecin Lagoon (Wierzbicka *et al.*, 1982).

Hysterothylacium aduncum (Rudolphi, 1802); larvae; location: intestinal wall, peritoneum, liver; distribution: Vistula Lagoon (Rolbiecki, 2003).

Schulmanella petruschewskii (Schulman, 1948); ("*Capillaria petruschewskii*") location: liver; distribution: Szczecin Lagoon (Wierzbicka *et al.*, 1982); Vistula Lagoon (Rolbiecki, 2003).

Acanthocephala

Acanthocephalus anguillae (Müller, 1780); location: intestine; distribution: Szczecin Lagoon (Wierzbicka *et al.*, 1982).

Acanthocephalus lucii (Müller, 1776); location: intestine; distribution: Szczecin Lagoon (Wierzbicka *et al.*, 1982), Gulf of Gdańsk (Rokicki, 1975), Lake Drużno (Styczyńska, 1958; Wiśniewski, 1958; Kozicka, 1959).

Mollusca: Bivalvia

Unionidae gen sp.; glochidia; location: gills, fins; distribution: Vistula Lagoon (Rolbiecki, 2003).

Copepoda

Caligus lacustris Steenstrup et Lütken, 1861; location: skin, mouth cavity; distribution: Vistula Lagoon (Rolbiecki, 2003).

Ergasilus sieboldi von Nordmann, 1832; location: gills; distribution: Szczecin Lagoon (Kozikowska, 1957; Wierzbicka *et al.*, 1982), Vistula Lagoon (Grabda, 1971; Rolbiecki, 2003).

Discussion

The parasites found represented 60 species (taxa) of parasites on the European perch, 43 on the ruffe and 41 on the pike-perch. Percid fishes were noted as new intermediate host for *Anguillicola crassus* (Rolbiecki, 2002, 2003). Pike-perch and European perch, like the three-spined stickleback, were also proved to be a paratenic host for *Anisakis simplex* in the coastal waters (Rolbiecki & Rokicki, 2000; Rolbiecki, 2003; Morozińska-Gogol, 2006). Pike-perch and ruffe were shown to be a postcyclic hosts of caryophyllidean tapeworm *Caryophyllaeus laticeps*.

The parasite fauna of percid fishes consist of allogecnic parasites (*Apatemon gracilis*, *Diplostomum spathaceum*, *Diplostomum* spp., *Ichthyocotylurus platycephalus*, *Ichthyocotylurus variegatus*, *Posthodiplostomum brevicaudatum*, *Posthodiplostomum cuticola*, *Tylodelphys clavata*, *Tylodelphys podicipina*, *Diphyllothorium latum*, *Ligula* sp., *Anisakis simplex*, *Desmidocercella numidica*, *Eustrongylides excisus*, *Eustrongylides mergorum*, *Eustrongylides* sp., *Corynosoma semerme*, *Corynosoma strulosum*) and autogenic group (the remaining parasites). The parasites collected were predominantly freshwater species. They have been known from percid fishes inhabiting freshwater habitats (e.g. Wierzbicki, 1970;

Waluga & Własow, 1988) and also from other freshwater fish species from the coastal water of the Baltic Sea. Because of low salinity, marine parasites were not very frequent in the estuaries covered by the present paper and occurred in fish from the water bodies affected by brackish waters of the Baltic Sea. Only *Bothriocephalus scorpii*, *Brachyphallus crenatus*, *Anisakis simplex*, *Hysterothylacium aduncum*, and *Echinorhynchus gadi* are typical marine species (Wierzbicka *et al.*, 2005; Zander & Reimer, 2002).

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