

SUPPLEMENTARY MATERIALS

The Relationship between Total Mercury, Its Fractions and Species Diversity of Diatom Taphocoenoses Deposited in Surface Sediments (Southern Baltic Sea)

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AREA I (PL1–15) The diatom community showed high abundance of eutraphents (48–75%), with percentage content decreasing from Kuźnica towards Władysławowo (Fig. S3). Along with their dominant frequency in the study area, a high percentage of β -mesosaprobionts (61–87%) was observed. Moreover, α -mesosaprobionts were observed in high abundance (2–20%). The inflow of higher salinity waters from Outer Puck Bay through the Kuźnica Passage resulted in a more frequent occurrence of marine species (euhalobous) (4–24%) and brackish species (mesohalobous) (32–69%) in the area.

Trophic preferences of the diatom flora found along the Hel Peninsula indicate that AREA I is a eutrophied region. An increase in nutrients in this area results from their remobilisation from sediments [1, 2]. Moreover, the nutrient-rich waters of Outer Puck Bay inflowing through the Kuźnica Passage additionally cause an increase in nutrients in the waters of Puck Lagoon, as confirmed by Hetko et al. [3] and Witak et al. [4]. The dominance of β -mesosaprobionts suggests pollution of AREA I resulting from excessive nutrients. Compared to previous studies in the area, there was no evidence of improved trophic or saprobic conditions [4]. Potential sources of pollution in northern Puck Lagoon include the sewage treatment plants in Swarzewo and Jastarnia, and the ports in Kuźnica and Jastarnia [5]. Moreover, the area is intensively influenced by humans through tourist and recreational activities. In the northern part of Puck Lagoon, a relatively low frequency of freshwater diatoms is observed, while a high frequency of marine and brackish species is recorded due to the inflow of the more saline waters of Outer Puck Bay through the Kuźnica Passage.

AREA II (PL16–PL81) In this part of the Puck Lagoon, the percentage content of alkaliphilic species decreased to 29%, while the frequency of alkalibionts increased to 30% (Fig. S3). A slight decrease in the frequency of eutraphentic forms (22–65%) with a simultaneous increase in the percentage of eu-mesotraphentic (16–60%) and mesotraphentic forms ($\leq 8\%$) suggests lack of improvement of trophic conditions in comparison to AREA I. In terms of saprobic preferences, the dominance of β -mesosaprobionts was observed (37–90%). Compared to the first area, in AREA II, the frequency of marine (3–42%) and brackish species (19–64%) decreased, while the percentage of oligohalobous halophilous species (7–44%) and oligohalobous indifferent taxa (3–60%) increased.

The dominance of β -mesosaprobionts in AREA II suggests that this region, like AREA I, features increased concentrations of organic matter. In the vicinity of this region, the Swarzewo wastewater treatment plant may be a direct source of increased nutrients [5]. This is indicated by higher frequency of the eutraphentic group (63%) near the Swarzewo wastewater treatment plant (station PL40). The increased frequency of oligohalobous indifferent species indicates a change in salinity conditions in AREA II compared to AREA I, resulting from the inflow of waters from nearby rivers (Reda, Płutnica, Gizdekpa). In the southern part of AREA II, however, an exceptionally high frequency of euhalobous taxa was observed. This is associated with a higher content of *Catenula adhaerens*. Its occurrence in this area resulted from water inflow from Outer Puck

Bay through the Głębinka Passage. Subsequently, currents from the Głębinka Passage to the city of Puck in Puck Lagoon [6] may have contributed to the transport of *C. adhaerens* into the central part of the basin that is under the influence of river water.

AREA III (PL82-129) In this area, an increased frequency of alkaliphilic, eutrophic, and α -mesosaprobic species was observed (33-71%, 30-80%, 1-30%, respectively) (Fig. S3).

The diatom community suggests that AREA III waters are rich in nutrients. The percentage of α -mesosaprobionts indicates a higher level of water pollution with biogenic substances, particularly in the southern part of the area. Increased eutrophication and saprobity of this area is strictly related to the inflow of waters from the Reda River and polluted waters from the Port of Gdynia, as well as to intensive tourism in the vicinity of Rewa.

Table S1. Environmental conditions during collection of study material

Sample ID	Depth (m)	Date	Sea surface temperature (°C)	Air temperature (°C)	Wind speed (m s ⁻¹)	Sea level (m)	Salinity	Height of significant wave (m)	Mean wave period (s)	
PI84, PI11-PI15, PI125-PI129	0.3	26.08.2019	21	21.3	2.7-3.6	0.313	7.1	0.14	2.06	
PI1-PI10		25.09.2019	14	14.8	3.5-4.7	0.467	7.2	0.19	2.28	
PI75-PI76		08.08.2019	22	20.7	6.5-8.2	0.178	7.1	0.34	2.08	
PI40, PI85-PI88, 96	0.4	26.08.2019	21	21.3	2.7-3.6	0.313	7.1	0.14	2.06	
PI16,PI50	0.5	07.08.2019	21	19.7	4.4-5.8	0.19	7.1	0.13	2.11	
PI53		08.08.2019	22	20.7	6.5-8.2	0.178	7.1	0.34	2.08	
PI63, PI65, PI107-PI109, PI118, PI119		26.08.2019	21	21.3	2.7-3.6	0.313	7.1	0.14	2.06	
PI19	0.6	07.08.2019	21	19.7	4.4-5.8	0.19	7.1	0.13	2.11	
PI22, PI25	0.7									
PI18, PI20, PI51	0.8									
PI93		08.09.2019	22	20.7	6.5-8.2	0.178	7.1	0.34	2.08	
PI23, PI32, PI33, PI39	0.9	07.08.2019	21	19.7	4.4-5.8	0.19	7.1	0.13	2.11	
PI17, PI24, PI27, PI47	1.0									
PI66, PI79										08.08.2019
PI121	1.0	25.09.2019	14	14.8	3.5-4.7	0.467	7.2	0.19	2.28	
PI26, PI35, PI38, PI44		1.2	07.08.2019	21	19.7	4.4-5.8	0.19	7.1	0.13	2.11
PI99, PI123			25.09.2019	14	14.8	3.5-4.7	0.467	7.2	0.19	2.28
PI34, PI36, PI37, PI46, PI52,PI64, PI80	1.5	07.08.2019	21	19.7	4.4-5.8	0.19	7.1	0.13	2.11	
PI120, PI122		25.09.2019	14	14.8	3.5-4.7	0.467	7.2	0.19	2.28	
PI41	1.8	07.08.2019	21	19.7	4.4-5.8	0.19	7.1	0.13	2.11	
PI43	1.9									
PI57, PI82-PI83	2.0	08.08.2019	22	20.7	6.5-8.2	0.178	7.1	0.34	2.08	
PI116- PI117, PI124	2.0	25.09.2019	14	14.8	3.5-4.7	0.467	7.2	0.19	2.28	
PI115	2.3									
PI42, PI45	2.5	07.08.2019	21	19.7	4.4-5.8	0.19	7.1	0.13	2.11	
PI54,PI58-PI59, PI62, PI67, PI81	2.5	08.08.2019	22	20.7	6.5-8.2	0.178	7.1	0.34	2.08	
PI110, PI113	2.5	25.09.2019	14	14.8	3.5-4.7	0.467	7.2	0.19	2.28	
PI114	2.7									
PI21	3.0	07.08.2019	21	19.7	4.4-5.8	0.19	7.1	0.13	2.11	

PI56, PI68		08.08.2019	22	20.7	6.5-8.2	0.178	7.1	0.34	2.08
PI28	3.2	07.08.2019	21	19.7	4.4-5.8	0.19	7.1	0.13	2.11
PI60-PI61, PI70-PI71	3.5	08.08.2019	22	20.7	6.5-8.2	0.178	7.1	0.34	2.08
PI98, PI106		25.09.2019	14	14.8	3.5-4.7	0.467	7.2	0.19	2.28
PI112	3.8								
PI55	4.0	08.08.2019	22	20.7	6.5-8.2	0.178	7.1	0.34	2.08
PI97, PI101		25.09.2019	14	14.8	3.5-4.7	0.467	7.2	0.19	2.28
PI69	4.1	08.08.2019	22	20.7	6.5-8.2	0.178	7.1	0.34	2.08
PI105		25.09.2019	14	14.8	3.5-4.7	0.467	7.2	0.19	2.28
PI111	4.3								
PI72, PI77, PI89	4,5	08.08.2019	22	20.7	6.5-8.2	0.178	7.1	0.34	2.08
PI100, PI102, PI103	4.5	25.09.2019	14	14.8	3.5-4.7	0.467	7.2	0.19	2.28
PI92, PI95, PI104	5.0								
PI73-PI74, PI78, PI90, PI91	5.5	08.08.2019	22	20.7	6.5-8.2	0.178	7.1	0.34	2.08
PI94	5.5	25.09.2019	14	14.8	3.5-4.7	0.467	7.2	0.19	2.28
PI48	5.9	07.08.2019	21	19,7	4,4-5,8	0,19	7,1	0,13	2,11
PI31, PI49	6.0								
PI30	6.5								
PI29	8.0								

Table S2. Ecological preferences of diatoms in terms of habitat, salinity, pH, trophic and saprobic status.

<p><u>Habitat [7]:</u></p> <p>planktic – living in water column,</p> <p>benthic – growing on hard substrate.</p>	<p><u>Salinity [8]:</u></p> <p>euhalobous – marine species living in waters at salinity of 30-40 PSU,</p> <p>mesohalobous – brackish species living at salinity 5-20 PSU,</p> <p>oligohalobous – freshwater species:</p> <p>halophilous – reaching the optimum at salinity below 5 PSU,</p> <p>indifferent – tolerant of a low salinity,</p> <p>halophobous – species do not tolerate any salt.</p>
<p><u>pH [9]:</u></p> <p>alkalibiontic – pH>7,</p> <p>alkaliphilic – pH ≈7, optimum pH>7,</p> <p>indifferent – pH ≈7,</p> <p>acidophilic – pH ≈7, optimum pH <5.5.</p>	
<p><u>Saprobity [10]:</u></p> <p>polysaprobous – occurs in heavily polluted waters,</p> <p>α-mesosaprobous – occurs in moderately polluted waters,</p> <p>α-β-mesosaprobous – occurs in conditions between a- and b-mesosaprobous,</p> <p>β-mesosaprobous – occurs in less polluted waters,</p> <p>oligosaprobous – occurs in low polluted waters,</p> <p>xenosaprobous – occurs in clear waters.</p>	<p><u>Trophy status [11]:</u></p> <p>eutraphentic – occurs in very fertile waters,</p> <p>eu-mesotraphentic – occurs in fertile waters,</p> <p>mesotraphentic – occurs in moderate fertility waters,</p> <p>meso-oligotraphentic – occurs in relatively nutrient-poor waters,</p> <p>oligotraphentic – occurs in nutrient-poor waters,</p> <p>eu-dystrophentic – species tolerant of high nutrient waters.</p>

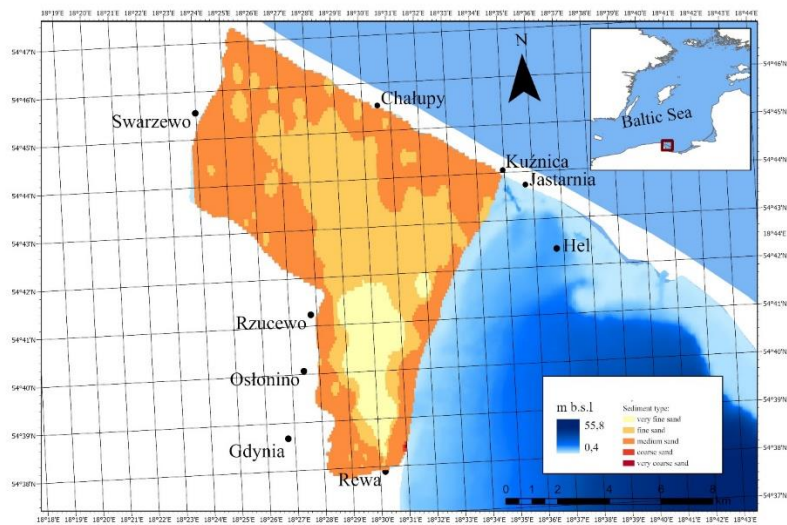


Figure S1. Sediment grain size in the inner Puck Bay.

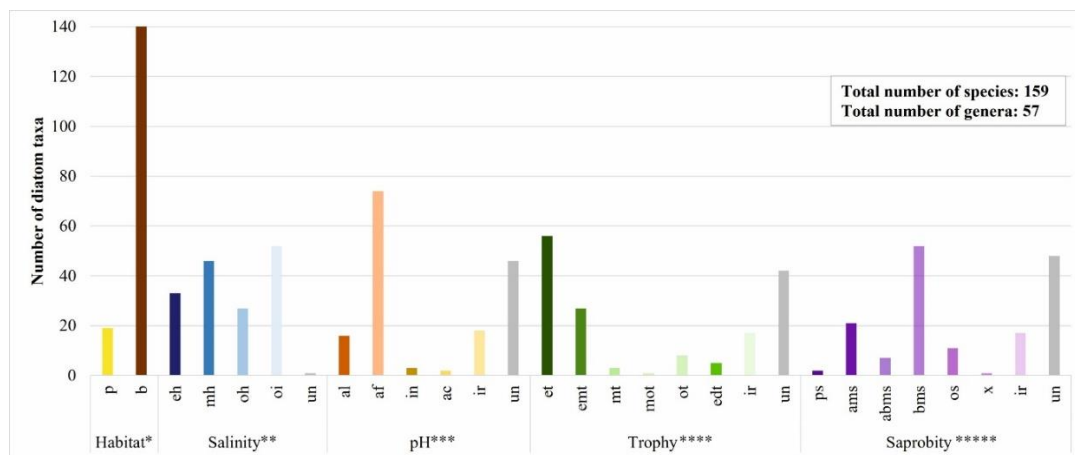


Figure S2. Characteristic of diatom taxa. Habitat: *p-plankton, b-benthos; salinity**:eh-euhalobous, mh-mesohalobous, oh-oligohalobous halophilous, oi-oligohalobous indifferent, un-unknown; pH***:al-alkalibiontic, af-alkaliphilic, in-indifferent, ac-acidophilic, ir-irrelevant, un-unknown; trophy ****:et-eutrphentic, emt-eu-mesotrphentic, mt-mesotrphentic, mot- meso-oligotrphentic, ot-oligotrphentic, edt-eurydystrophic, ir-irrelevant, un-unknown; saprobity*****:ps-polysaprobous, ams- α -mesosaprobous, abms- α - β -mesosaprobous, bms- β -mesosaprobous, os-oligosaprobous, x-xenosaprobous, ir-irrelevant, un-unknown

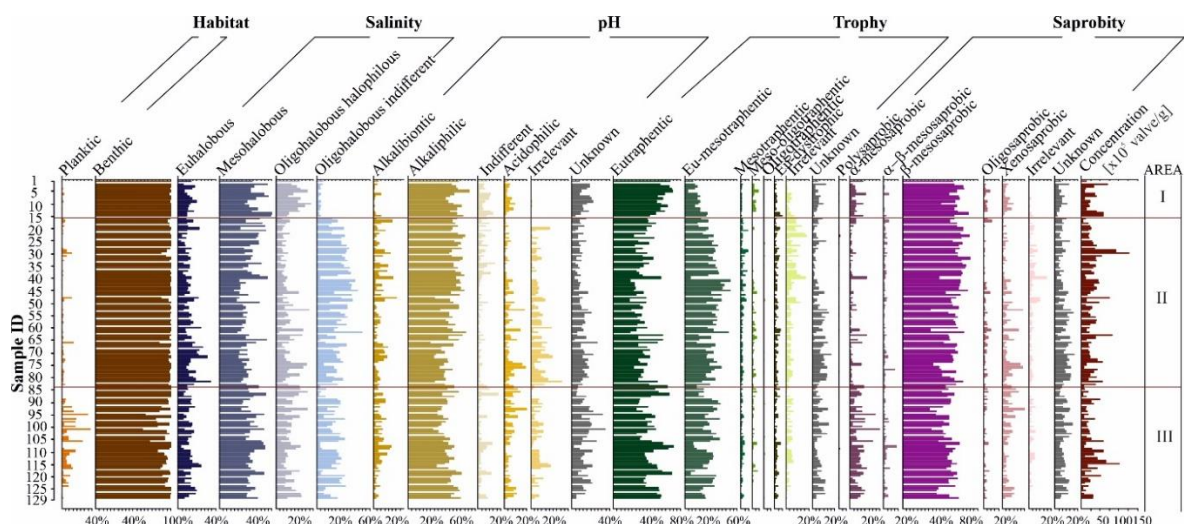


Figure S3. Percentage content of the diatom ecological groups.

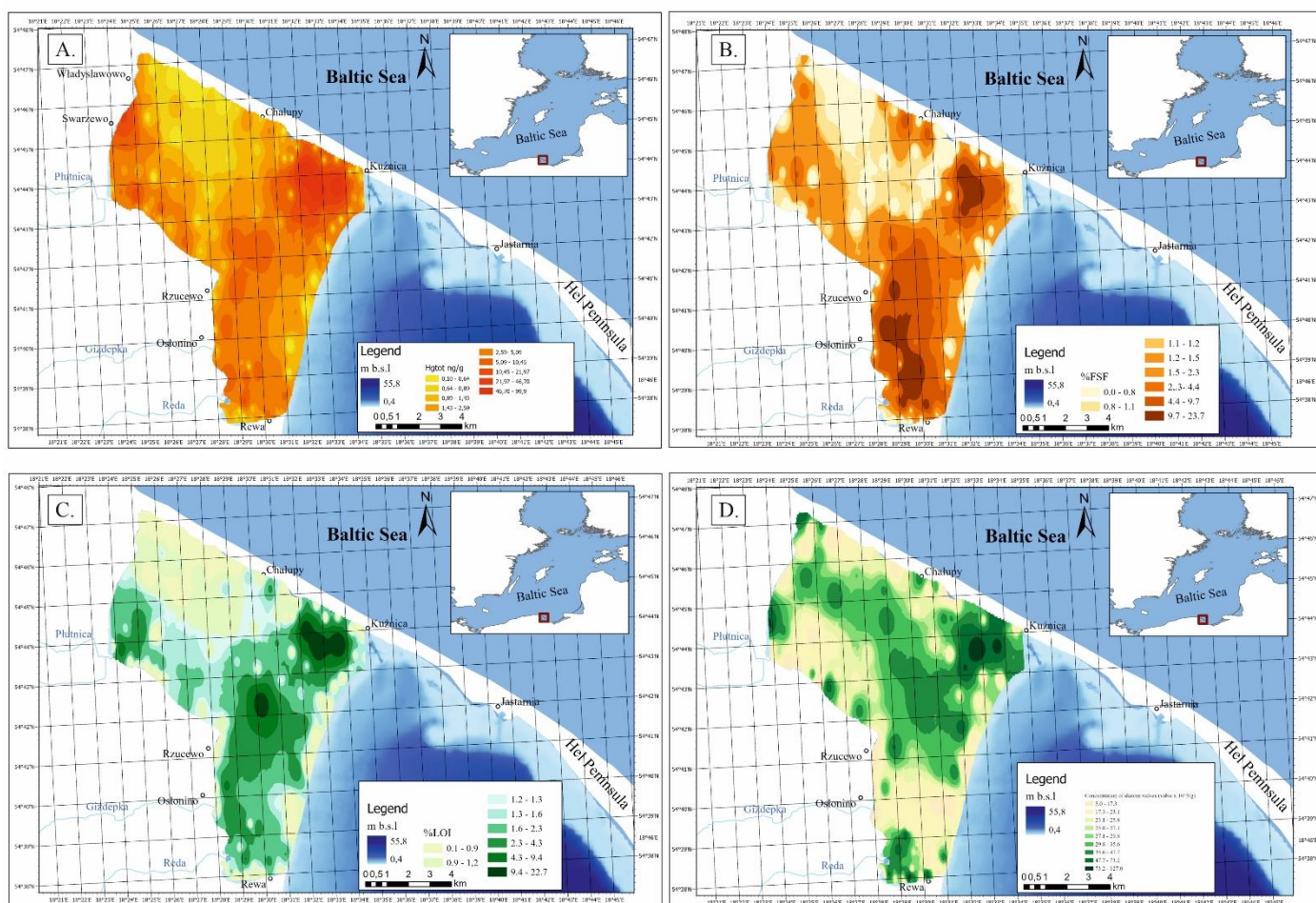


Figure S4. Spatial variability of the: A - concentrations of Hg_{tot} ($ng\ g^{-1}$), B - %FSF, C - %OM and D - contents of diatom valves ($valve \times 10^5\ g^{-1}$)

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