Plastic is pollutant present in every element of the ecosystem. The Baltic Sea is particularly vulnerable to plastic pollution because it is a semi-enclosed body of water with limited water exchange, a catchment area about four times larger than its surface area, and a catchment population of approximately 85 million people.

Over time, plastics can change their properties and may be colonized by microorganisms forming a biofilm that can absorb contaminants from the environment. Plastics eventually settle on the seabed, posing a threat to benthic organisms. Therefore, there is a need to study both "fresh" plastics, which are unaffected by degradation processes, and older plastics that have been present in the environment for longer time. The growing awareness of the negative impact of plastics on the environment has led to the increased popularity of plastic substitutes, such as bioplastics. The environmental impact of bioplastics is still insufficiently understood. Understanding the interactions between plastics, biofilms, and pollutants is essential to assess the exposure of benthic organisms to contaminants.

In this project, we aim to investigate how harmful substances interact with biofilms created on the surfaces of plastics and examine their impact on marine organisms, particularly mussels inhabiting the southern part of the Baltic Sea.

The project will help answer the following questions:

- How does the aging process affect common plastics, bioplastics, and synthetic fishing nets (ghost nets) present in the Baltic Sea?
- What microorganisms form biofilm on different types of plastics in the Gulf of Gdańsk?
- How do biofilm respond to various concentrations of contaminants such as polycyclic aromatic hydrocarbons, pharmaceuticals, caffeine, and their mixtures?
- What concentration levels of pollutants are harmless to microorganisms forming biofilms?
- How are pollutants absorbed and released from plastics with biofilms?
- How does contaminated biofilm on plastic affect mussels?

The part of the research concerning the formation of biofilms on different types of plastics will be conducted in-situ in the Gulf of Gdańsk. Stages concerning the sorption/desorption of contaminants on the biofilm, as well as the transfer of contaminants from the biofilm to mussels, will combine in-situ and laboratory studies.

Understanding the connections between different plastics, biofilms, and contaminants in the Baltic Sea is essential to assess the full impact of plastic pollution on marine ecosystems, especially benthic communities. Research is crucial for predicting the long-term ecological effects of the presence of plastics in the environment. The project will also provide new information on the environmental impact of bioplastics, which are often considered more eco-friendly.