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Developing a Framework for Microplastic Litter Reduction across NSW

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AUSMAP

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Plastic pollution is an ever-growing problem and with at least 80% of this pollutant generated as litter from local sources (Willis et al. 2017), it is important to understand the sources and pathways to better manage the issues. One form this plastic pollution takes is as 'microplastics' (<5 mm in diameter) which are either from the break-up of larger items or the direct discharge of microplastics (e.g. pre-production resin pellets). These microplastics are known to be ingested by a range of aquatic organisms, from plankton through to whales, and can cause potential harm (Wright et al. 2013). To be better informed about the risks of microplastics it is critical to measure and quantify their sources and sinks.

The Australian Microplastic Assessment Project (AUSMAP) is seeking to do this by engaging high-schools and local communities to collect scientific data on the prevalence of microplastics or 'hotspots' in Australia's aquatic environments (both marine and freshwater) through a standardised practical citizen science methodology. AUSMAP, managed through the Total Environment Centre in partnership with academic institutions like Macquarie University, trains 'leaders' who then engage their local community and build the capacity for educating the wider community, businesses and local governments about the plastic pollution problem. This leads to ingrained education and empowerment, and an increased ability to take leadership of these complex systemic problems. This can be achieved by collecting localised data from major sources, such as our cities and towns, and making the information publicly available to the community, industry and decision makers.

Our team of citizen scientists not only quantify microplastics, but help to identify type (e.g. hard fragments, resin pellets, fibres, soft plastics or foam), colour and shape of the plastics; vital to ascertain potential sources and impacts. Plastics are then sent to research partners for microplastic verification and chemical contaminants analysis. Information is then communicated back to communities via the AUSMAP webpage, social media and online interactive hotspot map.

Since inception in mid-2018, AUSMAP have trained and accredited 736 Leaders in the program at 46 training events across Australia. Our team have designed and distributed 175 field kits and worked alongside over 330 groups, including teachers, environmental educators, local government, research organisations, businesses and community members. Across Australia, we have collected approximately 380 samples, engaged directly with over 8,000 participants, equating to over 35,000 volunteer hours,

Figure 1: Microplastic sampling and AUSMAP community engagement

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and removed over 500,000 microplastics from our waterways (Figure 1).

Recently, AUSMAP, in collaboration with partners, has progressed to locate sources of microplastics through a series of catchment-based sampling techniques. The following case study illustrates the process as a model for future application more broadly.

DEE WHY CASE STUDY

Dee Why Lagoon, on Sydney's Northern Beaches, is a protected wetland, important for migratory shorebirds and as a nursery ground for marine life. In 2019, this lagoon was also recognised as a microplastic hotspot with subsequent sampling demonstrating that different parts of the catchment were responsible for specific litter items. Through a NSW EPA Round 5 Litter Grant, and partnering with Northern Beaches Council, The Surfrider Foundation and Macquarie University, the AUSMAP team investigated the microplastic sources more closley and ran community litter awareness days, including participation for key stakeholders in sampling and analysis, as a way to encourage behaviour change. Stormwater outlet netting and street level drain pit baskets were installed to determine litter sources across different land use types in the targeted catchment (e.g. Low density residential, Recreational and Special use and Light industrial).

The 14 pit traps collectively prevented approximately 450 kg of debris from entering the local waterway over the eight months of sampling. The majority of this debris (98%) consisted of organic material and soil (Figure 2), indicating that natural substances were also being washed into local waterways and may be a contributing factor for silting up or in-filling of the lagoon. Of the 2% of synthetic debris by weight, over 60,000 micro-litter particles were identified, which made up over 80% by number of the total synthetic load (Figure 3).

There was a high degree of variability in micro-litter between individual traps. Figure 4 illustrated that in one-month, amounts at a site can vary from

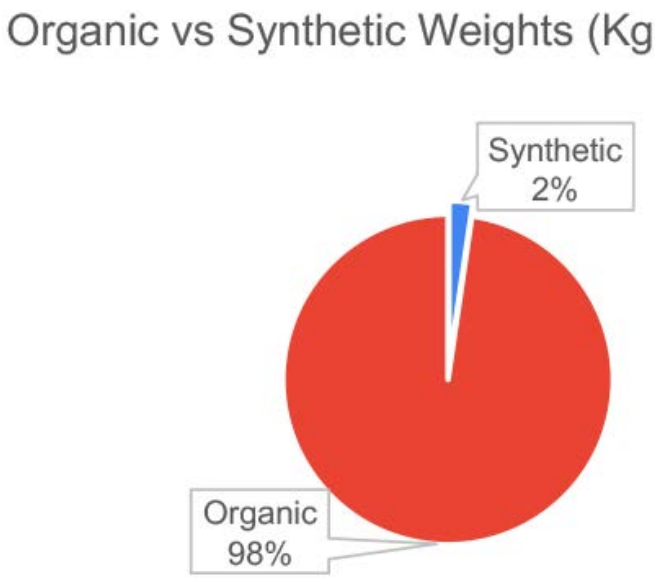

Figure 2: Percentage of types of debris by weight

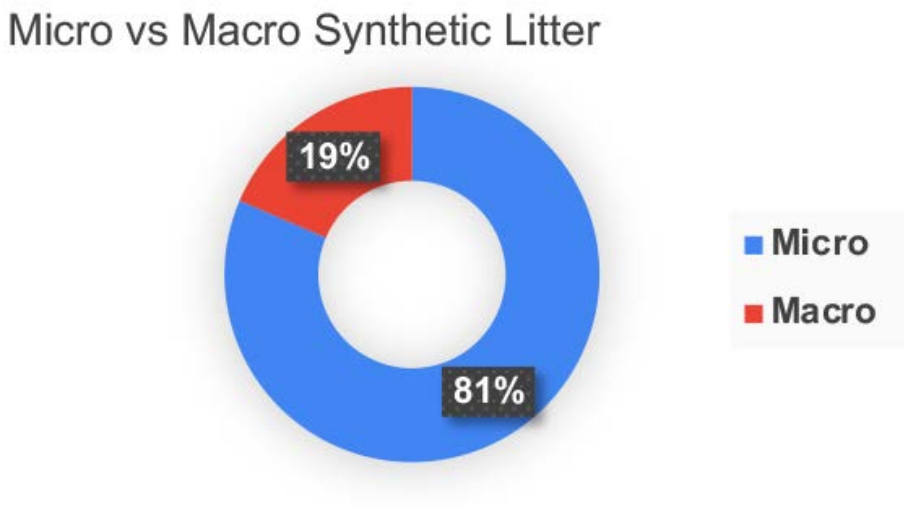

Figure 3: Percentage of synthetic litter by size class

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35 to 900 items. The land-use type and the weather over the months influenced the runoff types and amounts. With the sampling conducted during La Nina, these volumes were reflected of an overly wet period in the sample area (> 900 mm falling over the 8 months) and further sampling during dry periods is recommended to ascertain runoff fluctuations more broadly. In the light industrial locations glass, film and foam micro-litter was the dominant types, and the only location where industrial pellets were found. In the locations near to a synthetic field, rubber crumb was the dominant item. In the residential zone, a mixture of items were found including hard plastics fragments. This variability highlights the importance of land-use in determining microplastic sources, and hence sub-catchment level education and management strategies are recommended for greatest impact.

CONCLUSIONS

AUSMAP has demonstrated to be a reliable and affordable tool in identifying microplastic hotspots in our waterways, as well as a unique way to educate and inform communty and stakeholders of localised plastic pollution issues. The Dee Why case study demonstrated that microplastic can be tracked back to source, and that microplastics are already evident in high loads at the neighbourhood and streetscape level before entering waterways. This highlights that the stormwater system is a major conduit for microplastics and that any management should consider mechanisms to control this form of plastic pollution. The study also has provided a preliminary model based on nets and traps for reducing litter and microplastics in a catchment that is currently being validated in other areas.

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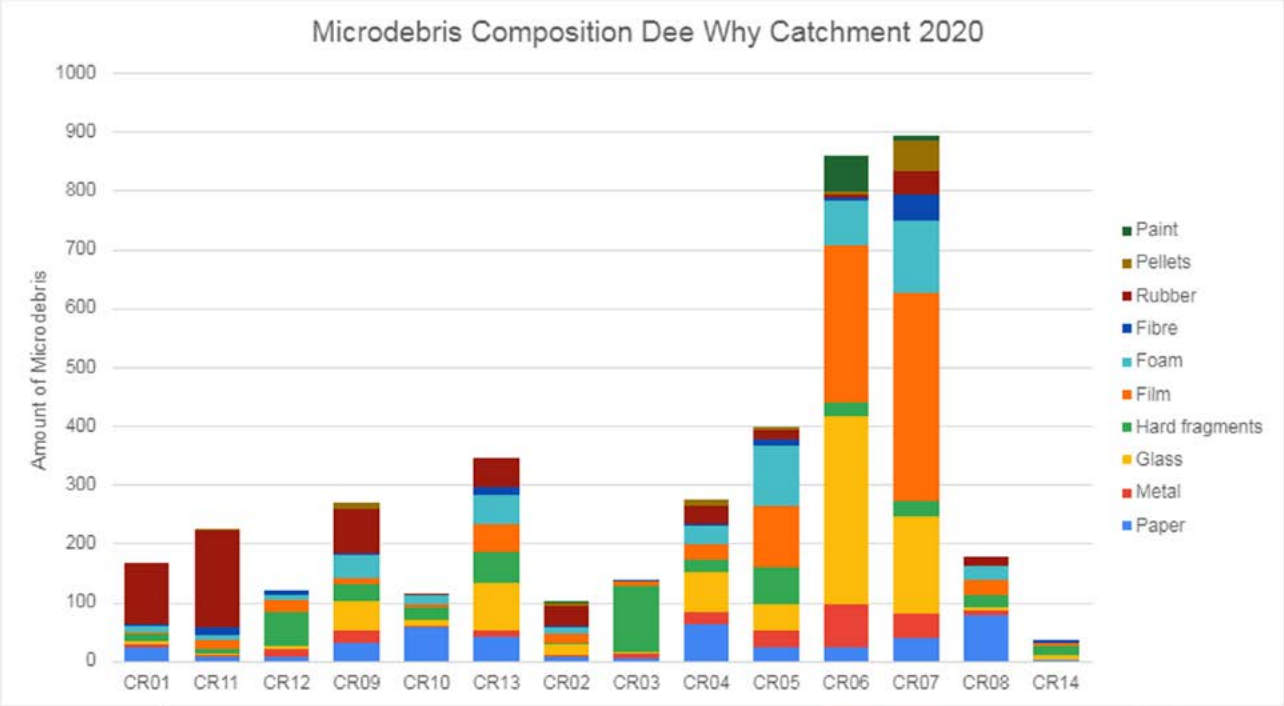

Figure 4: Example of micro-litter amounts and types across 14 sites for a month