6th September 2022 Ref. E9-8/2022

The Hon. Tanya Plibersek MP,
Minister for the Environment and Water,
PO Box 2676, Strawberry Hills, NSW 2012
Email: tanya.plibersek.mp@aph.gov.au

Senator The Hon. Jonathan Duniam MP,
Shadow Minister for Environment, Fisheries and Forestry
GPO Box 453, Hobart, TAS, 7001
Email: senator.duniam@aph.gov.au

Dear Sir/Madam,

RE: Marine Plastic Pollution and Possible Ameliorating Measures

The National Council of Women Australia (NCWA) is a non-government umbrella organisation with broadly humanitarian and educational objectives and works to improve conditions for women and their families, especially the most vulnerable. The NCWA represents over 135 women's organisations and is concerned about marine plastic pollution is concerned about marine plastic pollution and consider it is imperative that plastic waste be captured at its source and plastic waste from rivers and other outlets does not make it to the open sea.

It is heartening that 175 countries endorsed a resolution at the United Nations Environment Assembly (UNEA) on 2 March 2022 to negotiate an international legally binding agreement to end plastic pollution by the end of 2024. There are many challenges to confront not least microplastics and nanoplastics already in the ocean. The UN Resolution on an Enhancing Circular Economy was also endorsed at UNEA and should help achieve stainable consumption and production in the future.

We understand...Australia has set a national target of 80% average recovery rate from all waste streams by 2030, and 70% of plastic packaging recycled or composted by 2025

There is an opportunity for Australia to assist our South Pacific neighbouring countries in this endeavour.

The NCWA urges the Australian Government to

- Support the research and development of advanced recycling technologies (chemical, molecular or feedstock recycling);
- Adopt a circular economy for plastics with advanced recycling technologies and utilising existing manufacturing infrastructure to help Australia reach its targets of 80% average recovery rate from all waste streams by 2030, and 70% of plastic packaging recycled or composted by 2025.
- Encourage Shire Councils to identify outlets to the sea which carry plastic, and to deploy low-cost, low-tech solutions to capture the litter; and
- Enable Pacific Island countries through Pacific Ocean Litter Project, to likewise deploy low-cost, low-tech solutions to capture the litter from streams and rivers.

This submission has been prepared by the NCWA and NCWQ Environment Adviser, Dr Pat Pepper. Her supporting information on marine plastic pollution and possible ameliorating measures is attached.

Yours sincerely,

Chiou See Anderson
President – National Council of Women of Australia
President – National Council of Women of Queensland
Treasurer / Board Member – International Council of Women
Ph 0413 070 400; Email: president@ncwa.org.au

Supporting information on marine plastic pollution and possible ameliorating measures.
NCWA Environment and Habitat Adviser & NCWQ Environment Adviser, P.M. Pepper B.Sc. M.Sc. Ph.D.

Summary: Marine plastic debris is revisited, and removal and remedial measures investigated. Removal of floating plastic from ocean garbage patches and from rivers which researchers calculated had a high probability of entering the oceans were considered together with the ocean currents which could distribute the debris to the gyres. In addition, methods to remove microplastics were also considered. While advances using plastic-eating microorganisms look promising to break polymers into monomers from which more plastics can be created, there are serious concerns about releasing genetically engineered microorganisms into the environment.

It is heartening those 175 countries endorsed a resolution at the United Nations Environment Assembly (UNEA) on 2 March 2022 to negotiate an international legally binding agreement to end plastic pollution by the end of 2024. There are many challenges to confront not least microplastics and nanoplastics already in the ocean. The UN Resolution on an Enhancing Circular Economy was also endorsed at UNEA and should help achieve stainable consumption and production in the future. Adoption of a circular economy for plastics with advanced recycling technologies and utilising existing manufacturing infrastructure could help Australia reach it targets.

Recommendations: -

- Support the research and development of advanced recycling technologies (chemical, molecular or feedstock recycling);
- Adopt a circular economy for plastics with advanced recycling technologies, and utilising existing manufacturing infrastructure to help Australia reach its targets of 80% average recovery rate from all waste streams by 2030, and 70% of plastic packaging recycled or composted by 2025.
- Encourage Shire Councils to identify outlets to the sea which carry plastic, and to deploy low-cost, low-tech solutions to capture the litter; and
- Enable Pacific Island countries through Pacific Ocean Litter Project, to likewise deploy low-cost, low-tech solutions to capture the litter from streams and rivers.

Global treaty to end plastic pollution: More than 8.3 billion tons of plastic has been produced since the early 1950s with about 60% ending up in either a landfill or the natural environment. 80% of land-based plastic ends up in the ocean[1].

On 2 March 2022 at the United Nations (UN) Environment Assembly in Nairobi, *UNEA-5,* a resolution was endorsed by 175 countries including Australia, to negotiate an international legally binding agreement to end plastic pollution by the end of 2024. The treaty will require countries to meet set pollution reduction targets or action plans in other environments as well as the marine environment, and address the full lifecycle of plastic, including its production, design and disposal.[2]

Marine debris: Previous submissions to Federal and Queensland Governments and reports have drawn attention to the problems of Plastic Waste, Marine Debris and the Impact of microplastics and nanoplastics on the marine environment., including the potential of toxins incorporated during manufacture or absorbed from the environment onto microplastics, being transferred to marine organisms and potentially up the food chain. (NCWQ Submissions to Government: - Microplastics, April 2015; Microplastics and Nanoplastics, November 2017; Marine Debris, February 2018; Plastic Waste, October 2018)

Ocean garbage patches: Of the five known gyres (Great (North) Pacific, South Pacific, North and South Atlantic, Indian Ocean) where rotating ocean currents have pulled marine debris which range in size from large abandoned fishing nets to microparticles, into huge garage patches, the Great Pacific Garbage Patch is the most well-known and covers an estimated 1.6 million square kilometres(Oct 2021- cf size of Qld 1.7 million square kilometres) and rapidly expanding.[3,4]

Removal of floating plastic: After years of development and trials, Ocean Clean-up, a not-for-profit organisation, now believes its latest development, System 200 will be able to clean up 90% of floating ocean plastic by 2040.[5] Two thousand feet-long floating rods will corral floating plastic to be periodically collected by ships. While this will not collect the microplastic, the large pieces of plastic will be removed before sunlight and waves breaks them into thousands of microplastic bits. From surveys, Ocean Cleanup estimate 80,000 metric tons in the Great Pacific garbage patch, with 1.8 trillion plastic pieces, out of which 92% of the mass is to be found in objects larger than 0.5 centimeters.[6]

Eighty percent of the world's ocean plastics enter the ocean via rivers and coastlines with the rest from marine sources such as fishing nets, ropes, and fleets.[7] Meijer *et al* calculated the probability for plastic waste to reach a river and subsequently the ocean using geographically distributed data on plastic waste, land use, wind, precipitation, and rivers. They estimate that 1000 rivers account for 80% of global annual riverine plastic emissions, which range between 0.8 million and 2.7 million metric tons per year, with small urban rivers among the most polluting.[8]

As these rivers can present very different characteristics, including river width, flow dynamics, marine traffic, and urbanization, a wide range of mitigation measures must be applied to these rivers across the globe to substantially decrease the amount of waste entering the oceans from rivers. The Ocean Cleanup has developed river cleanup technology, interceptors, which can extract substantial amounts of waste from rivers and be deployed in several waterway types.[9]

Small, innovative businesses e.g. Plastic Fischer; RiverRecycle are deploying low-cost, low-tech solutions to capture plastic from rivers. Plastic Fischer's locally built, low-tech and low-cost TrashBoom consists of floats made from standard plastic piping, attached to wire mesh barriers which extends down into the water to capture pieces of plastic floating below the surface. Plastic Fischer joined forces with the Indonesian army in Bandung to develop and test the TrashBoom on heavily polluted Citarum River in Bandung*.* Plastic Fischer have deployed **26 meter** wide walkable TrashBoom in one of the most polluted tributaries to the Ganges: The Varuna River.
RiverRecycle's projects include a facility on the Mithi River in Mumbai, India. Plastic collected from the river is fed into a chemical recycling facility. Details and photographs of projects are available on their websites Plastic Fischer, RiverRecycle. [10]

Adelaide operates a number of trash racks or "gross pollutant traps" on the Torrens River.[11]

Because commonly applied plastic sampling techniques i.e. plankton nets with mesh sizes of several μm, are not suitable for nanoplastic (<1 μm) sampling, their abundance/concentration and distribution is unknown. The distribution of microplastics (1 μm to 5 mm) could be underestimated.[12] Given the potential toxicity of nano and microplastics and especially nanoplastics, their presence in the food chain is serious. Since these microplastics and nanoplastics are so small in size, continuously mixed by wind and wave action and spread from the surface all the way to the ocean floor, it is very difficult to remove them. A cost effective technological solution is an extremely daunting task.[13]

Removal of microplastics: Badola *et al* have reviewed physical, chemical and biological methods for microplastics removal.
• Physical methods based on adsorption/filtration
• Chemical methods based on coagulation and flocculation mechanism.
• Biological methods using degradation by microbial activities.
Most research has been conducted in-vitro under controlled conditions. However, some experiments in wastewater treatment plants have shown good efficiency.[14]

A series of other breakthroughs have been reported in recent years e.g. bacteria, *Ideonella sakaiensis,* which can eat a particular kind of plastic called polyethylene terephthalate (PET), from which bottles are commonly made. The bacterium could grow on PET and use it as its main source of nutrients, degrading the PET in the process. Enzymes produced by the bacterium reduce PET to its constituent chemicals. However, to make any of these naturally occurring bacteria useful, they must be bioengineered to degrade plastic hundreds or thousands of times faster. [15,16]

Zrimec *et al* claim synergistic degradation of plastics by microorganisms holds great potential to revolutionize the management of global plastic waste. Their study uncovered the earth microbiome's potential to degrade 10 different plastics. While differences between the ocean and soil microbiomes could reflect the base compositions of these environments, the researchers found that ocean enzyme abundance increases with depth as a response to plastic pollution and not merely taxonomic composition.[17]

Experts caution that large-scale commercial use of plastic-eating microorganisms could be years away and if released into the environment could create more issues than would be solved. Bacteria typically don't break up the polymers out of which plastics are composed, into their core elemental building blocks, including carbon and hydrogen. Rather the polymers are broken up to monomers, which are often useful only to create more plastics. While this recycling is useful, biodegrading the polymers could risk releasing chemical additives that are normally stored up safely inside the un-degraded plastic. Others warn that genetically engineered microorganisms could be needed and releasing these into the environment could have unknown side-effects.[15]

Future sustainable consumption and production: The UN Environment Programme Executive Director, Inger Andersen, states that a systemic transformation is needed to transition to a circular economy; [18] The Resolution on an Enhancing Circular Economy as a contribution to achieving sustainable consumption and production was endorsed at the UNEA on 2 March 2022[19]

Australia has set a national target of 80% average recovery rate from all waste streams by 2030, and 70% of plastic packaging recycled or composted by 2025.

A circular economy for plastics: Although advanced recycling conversion technologies can convert plastic waste to oil to be further processed and used as a fuel, King *et al* describe how the oil can also used to produce other plastic by cracking the oil (the process of breaking the chemical bonds of long chain hydrocarbons to smaller units) to produce a monomer (the building block of polymers) and then further processed into recycled polymers that are able to be manufactured into new plastic products with recycled content (a desirable circular economy proposition). Advanced recycling can process mixed, multi-layer, flexible and contaminated plastics which cannot be processed by other means (e.g. mechanical recycling). Adoption of a circular economy for plastics with advanced recycling technologies and utilising existing manufacturing infrastructure could help Australia reach its targets.[20]

Biodegradable bioplastics: CSIRO scientists are researching biodegradable bioplastics sourced from petro-chemical-based materials or renewable natural materials which will fully degrade into carbon dioxide and water leaving no residual microplastics or toxic residues. Products that currently benefit from biodegradability include food and soil-contaminated plastics that are unable to be recycled. However, since moisture is a trigger for the degradation of biodegradable bioplastics, they are currently limited to short-term storage of foods.[21]

Plastic substitutes: As an alternative to petroleum-based plastic, seaweed is being converted into sugars and then fermented in vats to produce natural polyesters. Seaweed-derived polymers can be re-used, recycled or composted.[22]

References:

1. ***UNEA5.2 Global Agreement Explanatory note and Resolution 27 October.pdf***
2. ***https://www.marineconservation.org.au/un-agreement-is-vital-step-towards-tackling-plastic-pollution-in-australias-wildest-places/ accessed 10May2022***
3. **https://en.wikipedia.org/wiki/Great_Pacific_garbage_patch; *accessed 19April2022***
4. **https://en.wikipedia.org/wiki/Marine_plastic_pollution#Microplastics *accessed 19April2022***
5. ***https://theoceancleanup.com/oceans/ / accessed 27May2022***
6. **https://theoceancleanup.com/great-pacific-garbage-patch/ *accessed 24April2022***
7. ***https://ourworldindata.org/ocean-plastics#:~:text=80%25%20of%20the%20world's%20ocean,nets%2C%20ropes%2C%20and%20fleets.***
8. ***J. J. Meijer, T. van Emmerik, R. van der Ent, C. Schmidt, L. Lebreton, More than 1000 rivers account for 80% of global riverine plastic emissions into the ocean. Sci. Adv. 7, eaaz5803 (2021).*. Distributed under a Creative Commons Attribution NonCommercial License 4.0 (CC BY-NC). Accessed *20April2022***
9. ***https://theoceancleanup.com/updates/in-search-of-the-rivers-that-carry-plastic-into-the-ocean/ accessed 16April2022***
10. ***https://www.weforum.org/agenda/2022/02/plastic-pollution-rivers-innovative-solutions/ accessed 23April2022***
11. ***https://en.wikipedia.org/wiki/Marine_debris accessed 20April2022***
12. ***https://pubs.rsc.org/en/content/articlehtml/2021/em/d0em00446d. accessed 21April2022***
13. ***https://marinedebris.noaa.gov/movement/great-pacific-garbage-patch accessed 21April2022***

14. *Badola N., Bahuguna A., Sasson Y. and J. S. Chauhan 2022; Microplastics removal strategies: A step toward finding the solution Front. Environ. Sci. Eng. 2022, 16(1): 7; https://doi.org/10.1007/s11783-021-1441-3* accessed 30 April2022
15. *https://www.forbes.com/sites/scottcarpenter/2021/03/10/the-race-to-develop-plastic-eating-bacteria/?sh=614e166c7406;* accessed 21 April2022
16. *https://www.theguardian.com/environment/2022/feb/05/how-super-enzymes-that-eat-plastics-could-curb-our-waste-problem* accessed 25April2022
17. *Zrimec, Kokina, Jonasson, Zorrilla and Zelezniak. (2021).* Plastic-degrading potential across the global microbiome correlates with recent pollution trends. *https://doi.org/10.1128/mBio .02155-21* Creative Commons Attribution 4.0 International license. *accessed 30 April2022*
18. *https://www.unep.org/plastic-pollution accessed 30 April2022*
19. *https://www.unep.org/news-and-stories/press-release/un-environment-assembly-concludes-14-resolutions-curb-pollution accessed 29April2022*
20. *King, S, Hutchinson, SA and Boxall, NJ (2021) Advanced recycling technologies to address Australia's plastic waste. CSIRO, Australia*
21. *https://ecos.csiro.au/bio-derived-plastics/ accessed 1May2022*
22. *https://ecos.csiro.au/could-seaweed-replace-plastic/ accessed 9May2022*

SDGs 3/11/12/14/15/17

info@ncwa.org.au
ABN 46 061 777 937