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Presence of the broad-nosed pipefish (*Syngnathus typhle*) in coastal waters of the Gulf of Gdańsk

Katarzyna Tarnowska, Mariusz R. Sapota¹

*Institute of Oceanography, University of Gdańsk
al. Marszałka Piłsudskiego 46, Gdynia, Poland*

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Abstract

The broad-nosed pipefish (*Syngnathus typhle*) is a species considered threatened with extinction on the Polish Baltic coast. The presence of *S. typhle* in the Gulf of Gdańsk was investigated primarily by means of scuba diving, and the species was recorded at 12 of 20 sites, which were investigated. A total of 85 individuals were found. The highest numbers were observed near the mouth of the river Płutnica and near the pier in Sopot. Pipefish were found in bottom areas covered with green algae (*Cladophora* sp. and *Enteromorpha* sp.) and brown algae (*Pilayella* sp.), but not by vascular plants as was previously reported.

¹ Corresponding author: ocems@univ.gda.pl

INTRODUCTION

The broad-nosed pipefish (*Syngnathus typhle*) (Fig. 1) inhabits coastal waters of the North Atlantic from the Bay of Biscay to the western coast of Great Britain, the English Channel, and the southern part of the North Sea to Bergen. The species is also present in the Mediterranean, the Black Sea and the Azov Sea (Dawson 1986). On the Polish Baltic coast this species has been recorded in the Gulf of Gdańsk, the Szczecin Lagoon and the Pomeranian Bay (Skóra 2001). The broad-nosed pipefish prefers shallow waters covered with phytobentos such as sago pondweed (*Potamogeton pectinatus*) and sea grass (*Zostera marina*) (Skóra 2001). During winter, when the temperature of surface waters decreases, *S. typhle* descends to deeper waters (Kujawa 1960).



Fig. 1. The broad-nosed pipefish (*Syngnathus typhle*) (Photo by K. Tarnowska).

During the 1960s and 70s, *S. typhle* was considered a common species in shallow waters of the Polish Baltic coast, where the vegetation on the bottom was prolific (Demel 1962, Demel 1967, Żmudziński 1974). Subsequently, there was a significant decline in the abundance of this species (Margoński 1994). In 1995, *S. typhle* was placed under protection in Poland. The species is considered extremely threatened with extinction, with a very rapid rate of decline. It is commonly stated that species that are extremely threatened with extinction can be saved only by means of active protection, which involves removing the causes of their disappearance (Głowaciński 2001). The active protection of *S. typhle* should consist of recultivation of the bottom areas where vascular

plants grew, introducing pipefish individuals from neighboring areas, and creating marine reserves in places where the environmental conditions are suitable for this species (Skóra 2001).

The main aims of this research were to find and describe the sites inhabited by *S. typhle* in the Gulf of Gdańsk, and to determine whether the abundance of pipefish in coastal waters of the Gulf of Gdańsk is currently higher than in the 1980s and 1990s.

MATERIAL AND METHODS

From November 2003 to July 2004, 31 dives were made in 18 locations in the Gulf of Gdańsk to verify whether *Syngnathus typhle* inhabits these sites. Additionally, individuals were collected in the yacht port in Gdynia by means of lift netting. Trawling surveys also were conducted at a distance of ca. 500 m from the pier in Sopot, with sampling every hour in the 24-hour cycle, to investigate changes in ichthyofauna abundance. A total of 20 locations were investigated, and were identified with symbols from “A” to “T” from east to northwest and then along the Hel Peninsula (Fig. 2). The symbols stand for the following sites:

- A) Stogi (Gdańsk)
- B) pier in Brzeźno (Gdańsk)
- C) pier in Sopot
- D) about 500 m to the north of the pier in Sopot
- E) pier in Orłowo (Gdynia)
- F) boulevard in Gdynia
- G) yacht port in Gdynia
- H) Babie Doły (Gdynia)
- I) Mechelinki
- J) Rewa Bay
- K) Osłonino
- L) between Osłonino and Rzucewo
- M) Rzucewo
- N) Bładzikowo
- O) near the mouth of the Płutnica river
- P) Władysławowo
- Q) between Chałupy and Kuźnica
- R) pier in Jurata
- S) constructions near the military port in Hel (external, southern part)
- T) western part of the pier in the fishing port in Hel

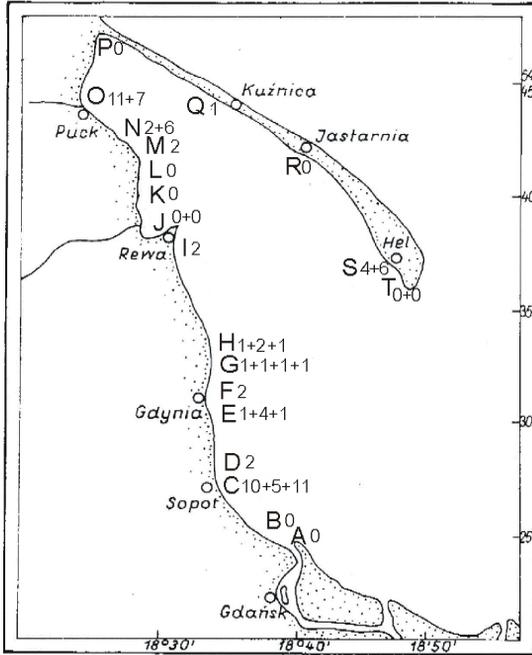


Fig. 2. Location of investigation sites and the number of individuals of *S. typhle* recorded at each site. The plus sign (+) separates the number of individuals recorded during each dive at the location.

Underwater surveys were conducted during the day, usually between 9 a.m. and 1 p.m., at a depth between 0.5 and 3 m, occasionally down to 6 m. Surveys were completed most often near the pier in Sopot (C) and near the pier in Orłowo (Gdynia) (E). During winter the number of dives was considerably fewer than in spring and summer, due to unfavorable weather conditions and the presence of ice cover on the sea surface in some locations. As a result, 2 dives took place in the autumn, 2 in the winter, 21 in the spring and 6 in the summer.

Individuals of *S. typhle* collected during the dive were placed in a plastic bottle with 5 l of seawater. Samples were taken ashore in order to measure the total length of the fish and identify their sex. The total length of individuals was measured within 1 mm accuracy. Individuals were measured alive, which negatively affected the precision. Males were distinguished on the basis of the presence of a brood pouch or a trace of it. In the case of females, the abdomen sometimes was bloated, because of the presence of developing eggs. Following measurement, the majority of the fish were released. Some were taken to the laboratory for further observations. Scuba diving was chosen as a suitable method to collect samples, because *S. typhle* is a threatened and protected species and methods that cause the death of many individuals could not be applied. Additionally, diving gives the opportunity to investigate fish in their natural environment, which provides valuable information about the ecology of

the species. The pipefish inhabits shallow water, which makes observations safer and more precise.

Another objective of the research was to describe favorable habitat conditions for the species. The depth at which individuals were found was measured with the diving computer. Physical conditions (e.g. whether the site is exposed to wave action), the presence of other fish species (mostly *Nerophis ophidion*) and the type of phytobenthic plants (distinguished to the genus level) present in the waters inhabited by *S. typhle* were recorded.

We also include information on the presence of pipefish in the Gulf of Gdański obtained from previous underwater videos, in addition to prior literature reports.

RESULTS

The presence of *Syngnathus typhle* was confirmed at 12 out of 20 investigated sites (Fig. 2). The highest number of individuals was found near the pier in Sopot (C) and near the mouth of the Płutnica River between Puck and Władysławowo (O). Locations where pipefish did not occur in high numbers, but were confirmed to be present more than once during different seasons were: constructions near the military port in Hel (S), the pier in Orłowo (Gdynia) (E), the breakwater near the housing estate Babie Doły (Gdynia) (H) and the yacht port in Gdynia (G). *S. typhle* was not observed near Osłonino (K), between Osłonino and Rzucewo (L), and near Władysławowo (P), while the presence of *S. typhle* was not confirmed near the western part of the pier in the fishing port in Hel (T). In addition, *S. typhle* was not found in Stogi (Gdańsk) (A), nor near the pier in Brzeźno (Gdańsk) (B). In Rewa Bay (J), *S. typhle* was not observed, but a very high number of straight-nosed pipefish (*Nerophis ophidion*) was recorded there (ca. 40 individuals during one dive). At other sites where *S. typhle* occurred, *N. ophidion* usually outnumbered *S. typhle*, but its numbers were never as high as in Rewa Bay (J). However, at the two sites where *S. typhle* was the most abundant (the pier in Sopot and near the mouth of the Płutnica River), this species outnumbered *N. ophidion*.

S. typhle was present at a depth between 0.5 and 5 m. Near the pier in Sopot (C), the individuals were further from the shore, at a depth of 3-5 m. Near the mouth of the Płutnica (O), where the bottom slope is very gradual, all individuals were found above 1.5 m. *S. typhle* was usually recorded in calm waters. For example, near Babie Doły (Gdynia) (H) the species was recorded on the side of the waterbreak, which is sheltered from wave action.

At most of the sampling sites, the brown alga *Pilayella* sp. and green algae *Cladophora* spp. and *Enteromorpha* spp. dominated among the benthic macroalgae. In some cases, as in the coastal waters near Mechelinki (I), there

was a nearshore zone where green algae were dominant and another below 1.5 m where *Pilayella* sp. dominated. There were also some locations, such as near the boulevard in Gdynia (F), the waterbreak in Babie Doły (Gdynia) (H) and the yacht port in Gdynia (G), where the biomass of green algae (mostly *Cladophora* sp., but also *Enteromorpha* sp.) was significantly higher than the biomass of the brown algae. In Rewa Bay (J) an exceptionally high quantity of vascular plants was recorded (primarily of *Potamogeton* sp.). There were also brown and green algae (*Pilayella* sp., *Cladophora* sp., *Enteromorpha* sp.), as was found on the other study sites. *Potamogeton* sp. was also present near Rzucewo (M). Another high plant, *Ruppia* sp., was found near Bładzikowo (N).

A total of 85 individuals of *S. typhle* were recorded. Sex was determined for 65 of them. Within this group, females accounted for 63% and males accounted for 37% of individuals. The male/female sex ratio was 1:1.7. Distinguishing sex based on morphological differences was not possible until the end of April, which is the beginning of the breeding season.

Total length was measured on 66 out of 85 individuals. The average length of individuals was 141 mm (s.d. ± 26 mm). The average length of females and males was 142 mm (females, s.d. ± 30 mm; males s.d. ± 20 mm, Fig. 3).

DISCUSSION

The number of individuals of *Syngnathus typhle* recorded in the Gulf of Gdańsk during research in 2003-2004 totaled 85, and was definitely higher than the number observed in the 1980s and 1990s.

In the 1980s, research on the broad-nosed pipefish (*S. typhle*) and straight-nosed pipefish (*Nerophis ophidion*) was conducted in the Gulf of Gdańsk. Samples were collected mainly near Rzucewo and near the yacht port in Gdynia. Only 15 individuals of *S. typhle* were found: four of them in 1986 and eleven in 1987-1988 (Margoński 1994). From 1988 to 1996, *S. typhle* was recorded only once in the annual seine netting in Puck Bay (Skóra 1996a). In 1995 one individual was collected accidentally in the port in Hel by lift netting (Skóra 1996b). Divers documented the presence of *S. typhle* to the southwest of the port in Jastarnia (Samsel 1998) and in Hel between the military port and the fishery port (Duris 1998) in 1998 and in 1999 on the shallow near Hel-Bór (Abramowicz 1999). However, according to Jackowski (2002), only 3 individuals of *S. typhle* were recorded in Puck Bay in the 1990s.

In the present research, the high abundance of *S. typhle* near the military port in Hel (S) was not surprising, because even when the size of the population in the Gulf of Gdańsk decreased significantly, the presence of *S. typhle* in Hel was confirmed (Duris 1998, Skóra 1996b). Pipefish probably were present in this area throughout the nineties, although they retreated from the majority of

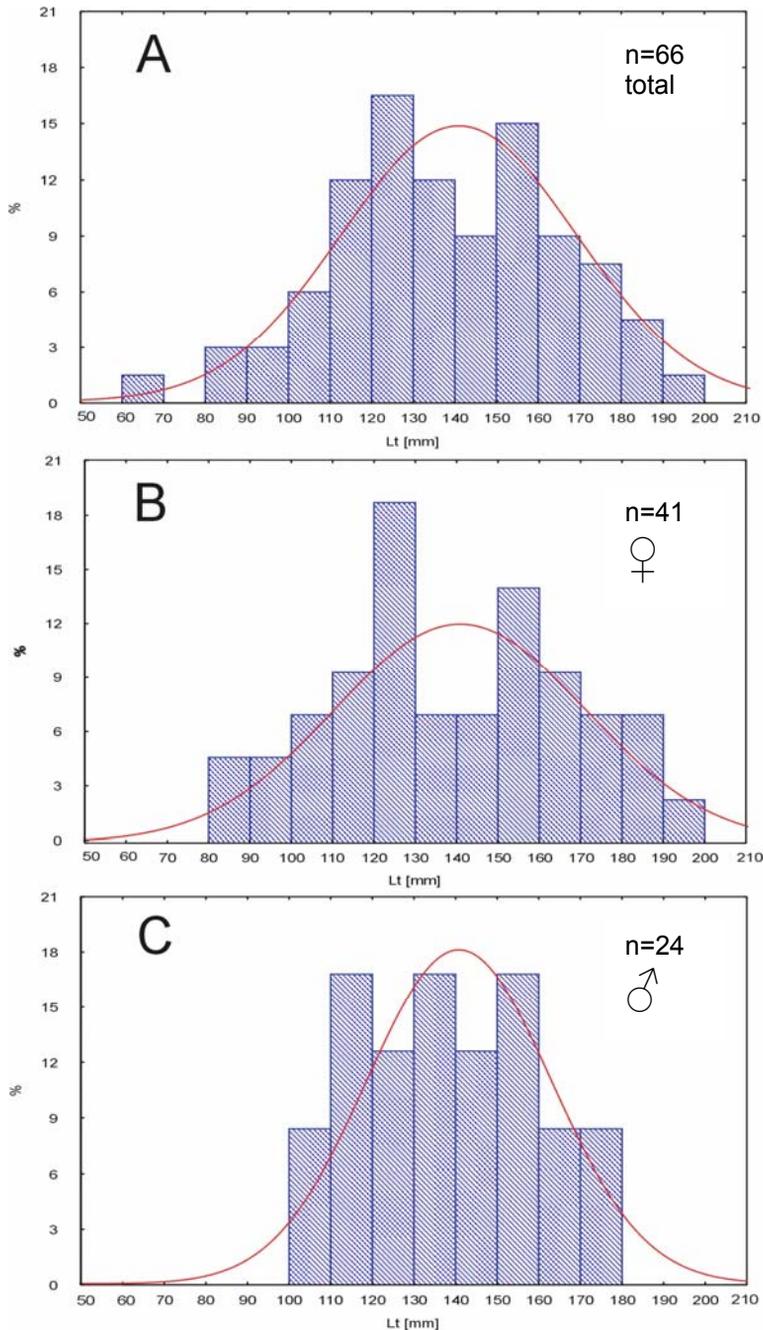


Fig. 3. The length distribution of *S. typhle*: a) total, b) females, c) males.

their former locations in the Gulf of Gdańsk. The absence of *S. typhle* near the fishing port in Hel (T) was unexpected, as its abundance was high near the military port in Hel (S), which is about 450 m from the fishing port and the conditions in both sites are similar. *S. typhle* was not observed in Stogi (Gdańsk) (A) nor near the pier in Brzeźno (Gdańsk) (B), presumably due to the fact that there is no benthic vegetation or plant-cover is minimal. Although the presence of *S. typhle* was not confirmed on sites such as Osłonino (K), between Osłonino and Rzucewo (L), Władysławowo (P) and the pier in Jurata (R), the possibility of the presence of this species there cannot be excluded, as there was only one underwater survey done at each of these sites. In some cases, visibility was substantially reduced by a prolific bloom of *Pilayella* sp., especially in the Puck Lagoon, so further research needs to be conducted to confirm the absence of *S. typhle* from these areas.

There is possible space competition between *S. typhle* and *N. ophidion*. In Rewa Bay (J), where the quantity of vascular plants is significant (Pliński and Florczyk 1993), an exceptionally high number of individuals of *N. ophidion* were recorded, while no *S. typhle* were observed. On the contrary, at the sites where *S. typhle* was most abundant (near the pier in Sopot and near the mouth of the Płutnica River), *N. ophidion* was much less numerous than at other sites.

Underwater surveys conducted in February and March 2004 demonstrated that, like many other fish species, *S. typhle* descends to deeper waters during winter (Kujawa 1960). This descent is caused by the drop in surface water temperature and the increase in wave action. In April, *S. typhle* returned to shallow coastal waters, when the surface water temperature reached ca. 8°C.

According to Skóra (2001), *S. typhle* prefers the bottom overgrown with vascular plants such as *Zostera marina* and *Potamogeton pectinatus*. There were important changes in abundance of these plants in the Gulf of Gdańsk during the last 30 years. The biomass of phytobenthos in Puck Bay in the 1980s was a quarter of that observed in the 1970s (Pliński and Florczyk 1984). Some species, such as *Tolypella nidifica*, vanished from the Gulf of Gdańsk and others, such as *Fucus vesiculosus* and *Furcellaria fastigiata*, were reported to undergo a significant decline in biomass (Klekot 1976). Simultaneously, brown algae from the Ectocarpaceae family expanded. In the coastal zone, the green algae *Enteromorpha* spp., especially *E. intestinalis*, began to dominate (Ringer 1990). Currently, *Fucus vesiculosus* does not inhabit the Gulf of Gdańsk. These changes are considered to be the primary reasons for the decline in the *S. typhle* population in this region (Skóra 2001). During the underwater surveys conducted in this research, areas covered with *Z. marina* were not found. In Rewa Bay (J), which is inhabited by *N. ophidion* but not by *S. typhle*, there is a relatively high abundance of *Potamogeton* sp. *S. typhle* was often recorded on bottoms covered with green algae (*Cladophora* sp. and *Enteromorpha* sp.) and

brown algae (*Pilayella* sp.). Fish colour is usually harmonized with the surroundings, and is brown or beige for fish living on bottoms covered with brown algae. The present habitat of *S. typhle* differs from the one it preferred in the past.

The length measurements and the sex ratio may not reflect the actual situation in the natural population, because the number of individuals may have been too small to be representative. Moreover, most of the individuals were measured between May and July, and there is no length data from winter. This sampling bias could influence the average length significantly, if *S. typhle* has a one-year life cycle, as suggested by Kujawa (1960). The average length of individuals was 141 mm, which is less than previously reported (Rudnicki 1985). However, the average length of the individuals measured in the Gulf of Gdańsk in the 1980s was 90.3 mm for males and 87.8 mm for females, but the measurements included only 15 individuals (Margoński 1994). There is no significant difference between the length of males and females of *S. typhle*, as is found in *N. ophidion*, where the female is generally longer than the male (Berglund et al. 1986). In this research the average length of females and males are equal and account for 142 mm. The number of recorded females was higher than males, which is consistent with the hypothesis that females are in excess and compete for males, ensuring the breeding success of males (Jones and Hunter 1999).

The length distributions of all individuals and of females alone have two peaks (Fig. 3), which could signify two different age groups. Further investigation is necessary to check this hypothesis.

Kujawa (1960) claimed that *S. typhle* has a one-year life cycle and that individuals die after breeding. Whereas, according to Jackowski (2002), they live more than one year, but reach sexual maturity in the first year of life. During this research certain breeding characteristics, such as a brood pouch for males or developing eggs for females, were not observed in some individuals at the beginning of the breeding period. If the thesis that *S. typhle* lives more than one year is true, it could be assumed that some of the individuals reach sexual maturity in the second or third year of life, rather than in the first. Further research needs to be conducted to verify this hypothesis.

One young individual recorded on the 24th of July 2004 measured 65 mm. This observation might illustrate that the offspring, which is about 30 mm long when it leaves the brood pouch, grows fast and reaches ca. 120 mm by November (Kujawa 1959).

In conclusion, the abundance of pipefish in the Gulf of Gdańsk is higher than that reported in the 1980s and 1990s. According to prior studies, *S. typhle* prefers the shallow waters inhabited by vascular plants, such as sea grass (*Zostera marina*), (Skóra 2001) which is presently uncommon in the Gulf of

Gdańsk. As a result, *S. typhle* currently inhabits primarily the waters where brown algae (*Pilayella* sp.) and green algae (*Cladophora* spp. *Enteromorpha* spp.) are abundant.

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