Committee Secretary
Standing Committee on Climate Change, Energy, Environment and Water
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Dear Committee Secretary,

The Australian Institute of Marine Science (AIMS) was grateful for the opportunity for Dr Darren Koppel to attend your hearing in Perth on Tuesday 27 June 2023. During his verbal evidence, Dr Koppel undertook to provide additional information on a number of topics. We therefore provide this submission in support of those undertakings.

The Multifarious Nature of Microplastics

The multifarious nature of microplastics means that unfortunately there is no one method that fits all microplastics, methods therefore need to be tailored to the specific polymer type. For example, some plastics are low density, meaning they float, whereas others are high density and settle in the sediments. The collection method used by the Australian Microplastic Assessment Project (AUSMAP) is designed specifically for the shoreline, and involves manual sieving and sorting of shoreline sediment. AIMS' research is focussed on employing the same method for the collection of microplastics from the shoreline, as well as the ocean surface, mid-column, and sediment, and also within sentinel organisms. Each of these environmental compartments requires a tailored method. The shape of the microplastic is also a determining factor in the method applied. For example, microplastic fibres required finer mesh to recover compared to films, foams, and particles. However, finer mesh has additional logistical implications in that it is not suited to citizen science projects such as AUSMAP.

The field and laboratory methods at AIMS are based on learnings from literature and were developed specifically for marine surface waters over six years as part of a pilot study. These have been adopted by the Integrated Marine Observing System (IMOS) to assess microplastic contamination Australia-wide. These methods are published on the Australian Ocean Data Network (AODN), and AIMS has been engaging to have them incorporated into the Ocean Best Practices System. AIMS is currently collaborating with the National Environmental Science Program and CSIRO to establish a standardised microplastics field collection decision workflow and, where possible, method harmonisation. This will assist researchers in selecting the method most suited to the environmental compartment, the sampling location, and their research question. The intent of the workflow is to support future research and monitoring projects in the marine environment.

Controlling quality assurance and checking for extraneous contamination introduced by the experimenter during the collection and processing steps of the workflow is critical to ensure the accuracy of microplastics data reported. AIMS is leading the push for a standardised approach, and has published on this recently (Dawson et al. 2023).

Comparing Data

Comparing data across studies has not been straightforward, mainly because of the collection methods used. For example, a tow net filter which filters the water over a distance travelled versus bottling which captures a volume of water at a specific location. As such, the units in which plastic contamination is reported differ. There is currently discussion scientific literature

regarding the need to harmonise reporting units. AIMS is engaged in this discussion, with a manuscript on this topic currently in review.

Monitoring

AIMS has been monitoring seven inshore estuary locations along the Queensland coastline for the past six years with samples currently being processed. It is important to highlight that microplastics are a suite of contaminants that are not homogeneously dispersed in time and space. To have an accurate baseline and trends, AIMS must monitor as many places and as many times a year as possible.

AIMS does not have research facilities or personnel in major urbanised centres like Sydney or Melbourne, however AIMS is establishing collaborations to facilitate monitoring in some of these areas. AIMS has a new collaboration with the New South Wales Department of Planning and Environment and the University of Newcastle to develop a monitoring program in New South Wales estuaries, and is exploring opportunities to expand monitoring in Darwin Harbour.

Australia-wide, AIMS currently monitors seven locations with IMOS moorings:

- Darwin Harbour (Northern Territory)
- Yongala (Queensland)
- Port Hacking Bay (New South Wales)
- Bonney Coast (Victoria)
- Gulf Saint Vincent (South Australia)
- Spencer Gulf (South Australia)
- Rottnest Island (Western Australia)

Early trends indicate higher microplastic loadings at the most urbanised location – Port Hacking Bay – however, further temporal data is needed to confirm this. The time of year and extreme weather event occurrences also influence the loadings observed. AIMS data from the IMOS monitoring program is publicly available on the AODN.

AIMS does not yet have collaborations with our near international neighbours however AIMS does have a strong relationship with Brazilian researchers to undertake comparative bi-national studies of Australian and Brazilian environments and marine life. This collaboration provides the framework under which new international collaborations can be established.

AIMS Studies

AIMS has conducted two studies on the Great Barrier Reef that in combination suggest that the microplastics found in this region may be coming from both the Australian coastline and the Coral Sea. The mathematical modelling of ocean hydrodynamics conducted in these studies do not extend to international waters, so it is not possible to predict with any certainty the international source. Together, both studies also suggest that the amount of microplastics coming from the Coral Sea vs the Australian coastline and how these are dispersed across the Great Barrier Reef varies during the year, possibly influenced by the wind and changes in currents. For example, during months when the south-easterly trade winds prevails, microplastics found at inshore locations originate from the Australian continent while those found at offshore locations are likely to originate from the Coral Sea, i.e., potentially internationally. IAIMS has also conducted localised studies at Lizard Island Research Station and shown there are microplastic accumulation zones driven by oceanic features. The impacts on marine life, such as larval fish in these accumulation zones, are still being assessed.

Global studies have found microplastics can be 'trapped' in the coral skeleton. When this occurs the coral simply grows around the item. AIMS has conducted research into microplastic contamination in corals collected from Lizard Island reefs and found up to 1.55 microplastics per gram of coral including both the polyp and skeleton. This result is substantially lower than what is being reported from other international reefs. AIMS also found that the size of the microplastics found in corals is similar to the size of their plankton prey. Other researchers have established that corals in aquaria will take up microplastics. AIMS is planning an ecotoxicology study in the latter half of 2023 to understand the impacts of microplastic intake by early stage juvenile corals.

In a study conducted by AIMS that is yet to be published, damselfish were exposed to microplastics originating from textile products and increased seawater temperature to assess changes in growth, behaviour, and stress levels. This study was conducted with environmentally relevant conditions of stress (i.e., low concentrations of microplastics according to what has been measured at the Great Barrier Reef, and seawater temperatures predicted by the IPCC) and suggests that levels of stress are affected by the combination of the concentration of plastics and the temperature of the water, whereas growth and behaviour are affected by seawater temperature only. The levels of changes however were not dramatic – no mortality was observed and not all fish responded the same. So, this study indicates there might be a potential for health effects caused by microplastics.

AIMS is collaborating with Central Queensland University, University of Queensland, RMIT, and the University of Newcastle on a variety of microplastics projects. We also have several government and international collaborations underway.

AIMS has not conducted any research into ghost nets, but we are very aware of their impacts. We have partnered with the Erub Arts and the Ghost Net Collective and used our microplastics research as a platform to promote awareness of the issue.

A single plastic item can potentially break into a million pieces, so removal of larger items is the key to minimising any further introduction of microplastics into the environment. Once they are a microplastic it is near impossible to remove them. If the source of microplastics is removed, then the expectation is that the current baseline levels will remain stable. It is unlikely that this level will drop in the near future and will only do so if microplastics are degraded or fragmented further into nanoplastics.

AIMS appreciates the Committee's interest in this important topic, and would be pleased to participate in further discussions or provide additional information if requested.

Yours sincerely,

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