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1. Summary

Marine plastic debris is an issue of extreme importance due to its the disastrous effects on marine life and the marine environment, and poses a significant economic and social cost to local governments, the community and potentially tourism. Marine plastic enters the environment as a result of poor governmental policies inadequately targeting the primary sources of marine plastic debris: single use plastic bags, plastic bottles and microplastics such as nurdles and microbeads.

This major environmental issue is generating increasing community concern and can be addressed through effective and practical government policies, which have the potential to reduce 70% of this material from the environment within a 3-5 year window. Suggested mechanisms that will significantly reduce marine plastic debris include:

- the introduction of a Container Deposit System, which would reduce beverage litter of the marine environment by 60% and almost triple bottle and cans recycling rates to 85%.
- The banning of single use plastic bags and microbeads, both items which are commonly mistaken as food by marine life, will have a drastic impact on the number of these items entering the marine environment.
- Improved stewardship with the plastic industry is also a vital step toward reduction of marine plastic, as manufacturing industries can play an important role in ensuring nurdles do not escape and enter the sea during manufacturing.

2. Introduction: The threat of marine plastic pollution in Australia and Australian waters

Marine plastic pollution is a growing global threat to biodiversity and is already having a devastating impact on the Australian environment with significant potential to disrupt our lifestyle and lead to substantial economic loss.

Government is long overdue in recognising that a major failing of policy to tackle marine debris, and in particular, marine plastic pollution has (to date) been the excessive focus on the international and 'at sea' generated waste.

Certainly, marine debris is a global problem where we experience international waste migrating to our shores (just as our marine plastic pollution in turn impacts many nations) and specific shipping and fisheries related challenges (e.g. ghost nets) create specific threats to our environment and communities.

However, it is critical that Australian Government and jurisdictions realign our policy responses to address the vast majority of marine plastic pollution - waste plastic packaging and products that enter the litter stream in our cities and towns, captured via the storm water system and swept to sea.

Research shows that the vast majority of plastics that enter the marine (and terrestrial) environment come from the everyday activities of Australians. The distribution of plastic marine pollution is within the control of Australian and state governments and can be acted on immediately. Effective action will readily eliminate well over 70% of marine debris found across the Australian coastal and estuarine environments.

Yet studies and decisions by Australian Governments like the Australian Packaging Covenant and recent Regulatory Impact Statements on plastic packaging pay scant attention to the potential for packaging to enter our marine environment, nor do economic analyses factor any marine plastic pollution impact costs to the environment and society – despite legal obligations to do so under the *Environment Protection and Biodiversity Conservation Act 1999*.

Commonwealth and state governments have been treating packaging and plastic waste as a political football for well over a decade – with governments talking tough about trash but, perhaps intimidated by big business threats, stall on any effective policy decisions. Instead they have backed tokenistic initiatives with a primary motivation to avoid industry criticism rather than address the issue.

Further, volunteer programs cannot be relied upon to address the problem as they generally have limited effected on litter rates and are often short lived. The voluntary retailer program initiated to address the overwhelming plastic bag use in Australia ended in 2005, and in the following year saw plastic bag use increasing by 17% between 2006 and 2007.¹ It should also be recognised that the majority of the Australian Packaging Covenant’s recycling achievements have occurred through kerbside programs and market for the materials rather than through its voluntary programs, which have had a limited impact on recycling rates.² Voluntary programs often lack the resources to develop effective recycling regimes, as evident by several lapsed voluntary incentive programs for drink containers.³

Effective, practical action targeting the most common sources of litter – plastic bottles, bags, microbeads and nurdles (plastic resin pellets and flake used to make plastic products) has the potential to eliminate over 70% of this material within a 3-5 year window, anything less is a failure of government policy.

This inquiry represents the 4th time the Senate has investigated the impacts of plastic packaging on our society and environment. There have been at least 4 Commonwealth studies to address packaging waste, as well as a number of discrete studies on the benefits to take action on plastic bags. The controversial alternative to genuine regulatory action – a partnership between industry and government (the APC) to solve our packaging waste and litter has been in place for over 15 years – yet its greatest achievement appears to be the provision of inaccurate information that consistently understates the problem and functions as an effective barrier to genuine action.

Yet despite the rhetoric the problem accelerates, community concern continues to grow (see below) and stakeholders have little confidence in the Commonwealth to lead a meaningful outcome. It’s time for government to stop talking and actually do something.

¹ “The Facts on Plastic Bags”, Boomerang Alliance, 08/15.

http://www.boomerangalliance.org.au/the_facts_on_plastic_bags

² As admitted in the NPC 2010 Review. “The Packaging Epidemic”, Boomerang Alliance,

<http://www.tec.org.au/boomerangalliance.org.au/packaging.html>

³ Tomra (23 July 2015), ‘Deposit Systems Worldwide – key learnings’. Presentation to QLD CD Advisory Committee

Omnipoll was commissioned by Boomerang Alliance to conduct a poll which included the question **“Are you concerned about the impacts of plastic packaging on the environment?”** in July this year. The results highlight the high levels of concern the community has about plastics packaging:

	National 1266	Male 629	Female 637	Grocery Buyer – 1096	NSW 369	QLD 212	SA/NT 159
WTD Resp	14746	7370	7376	13163	4929	2945	1205
Yes %	69	67	72	72	72	73	75
No %	20	21	18	19	15	17	15
Unsure %	11	12	10	9	13	9	10

3. Generation of litter and subsequent incidence of marine plastic pollution in Australia

While it is unclear how much plastic pollution enters our marine environment each year, recent research and data compilation by both the CSIRO and other groups indicates that both the vast majority (around 75%⁴) of Australian marine debris is plastic and generated terrestrially and is local in its nature. The CSIRO has stated that “most (marine debris) is from Australian sources, not the high seas, with debris concentrated near cities”.

The most recent Packaging Decision Regulation Impact Statement (DRIS) released in March 2014 estimated the average amount of packaging litter entering the environment each year at 73,699 tonnes p.a. which represents just 3.2kgs per capita.⁵

The Boomerang Alliance believes this figure is badly underestimated. Many points of consumption or waste generation of plastics packaging are missed in analysis. For example, it was recently identified that current plastic recycling rates are exaggerated by some 50% because the importation of semi- and finished plastic packaging had been excluded from past Australian Packaging Covenant (APC) annual reports⁶. Further the proportion of packaging, government and industry studies assume to be consumed ‘away from home’ is also consistently underestimated – consumption away from home, obviously, represents the vast majority of the material that is littered each year.

To determine the extent that the current data is likely to be underestimated, The Boomerang Alliance compared this evaluation with studies undertaken in Scotland and the USA.

By comparison Scotland identifies that the average amount of litter found in their environment is some 2 ½ times higher than that estimated in Australia at 7.74kgs per capita.⁷ Further, in 2009 Keep

⁴ Britta Denise Hardesty, Senior Research Scientist for CSIRO: ‘We found about three-quarters of the rubbish along the coast is plastic.’ <http://www.csiro.au/en/News/News-releases/2014/Plastic-on-the-coasts-is-ours>

⁵ “Packaging Impacts Decision Regulation Impact Statement”, 03/15.

<http://www.environment.gov.au/protection/nepc/publications/packaging-impacts-decision-ris>

⁶ The APC data is the basis of nearly all government studies regarding plastics packaging and related issues; consequently all government data on litter, marine debris and waste generally will present a performance level that is far better than the reality. <http://www.packagingcovenant.org.au/pages/apc-annual-reports.html>

⁷ “A Scottish Deposit Refund System; Final Report for Zero Waste Scotland” Eunomia Research & Consulting, 5/15

America Beautiful estimated that the amount of litter managed annually by state and local government was similar to that in Scotland but is the only report that quantifies private, public and community efforts to manage rubbish. This analyses saw the incidence of litter grow to 13.26kgs per capita – 5 times that estimated in Australia ⁸

With both a higher disposable income and outdoor lifestyle, it is not credible that the rate of littering in Australia is so much lower than that of the US or Scotland.

Further, a 1997 paper "Stormwater Gross Pollutants Industry Report" for the Cooperative Research Centre for Catchment⁹ indicated that over 12,000 tonnes p.a. of packaging litter entered Port Phillip alone, and that only represents the Melbourne proportion of the litter stream which reaches its waterways – extrapolation of this amount on a per capita basis (2.87kgs/person) would indicate that some 66,000 tonnes p.a. of packaging litter (i.e. nett of what is captured in traps or recovered through sweeping and clean ups) reaches our waterways (plus a further amount that is found in the terrestrial environment).

While it is hardly an exhaustive analysis, a simple extrapolation of the Port Phillip Studies presents an illustrative example of the potential marine pollution experienced in Australia's largest coastal communities:

ESTIMATED GENERATION P.A. OF MARINE DEBRIS IN MAJOR COASTAL COMMUNITIES:

COMMUNITY:	LITTER REACHING THE MARINE ENVIRONMENT P.A (TONNES)	TONNES OF MARINE PLASTIC POLLUTION (CSIRO ESTIMATE OF 75%)
SYDNEY (PORT JACKSON, MIDDLE HARBOUR AND BOTANY BAY)	12,545	9,409
MELBOURNE	12000	9,000
BRISBANE	6,144	4,608
PERTH	5,455	4,091
ADELAIDE	3,617	2,713
GOLD COAST	1,751	1,313
NEWCASTLE	1,234	926
CENTRAL COAST (NSW)	919	689
SUNSHINE COAST (QLD)	833	624
WOLLONGONG	833	624
HOBART	603	452
GEELONG	517	388
TOWNSVILLE	517	388
CAIRNS	431	323
DARWIN	344	258

NB The estimated volumes of litter in smaller centres shown above is likely to be much higher due to less recovery infrastructure (recycling services, public bins, sweeping services and pollutant traps).

⁸ Keep America Beautiful Inc (2009), 'National Visible Litter Survey and Litter Cost Study'

⁹ "Stormwater Gross Pollutants" Cooperative Research Centre for Catchment Hydrology, 12/97.

<http://staging.clearwater.asn.au/user-data/resource-files/CRC-Gross-Pollutants-Industry-Report-2001.pdf>

4. The products and materials that represent the major sources of marine plastic pollution

Plastic Bottles:

The single largest point of plastic litter and marine debris is beverage sector waste, with plastic bottles, along with lids, straws, cups etc. representing around half of the material (by volume) 3 of the litter stream and some 60% of all plastic rubbish recovered along our beaches and waterways.

Using the data outlined in the Packaging Decision Regulation Impact Statement (DRIS) released in March 2014 it is estimated that some 17.4billion bottles and cans are consumed in Australia each year – of which some 7.8billion bottles are plastic. After adjusting the DRIS figures to reflect the understated consumption reported in July of this year¹⁰ (which increases the number of plastic bottles consumed to 11.4billion p.a.) the recovery and recycling of plastic bottles is a poor 37% - meaning some 7.3billion plastic bottles are littered or landfilled each year.

Any effort to restrict plastic marine pollution is doomed to failure without strong and decisive steps to address bottles and cans. CSIRO Marine Scientist Dr Brita Denise Hardesty summarises the rationale for this simply:

“The waste associated with the beverage industry comprises a third and in some estimates a half of the marine debris we find globally”.

The problem of beverage litter has reached the point where first the Northern Territory, followed by NSW, the ACT and Queensland have all lost patience with the slow and inadequate studies by the federal process and moved towards the adoption of a Container Deposit Scheme.

When asked whether any jurisdictions were earning a ‘gold star’ in tackling marine debris, Dr Hardesty said “... we do not find full plastic bottles, or cans in South Australia. I would likely attribute that to the container deposit scheme that they have.”¹¹

The Commonwealth has, to date, ruled out taking decisive national action, and the March 2014 DRIS described the adoption of the most proven effective solution – A Container Deposit System – as expensive. Yet despite best efforts to paint a distorted picture of these costs (by presenting them as a total over 25 years without once breaking that down to measure the cost per unit sold), the data clearly demonstrates that the issue of beverage container rubbish is a big problem, not that a CDS represents a big cost. In fact, the Cost Benefit Analysis of option 4A, the Boomerang Alliance CDS Model, identifies the nett economic cost of adopting the solution that will reduce the amount of marine plastic pollution by some 50% was less than 1¢ per bottle or can sold.

Despite a concerted effort by the beverage industry to kill off CDS, the general public continues to show unprecedented levels of support for a CDS in Newspolls – with 85% of the public wanting a CDS and happy to pay a refundable deposit on the beverages they purchase.¹²

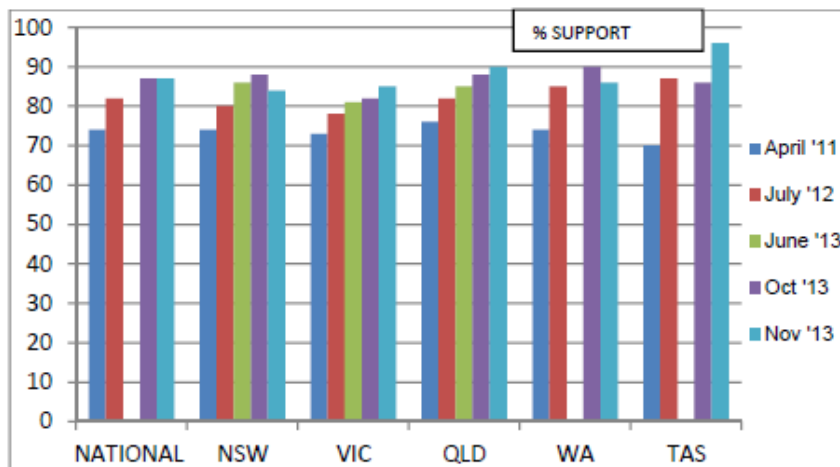
¹⁰ <http://www.smh.com.au/environment/australian-packaging-industry-falling-short-of-recycling-goal-may-cut-target-20150702-gj39h0>. & ‘The Australian Packaging Covenant’s Recycling Black Hole’, Jeff Angel (Boomerang Alliance) 06/15. http://www.boomerangalliance.org.au/apc_recycling_black_hole

¹¹ “Plastic Oceans”, ABC: Catalyst, 09/12. <http://www.abc.net.au/catalyst/stories/3583576.htm>

¹² *Standard question:* Thinking now about recycling and litter. South Australia currently has a deposit and refund scheme, where 10 cents is added to the cost of bottled and canned drinks **(PAUSE)**. The 10 cents is **refunded**, when people return empty bottles and cans to recycling collection points, mostly located at major shopping centres **(PAUSE)**. It’s been suggested the government should introduce a similar scheme **around Australia**, to encourage recycling and reduce litter. **(PAUSE)** Are you personally in **favour** or **against** the government introducing this type of deposit and refund scheme for bottles and cans **throughout** Australia? **UNFOLD IF IN FAVOUR** Is that strongly in favour or partly in favour?

1. Personally in favour or against?

Over the last 31 months support for container deposits has grown.



Single use plastic bags

Research by Clean Up Australia in 2009 estimated that over 3.9 billion single use plastic supermarket bags are consumed each year,¹³ and the Australian Government believes that around 2% (up to 80 million) of these single use bags enter the litter stream each year.

This number is likely to be understated because:

- Like other plastic packaging there is significant importation not captured by existing data as it is often imported in smaller quantities via convenience retailers or consigned in a mixed shipment of various goods and supplies.
- A common source of plastic bag litter are bags captured via the waste and recycling stream, but then escape processing facilities and landfills.
- In 2009 the Sydney Morning Herald claimed that plastic bag usage could be 30% greater than reported, information sourced from confidential industry data.¹⁴

By factoring these considerations it is reasonable to expect that consumption is over 5 billion p.a. and the amount of bags entering the litter stream each year is likely to be at least 100 million bags p.a.

While (even with the adjusted estimated above) single use bags do not represent a major part of the plastics consumed in Australia each year, plastic bags should be a priority for government action on marine debris because:

1. The lightweight nature of disposable plastic bags indicate they quickly migrate into the environment after use
2. Plastic bags resemble jellyfish in the marine environment and consequently are one of the most commonly consumed sources of plastics.
3. Turtles, in particular, target jellyfish as a primary food source; and at least 6 species of sea turtles are listed a threatened species under the *Environmental Protection and Biodiversity Conservation Act 1999*.

¹³ Plastic Bags Fact Sheet: Say NO to Plastic Bags, Clean Up Australia (July 2009)

http://www.cleanup.org.au/PDF/au/cua_plastic_bags_fact_sheet.pdf; "The Facts on Plastic Bags", Boomerang Alliance, 08/15. http://www.boomerangalliance.org.au/the_facts_on_plastic_bags

¹⁴ "The Facts on Plastic Bags", Boomerang Alliance, 08/15.

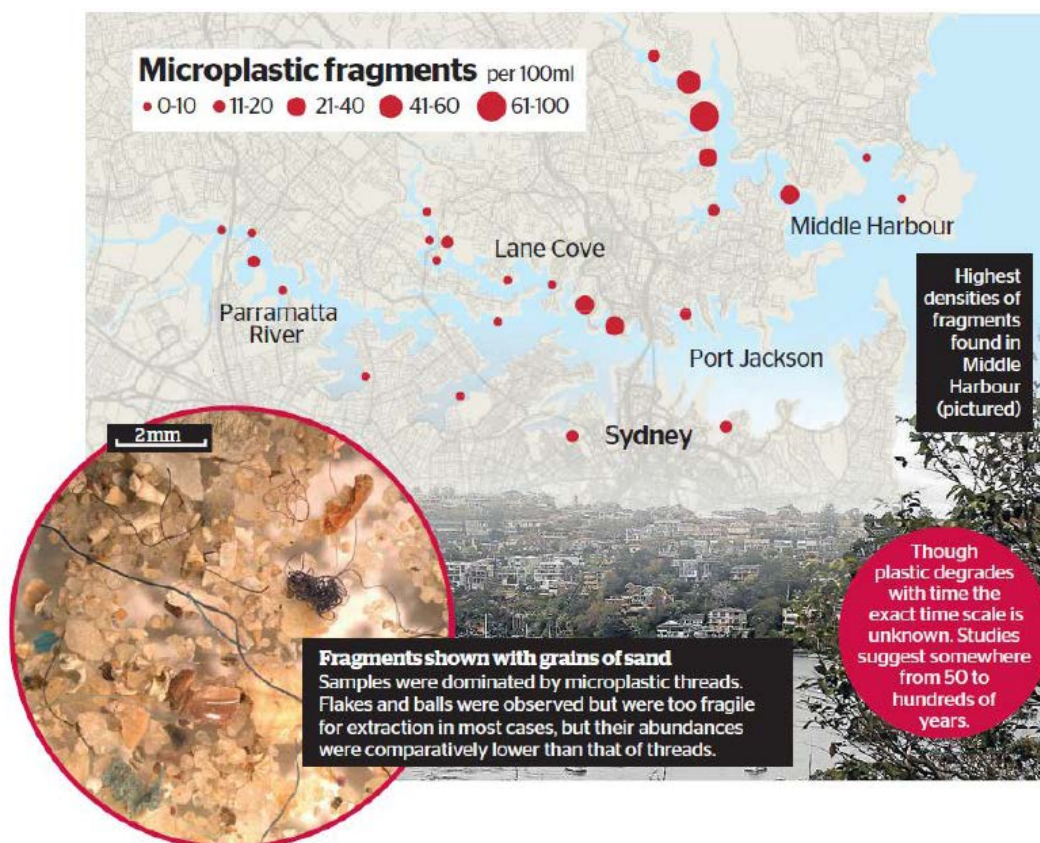
http://www.boomerangalliance.org.au/the_facts_on_plastic_bags

Microplastics

Microplastics are tiny plastic fragments, fibres and granules of less than 5mm in size. The primary sources of microplastics include:

- General plastic packaging (e.g. bottles and bags) and products that have been torn or broken down into small pieces of material
- Nurdles – which are pellets and flakes of plastic resin used in plastics extrusion and manufacture
- Microbeads – tiny plastic pellets used in a range of products as abrasives. In particular there is growing concern about the use of microbeads in personal care and laundry products

While exact estimates of the amount of microplastics entering our environment are unknown, in 2014, researchers from the Sydney Institute of Marine Science found “alarming” levels of microplastic pollution in Sydney Harbour. Sediment samples taken at 27 sites across the Harbour found concentrations of microplastics ranged from 0-10 to a high of 61-100 particles per 100ml of sediment in Middle Harbour (see below).



Like all plastics microplastics have significant potential to act as a toxic sponge – sucking up persistent organic pollutants and heavy metals to become a major vector for distributing toxic materials across the environment and importantly into our food chain.

Microplastics are seen to be a more direct threat than plastics generally as they are readily mistaken for zooplankton and other sources of marine food.

Critically, public policy should be focussed on the original and primary source of marine plastic pollution; yet it is critical to recognise that the policy responses should be focussed primarily on plastic products and packaging and its supply and disposal chains – not on the microplastic by-products.

Two areas where action specific to microplastics (rather than plastics generally) are required are microbeads and nurdles.

Microbeads are polyethylene (but can be also be made of polypropylene (PP), polyethylene terephthalate (PET), polymethyl methacrylate (PMMA) and nylon) microspheres that are widely used in cosmetics as exfoliating agents, personal care products (e.g. toothpaste), laundry detergents as well as biomedical and health science research, microscopy techniques, fluid visualization and fluid flow analysis, and process troubleshooting.

Microbeads are commercially available in particle sizes from 10 µm to 1000 µm (1mm). Low melting temperature and fast phase transitions make this material especially suitable for creating porous structures in ceramics and other materials.

Although useful, microbeads pose an environmental hazard when disposed of in waste water, as they pass through sewage treatment plants without being filtered out, their use and disposal is creating plastic particle pollution of our waterways, coastline and oceans.

Reports have shown that even if using sophisticated (and expensive) processes for settling solids in sewage that may remove up to 99% of microbeads from the final effluent that is pumped into our waterways, these processes would still create a major source of pollution. For example, if just 1% of microbeads escape capture in the sewerage treatment plants across the San Francisco Bay area, some 471 million microbeads would be released every single day.

While the extent of the problem in Australia remains unknown, a single tube of deep facial cleanser¹⁵ can contain 350,000 microbeads, demonstrating that the level of microbead pollution is substantial. Microbeads play a constructive and vital aspect of many products, and research into the use of microbeads in consumer goods are problematic.

The use of microbeads should be banned in cosmetics, personal care products, laundry detergents and cleaning products and paint.

Nurdles are pre-production microplastic pellets that typically enter the environment by escaping the boundaries of the plastic extruder or recycler factories, and are washed into waterways via the nearest stormwater drain. This is an offence in every state in Australia however is difficult to enforce.¹⁶

Many reasons exist to explain the abundance of pellets in the environment, including unsound practices within factories with regard to cleaning spill-over, but more important is perhaps the lack of mitigation methods that are designed to prevent such incursion to the environment from the factory floor. Factories hose their buildings and workshop floors down at night, resulting in pellets washing into drains — a documented practice at several major factories in these cities.

There is no filter on surrounding stormwater drains, so once they are in gutters or drainage areas, they are washed into stormwater outlets easily, resulting in entry to the river systems. Further, when transporting the resin pellets, hopper cars and trucks are not required to have lids on containers of pellets.

Little is being done to eliminate this threat; despite the fact that it is already an offense in every Australian jurisdiction to allow the discharge of pollutants from their site into the stormwater system.

Over several years, Tangaroa Blue carried out a number of studies concerning the prevalence of nurdles along our beaches and coasts. Tangaroa Blue undertook sampling across 41 broad

¹⁵ U.S. NGO “Sum of Us” estimate that Neutrogena’s “Deep Clean” facial cleanser contains over 350,000 microbeads in each tube alone

¹⁶ Queensland’s Plastic Pollution Crisis: Container Deposit & Other Solutions (June 2015) The Boomerang Alliance, p13. https://d3n8a8pro7vhmx.cloudfront.net/boomerangalliance/pages/65/attachments/original/1434695777/CDSOLUTIONS_QLD.pdf?1434695777

geographical locations including river systems in Brisbane, Sydney, Melbourne, Perth and Adelaide and found concentrations as high as 6,000 nurdles per square metre of beach.¹⁷

Similarly, research conducted around Brisbane has found pellets located within the Brisbane River. These sites are both up and downstream from Brisbane's main industrial and manufacturing areas highlighting the strong possibility of domestic release.

5. The impacts of marine plastic pollution, including impacts on species and ecosystems, fisheries, small business, and human health

The nature of plastics causes a number of complications within our biodiversity:

- Starvation of species due to the ingestion of large amounts of plastic;
- The manner in which plastics absorb toxic chemicals;
- Entanglement and injury from plastic rubbish;
- Indirect impacts across the food chain as a result bio magnification of plastic related pollution via the eating of plastic contaminated species

Within marine food webs, plastic debris commonly serves as both a transport medium and a potential source of toxic chemicals such as polychlorinated biphenyls (PCBs), endocrine-active substances and chemicals similar to DDT (often used as an agricultural insecticide). These chemicals are known to compromise immunity and cause infertility, even at very low levels.¹⁸

The Great Barrier Reef Outlook Report 2014 has identified marine debris and plastics as a major threat to the health of the reef. It was found that in the time period of 2008 to 2014, 683,000 items of marine debris were found with a total weight exceeding 42 tonnes. According to a recent study by the ARC Centre of Excellence for Coral Reef Studies, corals digest micro-beads at about the same rate as normal food.¹⁹ As demonstrated by the large amounts of plastic found in their guts, corals are unable to expel of these fragments. Eventually, corals will starve and die when their stomachs become filled with plastics.

In addition to the manner in which plastics act as a toxic sponge is the fact that microplastics are so small that they have the huge potential to affect virtually all marine life. "When things get that small, it opens it up for 96 per cent of the world's biodiversity, which are invertebrates, to potentially start ingesting them. They can enter the bloodstream through the gut, and then they can circulate in the bloodstream, they can directly enter cells and tissues of these animals" says researcher Professor Emma Johnston, from the Sydney Institute of Marine Science.

Marine Biologist Dr. Kathy Townsend from the Moreton Bay Research Station, University of QLD, confirms that approximately 30% of the turtles she autopsies have plastics, including plastic bags, in their intestinal tract with a further 6% killed due to entanglement.²⁰ Marine turtles are particularly vulnerable to floating debris as some species of marine turtles are thought to mistake plastic bags and other items for jellyfish prey.

¹⁷ A Review of Plastic Resin Pellet Distribution Throughout Australia and Mitigation Methods for Reducing Spill-Over into the Marine Environment (August 2013) and; Plastic Resin Pellets Information (September 2012) Tangaroa Blue Foundation, <http://www.tangaroablue.org/resources/reports/category/13-plastic-resin-pellet-information.html>

¹⁸ Queensland's Plastic Pollution Crisis: Container Deposit & Other Solutions (June 2015) Boomerang Alliance, p7. https://d3n8a8pro7vhmx.cloudfront.net/boomerangalliance/pages/65/attachments/original/1434695777/CDSOLUTIONS_QLD.pdf?1434695777

¹⁹ Microplastic ingestion by scleractinian corals by N.M. Hall, K.L.E. Berry, L. Rintoul, M.O. Hoogenboom is published in the journal Marine Biology. DOI 10.1007/s00227-015-2619 <https://research.jcu.edu.au/tropwater/publications/Halletal2015.pdf>

²⁰ 'Effects on Wildlife', Planet Ark: Plastic Bag Reduction, 12/11. <http://plasticbags.planetark.org/about/wildlife.cfm>

Moreover, the CSIRO has suggested that by 2050, “95% of all sea birds will have plastics in their gut.”²¹ It is estimated that globally over 1 million sea birds and over 100,000 mammals die every year as a result of plastics. These creatures die through ingestion of plastics they mistake as food or from entanglement in plastic items. Ingested debris may starve animals by preventing ingestion of food, reducing absorption of nutrients, mechanical blockage or impairment of the digestive system resulting in internal wounds and ulceration. When plastics are regurgitated as food to chicks by their parents, physical impacts and internal ulcerations are likely to lower survival rates.

Additionally, a significant number of dead whales and dolphins have been found to ingest sufficient plastics to have caused fatal blockages. In August 2000, an eight metre Bryde’s whale died soon after becoming stranded on a Cairns beach.²² An autopsy found that the whale’s stomach was tightly packed with 6M² of plastic, including many plastic check-out bags. Such obstructions in animals can cause severe pain, distress and death.

6. The Solutions

A Container Deposit System

Introducing container deposits would reduce beverage litter of the marine environment by 60% and almost triple bottle and cans recycling rates to 85%, while also creating an incentive that would see the private sector investing hundreds of millions of dollars into new collection and processing facilities while also providing a significant financial boost for both local government and community organisations.

In particular, CDS is one of the few options that successfully targets the most problematic aspect of the waste stream – away from home consumption i.e. hospitality outlets, public venues and recreational consumption – where recycling rates are very low (about 22% overall, but likely less due to underestimation of away from home consumption).

A CDS also improves the value of materials recycled. Plastics and glass recovered via a CDS is much cleaner than other recycling pathways and consequently is worth 20-25% more than materials recovered elsewhere. Further, by removing most of the glass that often contaminates paper and cardboard the yield of the remnant material in kerbside collection services also increases the value of the scrap, and allows for more space to take in new problem products and increase efficiency.

In particular, the Boomerang Alliance container deposit model has a number of unique features of benefit:

- Most depots being automated utilising Reverse Vending Machines and placed in the car park of shopping centres
- A One-Coordinator approach where a dedicated non-profit body administers the scheme. This overcomes the complexity of multiple coordinators in the SA and NT schemes; and creates transparency and a high degree of public accountability
- The use of a ‘hub’ to serve as a link between the coordinator and collection network. Most MRF’s and transfer stations could become hubs. This system would also promote the development of Drive Through Recycling Centres that would also collect a range of household and small business discards.
- Transportation costs are reduced by a system of regional ‘hubs’ that consolidate collections and could re-process product, further adding to regional employment opportunities.

²¹ Sources, Distribution and Fate of Marine Debris: CSIRO study. <http://www.csiro.au/en/Research/OandA/Areas/Marine-resources-and-industries/Marine-debris>

²² ‘Effects on Wildlife’, Planet Ark: Plastic Bag Reduction, 12/11. <http://plasticbags.planetark.org/about/wildlife.cfm>

Taking the figures used in the March 2014 DRIS (which only estimates savings to government) as a baseline, and factoring in the private and community sector costs of litter abatement would see the benefits attributed to litter reductions from a CDS skyrocket from an estimated \$7.81million p.a. (\$171.8million over the 22 year study period) to an annual saving in the order of \$66.7million per annum.

Banning plastic bags and microbeads

The banning of plastic bags and microbeads would have a significant impact on the amount of plastic that enters the marine environment and effectively target those plastics that are most likely to be mistaken as a source of food.

Polling conducted for NGO 'Do Something' in May 2009 found that 83% of Australians want a ban on non-biodegradable plastic bags. South Australia, the Northern Territory, Tasmania and the ACT have all already banned single use lightweight plastic bags. There are also bans in eight EU countries, in South Africa and many cities such as Kathmandu and Los Angeles. In Ireland it is reported that plastic bag use decreased by 90% following the introduction of a levy on bags. Plastic bags were banned in Bangladesh nearly 30 years ago because they clogged drains and caused flooding, a concern which states such as QLD should consider.²³

Improved stewardship within the plastics industry

Before any new policy or action is taken to address nurdles it is important to recognise that it is already an offense to dump waste down the stormwater system in every Australian jurisdiction. The only reason this problem exists is due to a poor effort to enforce regulations and inform the industry that it is expected to ensure nurdles do not migrate from their facilities or transport systems.

Further, government support and incentives to underpin a voluntary plan for improved stewardship within the plastics industry that minimises the impact of plastics extrusion and resin manufacture. This should include:

- That any plastic packaging or product has the maximum practicable recycled content;
- Embodies sustainable packaging design principles; &
- Has onsite management system to capture nurdles.

7. Conclusion

Evidently, it is critical that the government implements effective and practical policies to address the extreme threat marine plastic pollution poses to marine life, the marine environment and the economic and social costs associated with litter. As discussed, the major sources of marine plastic debris that need to be targeted are single use plastic bags, plastic bottles and microplastics such as nurdles and microbeads. With effective intervention, over 70% of this material will be reduced from the environment within a 3-5 year window.

Suggested solutions to this burgeoning issue include a Container Deposit System, which would reduce beverage litter of the marine environment by 60% and almost triple bottle and cans recycling rates to 85%, as well as generating significant revenue for both local government and community organisations. Banning of single use plastic bags and microbeads, both items which are commonly mistaken as food by marine life, will dramatically reduce the amount of these plastics entering the marine environment and thus the number of marine life deaths that occur as a result of ingestion of and entanglement in plastic. Improved stewardship with the plastic industry is also a vital step

²³ Queensland's Plastic Pollution Crisis: Container Deposit & Other Solutions (June 2015) The Boomerang Alliance, p11. https://d3n8a8pro7vhmx.cloudfront.net/boomerangalliance/pages/65/attachments/original/1434695777/CDSOLUTIONS_QLD.pdf?1434695777

toward reduction of marine plastic, as manufacturing industries can play an important role in ensuring nurdles do not escape and enter the sea during manufacturing.