

Bayesian Belief Networks to reduce unintentional bycatch in riverine and estuarine plastic removal systems

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Every year vast amounts of plastic waste enter our ocean transported by inland waterways. To prevent plastic debris from reaching the marine environment plastic clean-up technologies are being increasingly designed and developed. However, to date, the possible impact of clean-up technologies on riverine environments is not fully understood. In fact, various are the variables that could influence the chances of biota being unintentionally caught by a plastic clean-up installation. In the presented doctoral research, we aim to test the influence of four groups of variables on the probability of plastic and biota being removed by a clean-up system. A first central cluster of variables refers to the riverine conditions such as the flow velocity in which the clean-up device should be deployed. The next group of variables assembles the traits of the biota present in the river, such as their sizes, buoyancies, or adhesiveness. We identified the traits of plastic items (i.e., plastic size, shape, density, weathering) present in the riverine system as a third cluster of variables. Besides, and as a last group of variables, we will investigate the effect of the operational mechanism of the clean-up device (e.g., curtains of air bubbles, water wheels), which is expected to influence the chances of plastic and biota being collected. To carefully examine the impact of each group of variables on the probability of plastic removal and bycatch, we will collect data from scientific literature, experts and we will conduct mesocosm experiments to integrate missing information. We then suggest the integration of these data into a Bayesian Belief Network (BBN) model for an evidence-based trade-off between plastic removal and bycatch. In this study, we present how BBN probabilistic models can become a beneficial tool in guiding stakeholders in their choice of deploying a clean-up technology in a river or estuary.

Keywords: Bayesian Belief Networks; Plastic clean-up technologies; Rivers; Estuaries