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Plastic debris and plastic litter in the Kerch Strait of the Black Sea

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It is well-known that the shallow Sea of Azov can be thought of as a large estuary receiving discharges from the Don and the Kuban rivers, therefore, the flow through the Kerch Strait towards the Black Sea usually carries a variety of pollutants. However, the flux of plastic waste through the Strait has never been quantified. In situ measurements and sampling of microplastic debris and floating plastic litter in the Kerch Strait were conducted by a team from Shirshov Institute of Oceanology on July 16-18, 2020, along with CTD and ADCP profiling in the cross-section of the strait. The microplastic debris were sampled using a 0.3 mm mesh size Manta trawl net towed behind the R/V "Peleng" cruising at 4 kts and taking material from the upper 1 m of the water column. As a result, a large set of plastic particles, fibers and films were collected. All sampled items were measured, weighted, and sorted by composition using Micro NIR 1700 spectrometer instrument. The particle sizes ranged from 0.4 to 25.0 mm and weights varied between 0.05 and 7.72 mg. With respect to the chemical composition, about 63% of the collected particles were identified as HDPE (high-density polyethylene), 21% as PP (polypropylene), 5% as PET (polyethylene terephthalate), 4% as PA (polyamide), 4% as PC (polycarbonate), and 3% as all other types of plastic. The content of visually identifiable plastic litter in the Kerch Strait varied between about 10 and 200 pieces per km², with the average value close to 100 pieces/km². However, the distribution was far from homogeneous – the litter was mainly concentrated in the western part of the Strait, where the principal stream carrying the Sea of Azov water into the Black Sea is usually localized. The newly obtained data of plastic litter concentration together with the current velocity data collected in ADCP profiling enabled us to estimate for the first time the flux of plastic through the Kerch Strait from the Sea of Azov into the Black Sea. This can be done by simply multiplying the plastic concentration by the velocity and then integrating it over the cross-section of the Strait. This procedure yields an estimate of 14,700 major pieces of plastic such as bottles, bags, etc., passing through the Strait per day. Assuming the average weight of a plastic litter piece 15 g, this leads to 220 kg/day, or about 9 kg/hour. This is quite a considerable mass of plastic, although it is about 20 times smaller than the amount brought to the Black Sea by the Danube according to [Lechner et al., 2014]. It must be kept in mind, however, that our estimate for the Kerch Strait is based on instantaneous one-time measurements, and may not represent long-term average values.

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