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Philichthys xiphiae (Copepoda; Philichthyidae) – an interesting cranium parasite of the swordfish *Xiphias gladius* collected from the Baltic Sea

by

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Abstract

The swordfish, *Xiphias gladius* Linnaeus, 1758, is a fish that sporadically enters the Baltic Sea. The present paper describes the identification of a very rarely recorded and poorly studied copepod of the family Philichthyidae – *Philichthys xiphiae* Steenstrup, 1862 – in a dead swordfish found on a sea beach in Dźwirzyno (Poland) in 2016. Philichthyidae are parasites inhabiting the sensory canals in the lateral line and skull bones of marine fish. In the present case, two *P. xiphiae* females were found, which constitutes the first record of the species in the Baltic area.

Key words: alien species, *Philichthys xiphiae*, parasite, *Xiphias gladius*, Baltic Sea

1. Introduction

The native ichthyofauna of the Baltic Sea is relatively poor, comprising approximately 100 fish species, including about 70 marine species (HELCOM 2009). However, representatives of other species occasionally enter the sea, including large predatory fish, such as the swordfish, *Xiphias gladius* Linnaeus, 1758 (Xiphiidae). It is a migratory fish, inhabiting mostly oceans within their tropical and temperate zones. Although the swordfish prefers warmer waters, it shows high thermal tolerance, allowing it to move and feed in cooler regions, particularly during summer (Nakamura 1985; Froese & Pauly 2020). It has been mainly observed in the western part of the Baltic Sea. The first such observations from the Polish zone were documented in 1925, near Kuźnica on the Hel Peninsula. However, historical records contain older mentions of large fish with a habit indicating this species. The largest individuals caught include a 3 m specimen caught in Gdynia-Redłowo in 1939 and a slightly shorter (2.9 m) swordfish caught near Kąty Rybackie in 1957 (Skóra 1997; 2000; Bacevičius & Karalius 2005). Recently, i.e. since 2014, swordfish have been regularly observed along the Polish shore of the Baltic Sea. In 2015, for example, fishermen in the Świnoujście area caught a swordfish weighing approx. 60 kg. Large specimens were also found on the beach in Dźwirzyno in August 2016 (current research) and were caught near Jantar in August 2017 (2.7 m, 96 kg). In addition, swordfish were found in fishing nets near Dźwirzyno and Świnoujście even in late autumn, e.g. in November 2017, an approx. 2 m specimen weighing about 60 kg was found entangled in a net. Large individuals were also observed near Rewal in 2018, and an individual longer than 2 m was found on the beach in Stegna in August 2018 (B. Arciszewski, unpublished data).

However, such single, incidental records do not always enable more comprehensive studies, such as parasite fauna analysis. These types of studies are useful when investigating the introduction of parasites into new areas and assessing the possibility of expanding their ranges. Given ongoing climate change, this is a particularly important issue, especially as swordfish are migratory fish, travelling long distances to feed, which can be particularly conducive to parasite expansion. To date, more than 70 parasite species have been documented in *X. gladius*, most of which are helminths, including species with a wider host range and high zoonotic importance (Palko et al. 1981; Hogans et al. 1983; Dubina 1985; Williams & Bunkley-Williams 1996; Caton et al. 1998; Speare 1999; Castro-Pampillón et al. 2002a,b; Garcia et al. 2008, 2011; Mattiucci et al. 2014; Varghese & Unnikrishnan 2016; De Silva et al. 2017). The present paper describes a preliminary study concerning a unique record of *Philichthys xiphiae* Steenstrup, 1862, a rarely observed and poorly studied parasitic copepod from the family Philichthyidae.

2. Materials and methods

A dead female *Xiphias gladius* was found on 17 August 2016 on the beach in Dźwirzyno (Poland; Fig. 1). The specimen was large, weighing 96.15 kg and measuring 2.58 m in total length. Two copepods preserved in 70% ethanol were provided for the present study.

The copepods were placed in scientific collections as part of the Collection of Extant Invertebrates at the Department of Invertebrate Zoology and Parasitology, University of Gdańsk, Poland (UGDIZP).

3. Results and discussion

Two *Philichthys xiphiae* females were found in the frontal bone of the examined swordfish (Fig. 2). Copepods were identified based on the publications of Kabata (1979) and Boxshall & Helsey (2004). This is the first record of *P. xiphiae* in the Baltic Sea.

As a marine copepod, *P. xiphiae* is specific to this host. Members of the family Philichthyidae mainly inhabit the sensory canals of the lateral line and skull bones of marine fish. However, they differ from typical endoparasites in that they maintain contact with the external environment through openings in the host skin (Kabata 1979; Boxshall & Helsey 2004). The Philichthyidae family currently comprises nine genera. However, *Philichtys* is represented by only one species (Walter & Boxshall 2021). It is distinguished

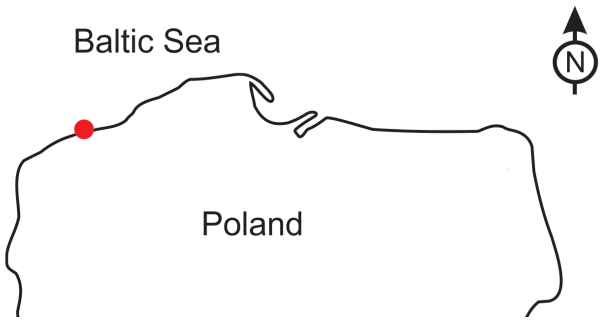

Figure 1
Dźwirzyno: • sampling locality

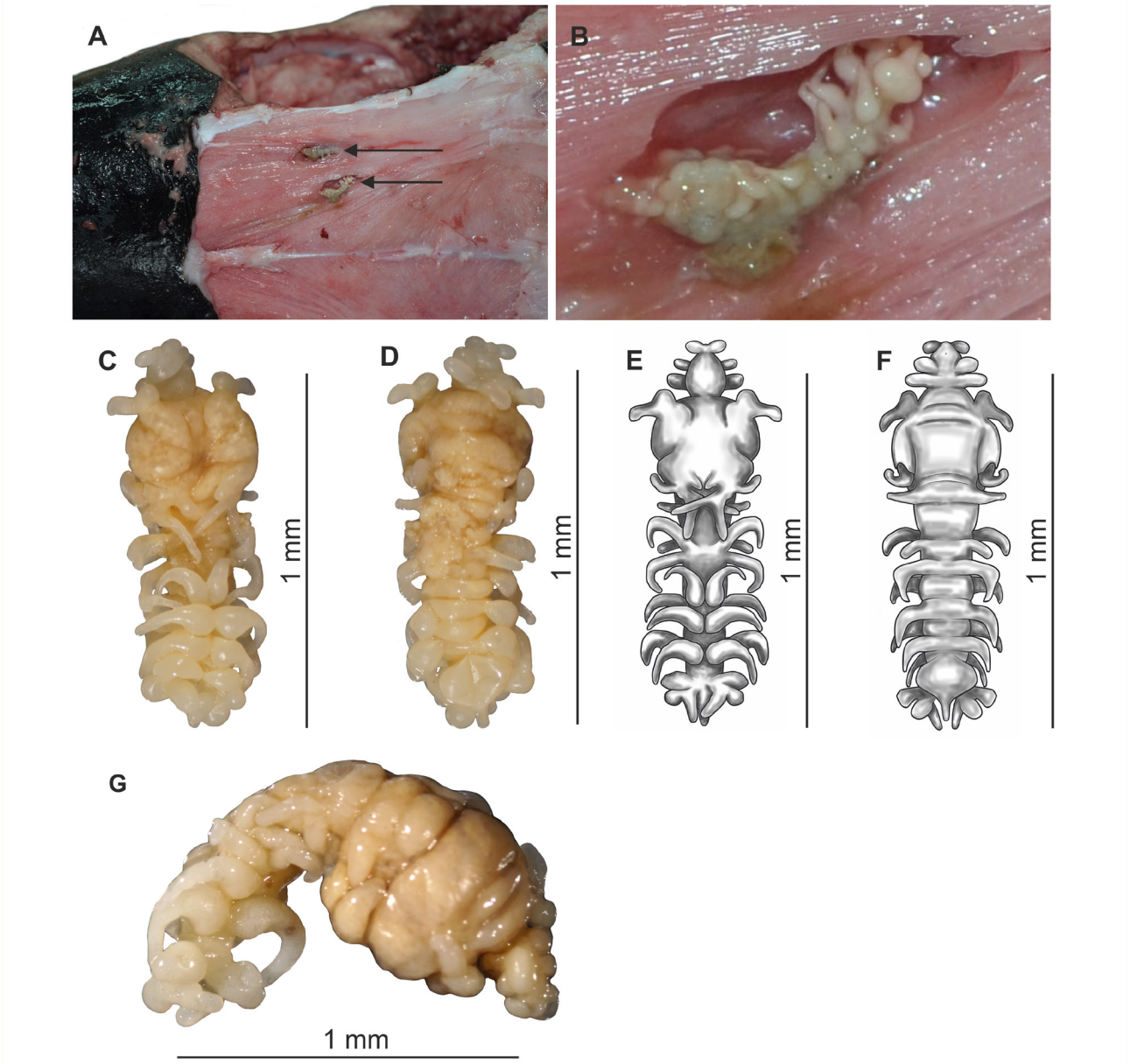

Figure 2

Philichthys xiphiae: A, B – copepods in the frontal bone of the examined swordfish, C, E – dorsal view, D, F – ventral view, G – lateral view

from other genera by the presence of three pairs of lateral processes on the cephalothorax, processes on the swollen region of the thorax located laterally, five pairs of processes on the abdominal section (two ventral and three dorsal), and is characterized by the absence of swimming legs (Kabata 1979; Boxshall & Helsey 2004). Females of these copepods have undergone a clear morphological modification consisting in reduced segmentation and reduction of legs as an adaptation to parasitism. Males, on the other hand, are considerably smaller than females and only slightly differ from a typical cyclopoid copepod, having distinct segmentation and recognizable legs (Kabata 1979; Kazačenko 2001; Boxshall & Halsey 2004).

Reports on *P. xiphiae* are sparse. It has been sporadically recorded in the North-West Atlantic, Baja California, the Kattegat, British waters, the Mediterranean Sea, the Adriatic Sea, the Pacific Ocean, and New Zealand (e.g. Steenstrup 1862; Bergsøe 1864; Vogt 1877; Stossich 1880; Valle 1881;

Thomson 1890; Graeffe 1900; Brian 1905, 1906; Rathbun 1905; Scott & Scott 1913; Wilson 1932; Hamond 1968; Hewitt & Hine 1972; Ho 1978; Kabata 1979; Williams & Bunkley-Williams 1996; Speare 1999; Ortega-García & Hernández-Trujillo 2017). However, few publications contain original data (e.g. Steenstrup 1862; Bergsøe 1864; Kabata 1979), others (e.g. Williams & Bunkley-Williams 1996) are review papers, replicating source data in different approaches. Some uncertainties also relate to taxonomic issues, as many *Philichthys* species have been synonymized or transferred to other genera, especially *Colobomatus* (Walter & Boxshall 2021). Therefore, uncertain identifications cannot be ruled out either. For example, Kabata (1979) states that the record from New Zealand (Thomson 1890) is controversial and requires re-examination.

Although *P. xiphiae* has mainly been described from swordfish, it has also been reported from other billfish, i.e. Indo-Pacific sailfish, *Istiophorus platypterus* (Shaw, 1792), and striped marlin, *Kajikia audax* (Philippi, 1887) (see Speare 1999; Ortega-García & Hernández-Trujillo 2017), classified as a member of closely related Istiophoridae (Froese & Pauly 2020). Due to this small number of records, there are many gaps in the knowledge regarding its distribution, host range, life cycle, biology, and harmfulness to the host. The parasite may not be uncommon, but it is difficult to detect as it is only visible after the dissection of the fish cranium. It is possible that, similarly to other Philichthyidae species, it causes tumors in fish (Kazačenko 2001), the effects of which remain unknown, but so far no such observations have been recorded.

Although the Baltic Sea is not a typical environment for swordfish, their presence there may be associated with strong seasonal storms and intrusions of water from the North Sea, enriching the Baltic with high-salinity waters, or the increased presence of mackerel or other attractive prey that may be followed by large predatory fish. In addition to swordfish, other fish species unusual for the Baltic Sea have also been observed, such as the ocean sunfish, *Mola mola* (Linnaeus, 1758) (see Grygiel 2010), as well as sharks, e.g. porbeagle, *Lamna nasus* (Bonnaterre, 1788), piked dogfish, *Squalus acanthias* Linnaeus, 1758 and lesser spotted dogfish, *Scyliorhinus canicula* (Linnaeus, 1758), velvet belly lanternshark, *Etmopterus spinax* (Linnaeus, 1758) (see Zidowitz et al. 2008; Więcaszek et al. 2018). It is now known that climate factors, particularly the progressive global warming, have an increasing influence on local environmental conditions (von Storch et al. 2015), which in turn results in the gradual expansion of the ranges of various species.

The increasingly common occurrence of large, migratory, predatory fish species in the Baltic Sea and other atypical basins represents a potential transmission factor for new, exotic parasites. There is therefore a need for more thorough analyses of their parasitofauna to enable more effective monitoring of potential risks to native fauna.

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