DRIFT NET

THE WORLD IS INCREASINGLY AWARE OF THE PROBLEMS OF PLASTIC POLLUTION. **GARY KING** REPORTS ON A PROJECT TO TRACK THE DRIFT OF PLASTIC WASTE IN THE NORTH SEA, TO SEE WHERE IT ENDS UP

Never before has there been such global awareness of the scale and impact of pollution on our oceans. The phenomenon of 'plastic islands' has entered the public consciousness and images of marine life devastated by floating plastic have engendered a sense of urgency – and the need for action.

Researchers worldwide are feverishly studying the Earth's oceans, assessing their 'health'. Fortunately, affordable state-of-the-art satellite technology and the power of the Internet of Things (IoT) are on hand to help them in their efforts.

One study to explore the movement of plastic pollution is being conducted by researchers at Germany's University of Oldenburg. A team from the university's Institute of Chemistry and Biology of the Marine Environment is studying the movement of plastics in the southern North Sea. The goal is to get a clear picture of drift patterns of plastic debris and to better understand the complex interaction of tides, winds and currents.

PhD student Jens Meyerjürgens explains: "We embed low-cost satellite trackers into floating buoys and these provide a wealth of information on the movement of plastics on the sea's surface. This helps us understand how debris moves and how it is affected by the complex interactions of wind, current and tides."

Tracking drift from space

The buoys (or 'drifters') are fitted with a tiny (7cm x 5cm) SPOT Trace devices, which helps researchers track their movement using the Globalstar satellite fleet 1,400km above the Earth. The SPOT Trace unit includes an integrated GPS receiver, simplex transponder and motion sensor. It is fitted inside the housing of the buoy directly below the cap. The cap is usually above the water surface so the device has a stable connection with the satellites. The other component in the buoy is a long-life battery pack which provides up to five months of power.

In a true IoT solution, data gathered from the movement of the buoys across the water is transmitted to Globalstar satellites, then to Globalstar's land-based earth stations, and made available on the SPOT website. The team exports the data from the website, refines it using software and plots the data on maps. The resultant analysis not only shows where the plastic is travelling, but also how fast.

Collecting and storing the data is a user-friendly process. Tracking data captured by the SPOT devices in the buoys is fed to the research team's computer simulation programmes. "We can download the data as a CSV file and store the files on our servers," Meyerjürgens says. Sophisticated

modelling tools simulate complex ocean currents at the surface to reflect movement of waste on the ocean surface. But for a truly comprehensive picture, the simulation is in 3D, examining depth and wave height too.

"It is important that we look at how debris travels in the water column and on the sea floor," Meyerjürgens says. The resulting dataset adds valuable granular detail to projections of surface drift behaviour. "We aim to make reliable predictions based on multiple algorithms and mathematical analysis," Meyerjürgens explains.

The team measures wave height with a wave radar array on the East Frisian island of Spiekeroog to understand the wave field structure in the coastal zone of the southern North Sea.

Modelling specialists on the team compare established models for North Sea current behaviour with an existing wave model. This data is combined with wind data to capture the effects of atmospheric forcing as well. The team interprets data from the drifters to analyse and record velocity, tide metrics, wave movement and wind.

Other partners in the project, funded by Lower Saxony's Ministry for Science and Culture, are tasked with analysing the composition of ocean pollutants – measuring the relative amounts of plastic bags, bottles and non-plastic pollutants such as metal – while others are taking care of removal.

"75 per cent of the debris that washes ashore on our islands is plastic, mostly from fishing activity," says Mathias Heckroth, managing director of Mellumrat eV, an NGO dedicated to conservation and scientific research on the uninhabited island of Mellum, one of the 32 Frisian Islands being studied by the University of Oldenburg team. Mellum is situated in the intertidal Wadden Sea, a UNESCO World Heritage Site protecting more than 10,000 species of plants and animals, from microscopic organisms to fish, birds and mammals. Up to 12 million migrating birds spend time on Mellum each year.

Heckroth says that the study is playing an important role in helping to identify the sources of plastic litter. It is also revealing unexpected drift movement: "For example, we usually have a west-to-east drift, but sometimes tracking the buoys reveals a drift in the opposite direction and we are studying why," Heckroth adds.

Message in a bottle

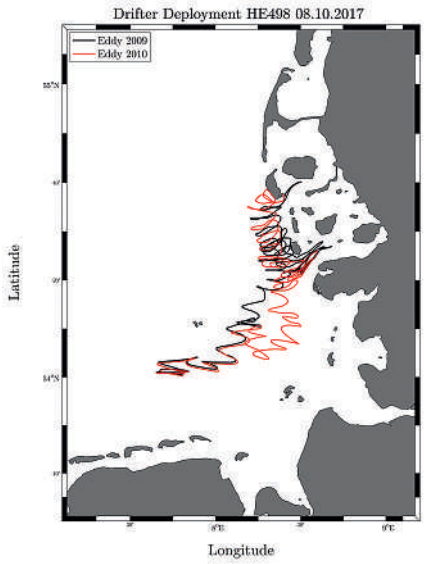
Environmental campaigners have long realised that an effective way of raising awareness of this issue is by issuing a widespread call to action, inviting the public to participate in scientific research. The university is doing exactly this by launching dozens of wooden 'floaters', similar to a message in a bottle. They are encouraging people who find the floaters washed up on a beach to get in touch. Each has a specific ID so they can be reported on the team's homepage, www.macroplastics.de, in German or English.

"18,000 floaters have been reported by citizens. Users can click on a map where they've found them and the accuracy has been pretty good," Meyerjürgens observes. "They are adding valuable information to the datasets from the satellite tracker-equipped buoys," he adds.

One of the most revealing discoveries so far has been how quickly some buoys wash ashore, some beaching in as little as one month or six weeks after travelling up to 1,100km. "It is clear that the influence of the wind on the movement of debris in the North Sea is greater than we anticipated," says Meyerjürgens.

The end game

Having a clearer understanding of the patterns of movement of plastics on the seas will go some way to improving efficiency of clean-up initiatives. Responsibility for cleaning beaches resides with local governments, which always face tightening spending budgets.



Example trajectories of two drift experiments

Another hoped-for benefit from these studies is the introduction of more robust legislation regarding pollution and mandating more effective decontamination programmes.

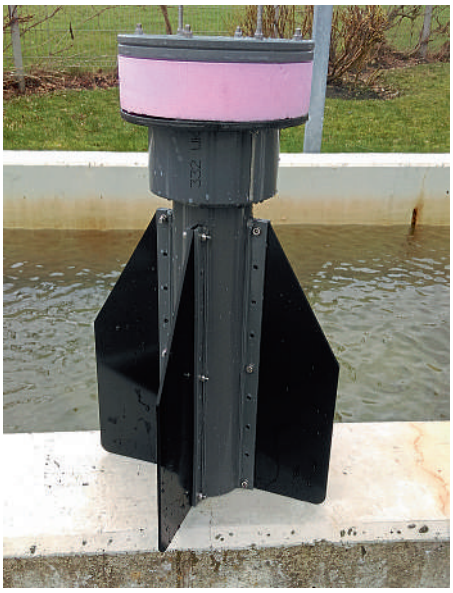
Says Heckroth, "A key role of the university's research is to help bring all stakeholders together, to give them compelling evidence and to raise public consciousness of this huge problem."

Meyerjürgens adds: "We very much hope this study inspires others and we would be delighted if our methodology became a template for use by fellow research institutions elsewhere in the world."

All life depends on the health of our seas. Thankfully, technological innovation, enabled by the reach of satellite communication, is leading to new scientific discoveries and enhanced understanding of these delicate ecosystems.

Gary King is SPOT regional sales manager EMEA at Globalstar (eu.globalstar.com)

Beached plastic debris on the island of Mellum



One of the buoys used for tracking