Mercury (Hg) is one of the most dangerous environmental pollutants. Its toxicity is mainly related to the fact that it damages the brain and nervous system, which contributes to many diseases such as Alzheimer's or Parkinson's disease, depression, and chronic fatigue syndrome. In smaller doses, Hg is responsible for speech problems and motor coordination problems.

Hg is an element that occurs naturally in the earth's crust and can be found in some minerals. As a result of human activity over the centuries, a large load of this metal has been extracted from natural deposits and entered the cycle. The high toxicity of Hg became known to humans relatively recently - in the 1950s. Since then, the use of Hg in industry and everyday products has been slowly reduced, which has led to a decrease in the extraction and emission of the element. It turned out, however, that these restrictions did not result in a significant reduction in the Hg concentration in the environment. This is because once Hg is introduced into the environment, it remains there for a very long time, moving between living and nonliving elements of the ecosystem. The most vulnerable to Hg pollution are the seas and oceans, where Hg is introduced with rivers and atmospheric precipitation. In the sea, Hg is either deposited to the bottom sediments that serve as a temporary reservoir of Hg, or it is incorporated into the food chain, the first link of which are plant organisms - phytoplankton, algae or seagrasses growing on the seabed. The concentration of Hg increases at successive levels of the food pyramid, and its concentration in top predators such as swordfish, seals, and polar bears can be up to a million times higher than in the surrounding water or air.

The main route of Hg entry into the human body is through the consumption of fish and seafood. The Hg concentration in Baltic fish has decreased over the past few decades and is currently not dangerous to health when consumed reasonably. However, it appears that in recent years, despite significant reductions in Hg emissions, there has been an increase in its concentration in some fish species, including the popular herring and cod. Although similar worrying trends have also been reported in several bodies of water in North America, their cause has not been precisely explained. In the case of the Baltic Sea, it may be related to the release of pollutants accumulated over the years in bottom sediments, especially in water bodies with limited water exchange, such as lagoons (Puck Lagoon, Vistula Lagoon or Szczecin Lagoon). Currently, due to the improvement in water quality as well as the extension of the vegetative season, more and more of the sea bottom area is covered with plants. It is a favourable environment for the development of animal organisms - mussels, shrimps or small fish and for the spawning of some fish. On the one hand, this is beneficial for the species richness of the ecosystem, but, on the other hand, the vegetation and benthic animals along with the nutrients they take up from the sediment and bottom water also absorb Hg. Thus, the pool of this toxic element in the marine food chain increases, thereby enhancing the exposure to human consuming fish. An important factor responsible for the introduction of Hg into the sea is its removal from the land, where has been accumulating in the soil for a long time. Intensive rains, floods, and storms are particularly important in this process, especially because in recent years we have observed an increase in the frequency and intensity of these phenomena.

Since fish play a very important role in the human diet, both due to their health benefits and their flavor, identifying the factors and processes responsible for their contamination is extremely important. Currently, eating fish caught in the southern Baltic is safe, but will it remain so? Will changes in the marine ecosystem in recent years nullify efforts to reduce Hg emissions to the environment from anthropogenic sources and to what extent? What might be the implications of this on a local and global scale? To answer these and other questions, it is necessary to investigate the levels of mercury in the marine environment along with an indication of its availability to organisms, to comprehensively examine the role of individual links in the food chain in the incorporation of Hg into the cycle and its subsequent transfer, and to recognize the impact of changing environmental parameters.