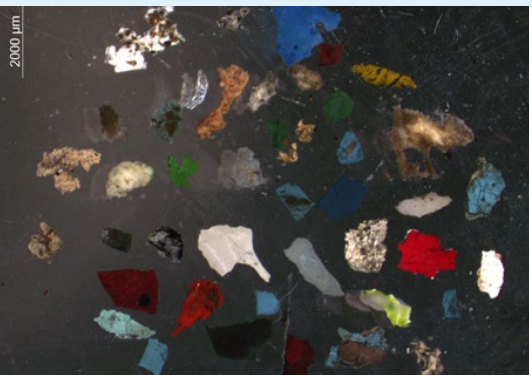
An Initiative of the German Federal Ministry of Education and Research

Plastics in the Environment

sources • sinks • solutions

Transport of microplastics in rivers

Microplastic input into the Baltic Sea via the Warnow River



These paint particles from the bottom of the Warnow River mostly consist of plastics. The particles in the µm-range can no longer be clearly identified with the naked eye. Therefore, all samples are examined spectroscopically.

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Microplastics enter the marine environment through many pathways. The input via rivers plays a significant role. The Warnow River was used as an example to investigate inputs into the Baltic Sea. Microplastics were found in varying amounts in all river samples. Weather conditions and the particle properties themselves are particularly important in determining whether the particles reach the Baltic Sea.

Microplastics pollution in the Warnow River

Polyethylene, polypropylene, polyester and polystyrene account for the largest share of plastic pollution in the Warnow River. Sewage sludge is the most important agricultural source of microplastics in the Warnow estuary. At a discharge of 16.5 m^3/s, approximately 200 plastic particles of > 50 µm per cubic meter of water enter the river mouth from the Upper Warnow. There, they account for 49% of the microplastic pollution, which is just as high as inputs from stormwater overflows and mixed sewer systems. 1.4% are discharged via the Rostock wastewater treatment plant. The annual input of microplastics from the Warnow River into the Baltic Sea is 152-291 billion particles, mainly in the size range of 10-100 µm.

"Microplastics in the Warnow River are typically smaller than 300 µm. Wind conditions determine their persistence in the estuary or their outflow into the Baltic Sea."

Prof. Dr. Matthias Labrenz,
Leibniz Institute for Baltic Sea Research

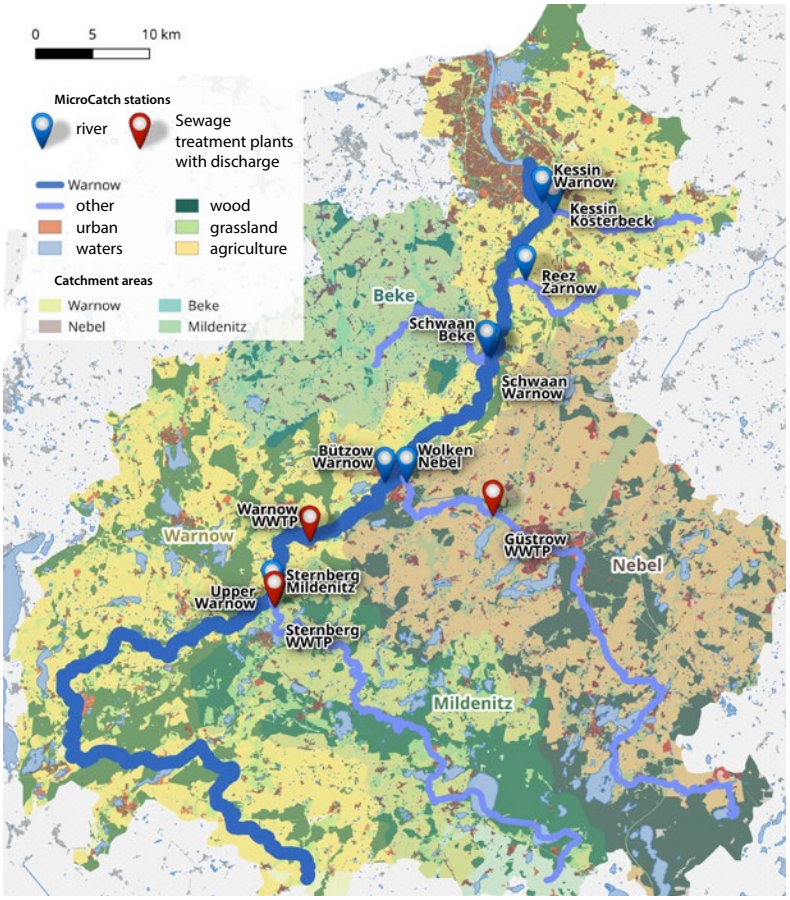

Fig. 1: In its upper reaches, the Warnow is characterized by a predominantly rural-influenced estuary. Near Rostock, it flows into the Baltic Sea via its urban-influenced estuary.

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Research on microplastic sinks and sources

For the Warnow catchment, the MicroCatch_Balt project identified sources and sinks of microplastics, as well as dispersal processes on their way to the Baltic Sea. Surface water samples were taken in the Warnow and its tributaries at three points in time at nine stations each.

Up to 1,000 liters of water were sucked through filters with a 10 µm mesh size. Subsequently, the natural particles were separated from the plastic particles as best as possible. All remaining particles in a sample were examined spectroscopically to determine the type, shape and size of the plastic particles.

Most of the microplastics are washed back ashore near the point of emission and accumulate on the beaches.

South-east wind carries microplastics from the Warnow River into the Baltic Sea

The microplastic particles that arrive in the estuary only reach the Baltic Sea under certain wind and current conditions: For example, with a south-easterly wind, light microplastics floating in the upper water layer drift in the direction of the Baltic Sea. Under the same conditions, however, heavier particles are transported inland with the saline deep water. With winds from north-west, both light and heavy particles remain in the estuary.

Reducing plastic inputs

Measures to reduce microplastic inputs should focus on rainwater run-off and emissions from combined sewer systems in the Warnow estuary. Particularly during extreme events, such as heavy rainfall or major public events, micro- and macroplastics are introduced into the Warnow River and the Baltic Sea via these pathways; with currently unsatisfactory retention options.

Fig. 2: Density separation of the light components (plastic/organics) from heavy sediments. Microplastic analyses from environmental samples are very laborious and time-consuming. Several months pass from sample collection to result.

Fig. 3: The ‚Rocket' device, developed specifically for the sampling of microplastics, during a test sampling at the Baltic Sea.

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