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PRESS RELEASE

SURVEILLING MARINE LITTER FROM SPACE BECOMES A REALITY

A new study published in *Nature Communications* shows the idea of monitoring marine litter by satellite turning into reality. The new technological development for detecting floating plastic pollution has been tested in the Mediterranean Sea. Using satellites currently in orbit, researchers achieved an unprecedented view of the emissions and accumulation areas of marine litter. The future implementation of a satellite sensor specifically designed for this purpose could increase current detection capacity by twenty times.

Satellites are one of the great hopes for monitoring marine plastic pollution. Yet, the quantity of plastic on the sea surface is rarely high enough to generate a detectable signal from space. Plastics and other floating debris have to be aggregated into dense patches at least tens of metres in size to be detectable by existing satellites. These patches of floating litter are called **slicks, streaks, or litter windrows**. They are often filament-shaped, being the result of the presence of convergence current lines on the sea surface.

The detection of a litter windrow is indicative of high pollution at a particular place and time. However, using such scattered and ephemeral patches of litter, as the basis for developing a space mission dedicated to the global monitoring of plastic pollution, raised big questions. “We didn’t know if the abundance of litter windrows was enough to draw maps, or to reveal trends over time”, notes Andrés Cózar, from the University of Cádiz (Spain) and co-director of the work together with Manuel Arias, from the Institute of Marine Sciences, CSIC (Spain).

The team of Cózar and Arias, consisting of multinational space companies and research institutes from 6 countries and funded by the Discovery Element of the European Space Agency (ESA), tested the usefulness of litter windrows as a proxy for monitoring marine litter. Using a 6-year historical series of 300,000 satellite images, the team scanned the entire Mediterranean Sea every three days, at a spatial resolution of 10 metres, in search of windrows. They relied on the Sentinel-2 satellites of the Copernicus Programme of the European Union, whose sensors, while not designed for litter detection, have a somewhat limited capability for plastic detection. “Searching for litter aggregations of metres in size on the ocean surface is like looking for needles in a haystack”, explains Manuel Arias. The automation of this task was only possible with the use of supercomputers and advanced search algorithms.

They found thousands of litter windrows. Many were more than a kilometre long, and some up to 20 km long. Enough windrows to create the most complete map of marine litter pollution to date. “Litter detections with a non-specialised satellite allowed us to identify the most polluted areas and their major changes over weeks and years. Litter is injected into the Mediterranean Sea as the rainstorms rage.”, says Andrés.

An important contribution of this work has been the understanding of the significance of the litter windrow structures in the context of marine monitoring. Litter windrows are mainly associated with land-based litter emissions in the preceding days. This feature makes them particularly useful for surveillance and management of the problem, and the authors illustrate this applicability with real-world cases. They assess the effectiveness of action plans against marine litter in Rome (Italy), identify a pollution hotspot related to shipping through the Suez Canal (Egypt), or use the satellite to provide guidance for cleanup operations in the Bay of Biscay (Spain).

“The tool is ready to be used in other world regions, which I am convinced will teach us much about the littering phenomenon, including identification of sources and the pathways to the ocean”, says Manuel. “There is still room for improvement. The sensor used in our proof was not designed to detect plastic. Detection capability would be enormously improved if we put observation technology into orbit tailored for ocean plastics”, stresses Andrés.

The idea of monitoring marine litter pollution from satellites proves to be not only feasible, but also really promising, even for issues beyond plastic. The deployment of a sensor specifically dedicated to the detection and identification of floating objects of one metre in size could also be useful in contribute to issues as relevant as oil spills, loss of cargo, or even search and rescue tasks at sea.

Together with the University of Cadiz and CSIC, the team is composed of researchers from the European Space Agency (ESA), ARGANS France, the Universitat Politècnica de Catalunya (Spain), the Consiglio Nazionale delle Ricerche (ISMAR-CNR, Italy), the Technical University of Crete (Greece), ARGANS Ltd. (UK), AIRBUS Defence and Space (France), the Joint Research Centre (JRC) of the European Commission, The Ocean Cleanup (The Netherlands), and ACRI-ST (France). The study was funded by the European Space Agency and the Spanish Ministry of Science and Innovation (Global Litter Observatory, ref. CTM2016-77106-R/ AEI/10.13039/501100011033/ European Union NextGenerationEU/PRTR).

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Short link with full-text access to the paper (please use): https://rdcu.be/dKNN6

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Infographics, pictures of litter windrows and more resources at **www.marinelitterlab.eu**

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