



## **Spatio-temporal co-location analysis of dynamic plastic debris and marine life in the Pacific Ocean**

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Majority of the plastics making up the garbage patch in the Pacific Gyre originate from ten rivers in Asia. Due to complex industrial activity coupled with heavy rain events, the amount of plastics introduced to the Pacific Ocean have distinct temporal signatures. In this work, spatio-temporal patterns of river plastic debris is quantified and movement trajectory of plastics from different rivers to the Pacific Gyre is modeled. In this study, spatio-temporal co-location of plastic streams and marine animals is studied. A GIS workflow is used to combine multiple data sources to model and mine spatio-temporal patterns behind different marine animal species' exposure to moving plastics. Plastic movement is modeled as a coupled process between ocean currents and surface winds, using an open-source Lagrangian simulator. Resulting movement of spatially-heterogeneous plastics is represented within a space-time data structure. A spatio-temporal co-location analysis between plastic movement and animal telemetry is developed to statistically model exposure times of different marine animal species to moving plastics. Lastly, a sensitivity study that highlights the impact of legislation and action for plastic management is presented.