The Senate

Environment and Communications References Committee

Toxic tide: the threat of marine plastic pollution in Australia

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Committee contact details

PO Box 6100
Parliament House
Canberra ACT 2600

Tel: 02 6277 3526
Fax: 02 6277 5818
Email: ec.sen@aph.gov.au
Internet: www.aph.gov.au/senate_ec

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Committee membership

Committee members

Senator Anne Urquhart, Chair	ALP, TAS
Senator Linda Reynolds CSC, Deputy Chair (from 12 October 2015)	LP, WA
Senator Anne McEwen (from 18 April 2016)	ALP, WA
Senator Chris Back (from 12 October 2015)	LP, WA
Senator the Hon Lisa Singh	ALP, TAS
Senator Larissa Waters	AG, QLD

Substitute member for this inquiry

Senator Peter Whish-Wilson (AG, TAS) for Senator Larissa Waters (AG, QLD)

Former members

Senator the Hon Anne Ruston, Deputy Chair (to 12 October 2015)	LP, SA
Senator the Hon James McGrath (to 12 October 2015)	LP, QLD
Senator Joe Bullock (to 13 April 2016)	ALP, WA

Committee secretariat

Ms Christine McDonald, Committee Secretary

Mr Colby Hannan, Principal Research Officer

Ms Fattimah Imtoual, Senior Research Officer

Ms Kirsty Cattanach, Research Officer

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8.29 The committee recommends that any future Australian Government policies on mitigating the threat from marine plastic be underpinned by sound, peer-reviewed research.

Recommendation 2

8.30 The committee recommends that the Australian Government actively support research into the effects of marine plastic pollution in Australian waters, including research to more fully evaluate:

- **the extent of marine plastic pollution;**
- **the sources of marine plastic pollution;**
- **the effects at the population level; and**
- **the effects on ecosystems particularly in the Great Barrier Reef.**

Recommendation 3

8.31 The committee recommends that the Australian Government actively support research into the threat posed by microplastic pollution, including research to:

- **identify the extent of microplastic pollution;**
- **evaluate the effects of microplastic pollution on marine fauna;**
- **evaluate the effects of microplastic pollution on ecosytems; and**
- **identify mitigation measures.**

Recommendation 4

8.32 The committee recommends that the Australian Government actively support research into the threat posed by marine plastic pollution, particularly microplastic, on human health.

Recommendation 5

8.33 The committee recommends that the Australian Government undertake work to identify and establish the costs of the externalities associated with marine plastic pollution.

Recommendation 6

8.36 The committee recommends that industry contributes further funding of scientific research through the Australian Packaging Covenant.

8.37 The committee recommends that this funding be provided for research which particularly addresses the effect of marine plastic pollution on marine fauna, and human health from ingestion as well as research to identify mitigation strategies.

Recommendation 7

8.40 The committee recommends that the Australian Government consult with stakeholders, including the Tangaroa Blue Foundation, CSIRO and relevant scientists, to explore mechanisms to establish a national marine pollution database.

Recommendation 8

8.45 The committee recommends that the Australian Government place marine plastic pollution on the Council of Australian Governments' agenda for urgent consideration.

8.46 In recognition of the level of threat associated with plastic pollution in Australia's marine environment, and the need for a comprehensive and coordinated response, the committee recommends that the Australian Government pursue the establishment of a working group, under the auspices of the meeting of environment ministers, to address specific matters related to marine plastic pollution.

Recommendation 9

8.50 The committee recommends that the Australian Government explore opportunities for increased regional leadership and direct support on the issue of marine plastic pollution, including projects focused on ghost net recovery.

Recommendation 10

8.54 The committee recommends that the Australian Government pursue mechanisms to improve support and coordination of clean-up activities through the meeting of environment ministers working group to ensure that the most effective outcomes of these activities are achieved.

Recommendation 11

8.61 The committee recommends that the Australian Government:

- **support CSIRO research to identify the extent of ghost nets in Australian waters, and to identify means to prevent the loss of fishing gear;**
- **support the development of innovative technologies for the tagging of fishing gear and support the introduction of these technologies by the Australian-based fishing industry, and by fishing industries in regional countries;**
- **undertake a review of current Commonwealth arrangements to detect and remove ghost nets; and**
- **develop a nationally consistent strategy through the meeting of environment ministers working group to ensure that ghost nets are collected in a timely manner in the Australian Fishing Zone, and coastal waters.**

Recommendation 12

8.62 The committee recommends that the Australian Government reinstate funding for GhostNets Australia to allow it to continue its work to identify and retrieve ghost nets.

Recommendation 13

8.65 The committee recommends that the Australian Government, through the meeting of environment ministers working group, encourage all jurisdictions to support the implementation of targeted education campaigns which aim to change consumer behaviour in relation to the use of plastics, and to provide consumers with information regarding alternatives to traditional plastic.

Recommendation 14

8.70 The committee recommends that the Australian Government implement the recommendations from the Senate Environment and Communications References Committee inquiry into stormwater management in Australia, in particular:

- **Recommendation 1—the development and implementation of a national policy framework for stormwater management (a National Stormwater Initiative); and**
- **Recommendation 4—the consideration of new funding models and financial incentives that would facilitate improved stormwater management outcomes in an economically efficient way.**

Recommendation 15

8.78 The committee recommends that the Australian Government, through the meeting of environment ministers working group, actively encourage the states and territories, which have not already done so, to consider the most effective methods to address marine plastic pollution in their jurisdictions. These should include implementation of container deposit schemes and other anti-littering mitigation strategies.

Recommendation 16

8.79 The committee recommends that, if all states and territories have not introduced container deposit scheme legislation by 2020, the Australian Government revisit the issue with the view to developing legislation for those jurisdictions which are yet to implement container deposit schemes.

Recommendation 17

8.84 The committee recommends that the revised Australian Packaging Covenant include improved reporting and compliance by industry.

Recommendation 18

8.85 The committee recommends that the Australian Government, through the meeting of environment ministers working group, engage with states and territories to improve enforcement of the Australian Packaging Covenant.

Recommendation 19

8.86 The committee recommends that the Department of the Environment give consideration to recognising the role of product stewardship in the Threat Abatement Plan by including reference to the Australian Packaging Covenant

Recommendation 20

8.88 The committee recommends that the review of the Australian Packaging Covenant include support for the development innovative packing solutions that offer alternatives to plastics.

Recommendation 21

8.91 The committee recommends that the Australian Government support states and territories in banning the use of single-use lightweight plastic bags. In doing so, the Australia Government should ensure that alternatives do not result in other pollutants entering the environment.

Recommendation 22

8.95 The committee recommends that the Australian Government move to immediately ban the importation and production of personal care products containing microbeads.

Recommendation 23

8.97 The committee recommends that the Australian Government, through the meeting of environment ministers working group, identify measures, including regulatory measures, already available to prevent plastics entering the marine environment and ensure that they are being implemented effectively in all jurisdictions. In particular, the committee recommends that more effective enforcement of environmental laws in relation to preventing nurdles entering the waste management system be pursued.

List of abbreviations

ALDFG	abandoned, lost or otherwise discarded fishing gear
AFGC	Australian Food and Grocery Council
AFMA	Australian Fisheries Management Authority
AIMS	Australian Institute of Marine Science
ALGA	Australian Local Government Association
AMDI	Australian Marine Debris Index
AMSA	Australian Maritime Safety Authority
APC	Australian Packaging Covenant
APEC	Asia-Pacific Economic Cooperation
BPA	bisphenol A
CDS	container deposit scheme
COAG	Council of Australian Governments
CWA	Clean Water Act (US)
DDT	dichlorodiphenyltrichloroethane
EDC	endocrine disrupting chemical
EPA	Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
GBRMPA	Great Barrier Reef Marine Park Authority
GPML	Global Partnership on Marine Litter
ICNA Act	*Industrial Chemicals (Notification and Assessment) Act 1989*
MARPOL	International Convention for the Prevention of Pollution from Ships
MOU	Memorandum of Understanding
MPP	marine plastic pollution
NELA	National Environmental Law Association
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
NPCIA	National Packaging Industry Association

NRM	Natural Resource Management
PCB	polychlorinated biphenyl
PCP	personal care product
PET	polyethylene terephthalate
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
POP	persistent organic pollutant
RIS	Regulation Impact Statement
RVMS	Reverse Vending Machine Scheme
SCEW	Standing Council on Environment and Water
SOLAS	International Convention for the Safety of Life at Sea
SPREP	Secretariat of the Pacific Regional Environment Programme
TAP	Threat Abatement Plan
UNEP	United Nations Environment Programme

Chapter 1

Introduction

1.1 On 18 June 2015 the Senate referred the following matter for inquiry and report by 8 April 2016:

> The threat of marine plastic pollution in Australia and Australian waters, with particular reference to:
>
> (a) the review of current research and scientific understanding of plastic pollution in the marine environment;
>
> (b) sources of marine plastic pollution;
>
> (c) the impacts of marine plastic pollution, including impacts on species and ecosystems, fisheries, small business, and human health;
>
> (d) measures and resourcing for mitigation; and
>
> (e) any other relevant matters.

1.2 The reporting date was extended to 18 April 2016 and subsequently extended to 20 April 2016.[1]

Conduct of the inquiry

1.3 The committee advertised the inquiry on its website and in *The Australian* newspaper. The committee also wrote to relevant organisations and individuals inviting written submissions.

1.4 The committee received 193 submissions, which are listed at Appendix 1. The committee also received 527 copies of form letter 1; 174 copies of form letter 2, and 50 short statements accepted as correspondence. The committee held public hearings for this inquiry in Sydney on 18 February 2016, Canberra on 26 February 2016 and 31 March 2016 and Brisbane on 10 March 2016. A list of witnesses who appeared at the hearings may be found at Appendix 2.

Acknowledgement

1.5 The committee would like to thank the organisations and individuals who provided evidence to the inquiry. Many of the submissions received contained in-depth analysis of the issues and extensively referenced research articles. These submissions greatly assisted the committee in its deliberations on the issues raised.

1.6 Other submissions provided photographs and information on programs to clean-up marine debris in areas across Australia. This evidence presented the

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1 *Journals of the Senate*, 2013–16, No. 149, (18 April 2016), p. 4095.

committee with not only graphic evidence of the extent of marine pollution and its effects but also the level of commitment of many individuals and groups who spend thousands of hours cleaning up Australia's coastal environments.

1.7 Submissions also provided evidence of the contribution of individuals and groups in identifying and implementing solutions to lessen the impact of marine plastic pollution—this included suggesting to bait companies to use zip lock bags so that recreational fishers were more likely to take bait home after a day's fishing rather that discarding it in the water, to engaging with local schools to build awareness of the need to properly dispose of litter, and encouraging local businesses to change their packaging.

Structure of the report

1.8 This report comprises 8 chapters. The matters covered in the remaining chapters of the report are outlined below:

- Chapter 2 provides an overview of marine plastic pollution including magnitude, sources and types, and also examines recent estimates of the cost of plastic pollution;
- Chapter 3 examines the impacts of marine plastic pollution on marine fauna, fisheries, ecosystems as well as human health; and
- Chapter 4 examines the mechanisms available to the Australian Government to address marine plastic pollution as well as concerns about the lack of a coordinated approach to policy development and implementation.

1.9 The remaining chapters of the report examine mechanisms to address marine plastic pollution in the two key areas of removal and prevention through source reduction as follows:

- Chapter 5 examines the scope and effectiveness of current strategies to remove marine plastic pollution;
- Chapter 6 explores source reduction through changes in consumer behaviour, and infrastructure;
- Chapter 7 explores source reduction through improvements in product stewardship, regulatory and legislative changes, and enforcement activities; and
- Chapter 8 provides the committee's conclusions and recommendations.

Previous inquiries

1.10 The committee acknowledges the significant work undertaken by previous iterations of the Environment and Communications Committee in undertaking inquiries into the implementation and management of container deposit schemes.[2]

1.11 These inquiries received evidence both in support of, and in opposition to, container deposit schemes. The committees found that there was generally evidence to support the claim that the schemes reduced litter in the environment. However, there were concerns raised regarding potential associated costs of operation both to manufacturers, retailers, and consumers. There was also a lack of consensus on an appropriate model for implementation.

1.12 For this inquiry, the committee chose to consider container deposit schemes in the context of identifying mitigation strategies to counter the threat to the marine environment from single-use consumer products.

1.13 In addition, the Environment and Communications References Committee tabled its report on the inquiry into stormwater management in Australian in December 2015.[3] This report canvassed a number of issues directly related to the stormwater infrastructure which is a key mechanism to preventing litter, including plastics, from entering the marine environment.

Note on references

1.14 All references in this report to the Committee Hansard are to the proof version of the transcript. Page numbers may vary between the proof and the official Hansard transcript.

2 See Senate Environment and Communications References Committee, *Operation of the South Australian and Northern Territory container deposit schemes*, November 2012; Senate Environment, Communications and the Arts Legislation Committee, *Environment Protection (Beverage Container Deposit and Recovery Scheme) Bill 2009*, September 2009; and Senate Standing Committee on Environment, Communications and the Arts, *Management of Australia's waste streams (including consideration of the Container Recycling Bill 2008)*, September 2008.

3 Senate Environment and Communications References Committee, *Stormwater management in Australia*, December 2015.

Chapter 2

Overview of marine plastic pollution

2.1 According to the United Nations Environment Programme (UNEP), 'marine litter' refers to any persistent, manufactured or processed solid material disposed of, or abandoned in, the marine and coastal environment. It can consist of items that have been deliberately discarded into rivers and oceans, or on beaches; brought indirectly into the marine environment through sewage, stormwater, winds and rivers; or accidentally lost, including items lost at sea such as fishing gear and cargo.[1]

2.2 The concerns with plastic in marine debris is its vast distribution in the water column, on the seabed and along coastal shorelines, as well as its persistence, and its characteristic of breaking down to smaller and smaller particles. These characteristics set plastics apart from other debris in the oceans with many submitters noting that plastics remain in the environment for decades if not longer.[2] Professor Tony Underwood, added that:

> I think the focus on plastic might be justified because it is persistent in ways that metal, wood and other materials are not. Plastic just gets smaller and smaller, but it does not go away. That is different from metal which eventually, when you throw it in the sea, will be gone. I think there is a good reason why the focus on plastic keeps coming up compared with other debris.[3]

2.3 This chapter canvasses the magnitude of marine plastic pollution, types of marine plastic pollution, sources of plastic pollution in the Australian marine environment, and the extent of marine plastic pollution in Australian waters.

2.4 The committee notes the extensive body of research on marine plastic pollution, and the differing hypotheses, research methods, and findings available. This report utilises research presented to the committee in evidence, and acknowledges any associated limitations. The committee also acknowledges that research continues to be conducted into the threat of marine plastic pollution, and that understanding of the issue continues to evolve.

2.5 In addition, the committee has drawn on the recently released report by the World Economic Forum and the Ellen MacArthur Foundation—*The New Plastics Economy*: *Rethinking the future of plastics*—which explores issues related to the production and use of plastics particularly plastic packaging. The report noted that,

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1 United Nations Environment Programme, *Marine Litter – an analytical overview*, 2005, http://www.unep.org/regionalseas/marinelitter/publications/docs/anl_oview.pdf, (accessed 22 February 2016), p. 3.

2 Dr Eric Woehler, Convenor, Birdlife Tasmania, *Committee Hansard*, 26 February 2016, p. 35.

3 Professor Tony Underwood, *Committee Hansard*, 18 February 2016, p. 6.

while undertaking work to explore the opportunities and challenges for the circular economy[4] across global supply chains, plastic packaging became an area of focus 'due to its omnipresence in daily life all over the globe'. Plastic leaking (escaping) from after-use systems was identified as a key theme. It was stated that the 'evidence of the looming degradation of marine ecosystems by plastics waste, particularly plastic packaging, has made plastics leakage a priority topic'.[5]

Plastics production

2.6 Plastics have existed for just over a century, however, mass production commenced in earnest in the 1950s.[6] Plastics are made from organic polymers including petrochemicals, cellulose, coal, natural gas and salt. The World Economic Forum noted that over 90 per cent of plastics produced are derived from virgin fossil feedstocks which represent about 6 per cent of global oil consumption.[7]

2.7 Polymers are mixed with a complex blend of additives such as stabilisers, plasticisers and pigments. Plastics may also contain unintended substances in the form of impurities and contaminants.[8] Examples of plastics include polyethylene terephthalate (PET or PETE), high-density polyethylene (HDPE), polyvinyl chloride (PVC), polypropylene (PP), polystyrene (PS) and low-density polyethylene (HDPE).

2.8 Generally, plastics are extremely durable. However, the development of 'bio-degradable' and 'degradable' plastics has seen the production of plastic items which degrade more quickly than traditional plastics. Though these items are no longer present in the environment at the macro-level, they continue to exist as microplastics. Degradable and biodegradable plastic is commonly used to produce shopping and garbage bags. Issues associated with the use and classification of biodegradable and degradable plastics are discussed further in Chapter 7.

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4 Today's economic model is generally seen as linear: 'take, make, dispose' and relies on large quantities of cheap, easily accessible materials and energy. The circular economy focuses on preservation and enhancement of natural capital, optimisation of resource yields and fostering of system effectiveness. http://www.ellenmacarthurfoundation.org/circular-economy/overview/characteristics

5 World Economic Forum, *The New Plastics Economy*: *Rethinking the future of plastics*, January 2016, http://www3.weforum.org/docs/WEF_The_New_Plastics_Economy.pdf, (accessed 23 February 2016), p. 6.

6 Vegter AC, Barletta M, Beck C, Borrero J, Burton H, Campbell M, Costa F, Ericksen M, Ericksson C, Estrades A, Gilardi KVK, Hardesty BD, Ivar do Sul JA, Lavers JL, Lazar B, Lebreton L, Nicols WJ, Ribic CA, Ryan PG, Schuyler QA, Smith SDA, Takada H, Townsend KA, Wabnitz CCC, Wilcox C, Young LC, Hamann M, 'Global research priorities to mitigate plastic pollution impacts on marine wildlife', *Endangered Species Research*, 2014, 25: 225–247, http://www.int-res.com/articles/esr_oa/n025p225.pdf.

7 World Economic Forum, *The New Plastics Economy*: *Rethinking the future of plastics*, January 2016, http://www3.weforum.org/docs/WEF_The_New_Plastics_Economy.pdf, (accessed 23 February 2016), p. 7.

8 National Toxic Networks, *Submission 4*, discusses toxicity associated with plastics.

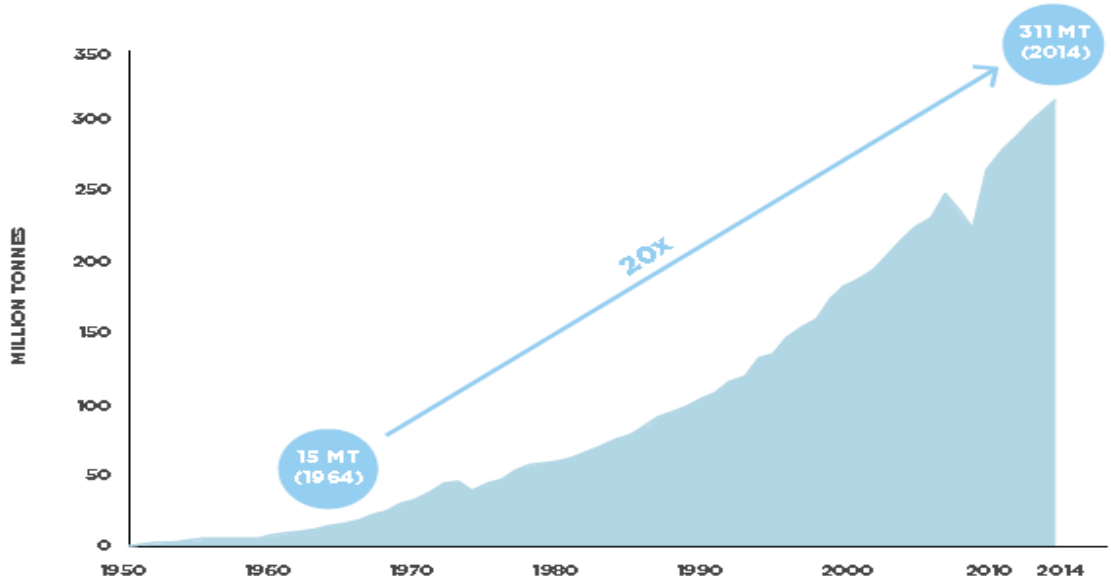
2.9 With most plastic products being lightweight, inexpensive, durable and disposable, they have become an indispensable part of life with the World Economic Forum stating that:

> Plastics have become the ubiquitous workhorse material of the modern economy—combining unrivalled functional properties with low cost. Their use has increased twentyfold in the past half-century and is expected to double again in the next 20 years. Today nearly everyone, everywhere, every day comes into contact with plastics—especially plastic packaging…[9]

2.10 The World Economic Forum went on to note that plastics are increasingly being used across economies in sectors ranging from packaging to construction, transportation, healthcare and electronics. This increasing use is reflected in the rate of increase in global plastic production: in 1964, 15 million tonnes of plastics were produced, in 2014 that had increased to 311 million tonnes. According to the World Economic Forum, plastics production is expected to double again in 20 years, and to almost quadruple by 2050.[10]

2.11 Figure 2.1 provides the growth of production between 1950 and 2014.

Figure 2.1: Growth in global plastics production 1950–2014



Source: World Economic Forum, The New Plastics Economy: Rethinking the future of plastics, January 2016, p. 11.

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9 World Economic Forum, *The New Plastics Economy*: Rethinking the future of plastics, January 2016, http://www3.weforum.org/docs/WEF_The_New_Plastics_Economy.pdf, (accessed 23 February 2016), p. 6.

10 World Economic Forum, *The New Plastics Economy*: *Rethinking the future of plastics*, January 2016, http://www3.weforum.org/docs/WEF_The_New_Plastics_Economy.pdf, (accessed 23 February 2016), p. 7 and p. 10.

2.12 Plastic is produced in most global economies with 85 per cent of production concentrated in three economies: the United States, Europe and Asia. In 2014, for example, 45 per cent of world plastic production took place in Asia (with China accounting for 26 per cent) followed by Europe with a 20 per cent share, and the North American Free Trade Agreement (NAFTA) with a 19 per cent share.[11]

2.13 As noted above, plastics are used in many sectors. However, its use is concentrated in packaging, that is, material designed for immediate disposal. Plastic packaging represents 26 per cent of the total volume of plastic production globally. In 2013, the plastics industry sold 78 million tonnes of plastic packaging with a total value of US$260 billion. Plastic packaging volumes are expected to double within 15 years, and more than quadruple by 2050 to an estimated 318 million tonnes which the World Economic Forum noted is more than the entire plastics industry output today.[12]

2.14 Plastic packaging ranges from water and soft drink bottles to shrink-wrap, rubbish bags and drink cups. Different plastic polymers are used across packaging products for example, PET (polyethylene terephthalate) bottles and PE-LD (polyethylene, low density) food wrap.

Plastic production in Australia

2.15 The Australian plastic production industry produces over 1.2 million tonnes per year, representing approximately 10 per cent of Australian manufacturing activity. The industry also employs 85,000 people.[13] In Australia 1.5 million tonnes of plastic were consumed in the 2012–13 financial year which equates to approximately 65 kilograms of plastic for every man, women and child in Australia.[14] Only 20 per cent is subsequently recycled. In addition, 37 per cent of this plastic was single-use disposable packaging.[15]

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11 Statista, *Distribution of global plastics materials production in 2014, by region* http://www.statista.com/statistics/281126/global-plastics-production-share-of-various-countries-and-regions/ ; World Economic Forum, *The New Plastics Economy*: *Rethinking the future of plastics*, January 2016, http://www3.weforum.org/docs/WEF_The_N Plastics ew_ _Economy.pdf, (accessed 23 February 2016), p. 22; see also paragraph 2.7.

12 World Economic Forum, *The New Plastics Economy*: *Rethinking the future of plastics*, January 2016, http://www3.weforum.org/docs/WEF_The_N Plastics ew_ _Economy.pdf, (accessed 23 February 2016), p. 10.

13 Dr Mark Browne, and co-authors Professor Tony Underwood, Professor Gee Chapman, Professor Emma Johnston, *Submission 21*, p. 1.

14 Associate Professor Mark Osborn, *Submission 16*, p. 2.

15 Reisser J, Shaw J, Wilcox C, Hardesty BD, Proietti M, et al., 'Marine Plastic Pollution in Waters around Australia: Characteristics, Concentrations, and Pathways', 2013, *PLOS ONE*, PLOS ONE 8(11), http://www.plosone.org/article/fetchObject.action?uri=info:doi/10.1371/journal.pone.0080466&representation=PDF (accessed 9 November 2015), p. 1.

The magnitude of marine plastic pollution

2.16 Plastics which enter the oceans can either float on the ocean surface, or sink to the seafloor if they are made of polymers denser than seawaters. Over time, buoyant plastics can drift ashore or they may drift out into the open oceans. Plastics in the open ocean tend to accumulate in convergence zones. These zones include five large-scale gyres of the South and North Pacific, South and North Atlantic and the Indian Ocean.[16] The sizes of these gyres are difficult to determine as they are constantly expanding and moving.[17]

2.17 Reports of marine plastic pollution were first noted in scientific literature in the early 1970s.[18] The Australian Institute of Marine Science (AIMS) commented that 'in northern Australia, marine plastic pollution was first identified as an issue of concern in the 1990s'.[19]

2.18 Since that time, various organisations have reported on the magnitude of marine plastic pollution, but it remains unclear how much plastic is currently in the ocean, and how much is entering each year. For example, in 2005, the UNEP stated that it was estimated that 6.4 million tonnes of marine litter were disposed of in the oceans and seas each year. The UNEP further estimated that over 13,000 pieces of plastic litter were floating on every square kilometre of ocean surface.[20]

2.19 A study published in 2014, commented that the ocean surface water alone contained five trillion plastic pieces.[21] Another study published in 2015 estimated that between 4.8 and 12.7 million metric tonnes of plastic entered the ocean in 2010 from land sources. Most of this plastic was comprised of single-use plastics, designed for immediate disposal.[22]

2.20 In its January 2016 report, the World Economic Forum stated that 'the best research currently available estimates that there are over 150 million tonnes of plastic

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16 Reisser J, *et al*., 'Marine Plastic Pollution in Waters around Australia: Characteristics, Concentrations, and Pathways', 2013, *PLOS ONE*, p. 1, PLOS ONE 8(11), http://www.plosone.org/article/fetchObject.action?uri=info:doi/10.1371/journal.pone.0080466&representation=PDF (accessed 9 November 2015).

17 Surfrider Foundation Australia, *Submission 14*, p. 3.

18 Jambeck, J. A, Andrady, R, Geyer, R, Marayan, M, Perryman, T, Siegler, C, Wilcox C, 'Plastic waste input to the oceans from land', 13 February 2015, *Science*, Volume 347 Issue 6223, http://science.sciencemag.org/content/347/6223/768 (accessed 22 February 2016), p. 1.

19 Australian Institute of Marine Science, *Submission 11*, p. 2.

20 United Nations Environment Programme, *Marine Litter An analytic overview*, 2005, http://www.unep.org/regionalseas/marinelitter/publications/docs/anl_oview.pdf, p. ii.

21 Associate Professor Mark Osborn, *Submission 16*, p. 1.

22 Jambeck, J. A, *et al*, 'Plastic waste input to the oceans from land', 13 February 2015, *Science*, Volume 347 Issue 6223, http://science.sciencemag.org/content/347/6223/768 (accessed 22 February 2016), p. 1.

waste in the oceans today'. In addition, it was stated that the amount of plastic in the world's oceans is forecast to grow to 250 million tonnes in 2025.[23] The World Economic Forum described this amount of plastic entering the marine environment in graphic terms:

> Each year, at least 8 million tonnes of plastics leak into the ocean—which is equivalent to dumping the contents of one garbage truck into the ocean every minute. If no action is taken, this is expected to increase to two per minute by 2030 and four per minute by 2050.[24]

2.21 Forecast growth in the amount of plastic finding its way into the marine environment is based on increased population and economic growth occurring in developing countries as well as continued increases in consumer consumption in developed countries.[25] Dr Britta Denise Hardesty, Senior Research Scientist from the CSIRO, similarly commented that 'the amount of plastic going into the ocean is proportionate to the amount of plastic produced', with the global increase in plastic production corresponding to the increase in the amount of plastic that is entering the ocean.[26]

2.22 The committee notes that in evidence, a note of caution was sounded regarding the predictions of the amount of marine plastic in the marine environment contained in the World Economic Forum paper. Professor Stephen Smith from the National Marine Science Centre, commented that care was required as the predictions were 'over a long temporal scale, but I think it highlights the importance of the problem'. Professor Smith went on to state that if the rate of waste entering the ocean continues, 'then I would support dire predictions'.[27]

2.23 Professor Underwood also noted that there were variances in estimates of the amount of plastics entering the ocean due to lack of knowledge and the lack of clarity about how much plastic there is in the world at any given time, 'because the estimates are not particularly good'.[28]

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23 World Economic Forum, *The New Plastics Economy*: *Rethinking the future of plastics*, January 2016, http://www3.weforum.org/docs/WEF_The_N Plastics ew__Economy.pdf, (accessed 23 February 2016), p. 14.

24 World Economic Forum, *The New Plastics Economy*: *Rethinking the future of plastics*, January 2016, http://www3.weforum.org/docs/WEF_The_N Plastics ew_ _Economy.pdf, (accessed 23 February 2016), p. 7.

25 Jambeck, J. A, *et al.*, 'Plastic waste input to the oceans from land', 13 February 2015, *Science*, Volume 347 Issue 6223, http://science.sciencemag.org/content/347/6223/768 (accessed 22 February 2016), p. 770.

26 Dr Britta Denise Hardesty, CSIRO, *Committee Hansard*, 26 February 2016, p. 8.

27 Professor Stephen Smith, *Committee Hansard*, 18 February 2016, p. 2.

28 Professor Tony Underwood, *Committee Hansard*, 18 February 2016, p. 2.

The magnitude of marine plastic pollution in Australian waters

2.24 The committee received evidence of the limited knowledge of the magnitude of marine plastic pollution in Australian waters. The then Department of the Environment, Water, Heritage and the Arts in its 2009 background paper for the Threat Abatement Plan for the impacts of marine debris on vertebrate marine life commented:

> Information and data on the sources, magnitude and impacts of marine debris around Australia has been derived primarily from land-based coastal surveys. This information probably under-represents the actual quantity of marine debris in Australia's marine and coastal environments, as debris may sink, may become buried underground or become entangled underwater on rocky outcrops and reefs, and never float ashore. There is little information available on the magnitude of the debris that is floating in the sea or present on the seabed.[29]

2.25 The background paper went on to state that data available at that time suggested that high concentrations of debris accumulate on parts of the coastline all around Australia. Specific areas where debris had been reported at comparatively high densities included coasts adjacent to urban centres and remote areas of north-western Cape York, Groote Eylandt, northeast Arnhem Land, the far north Great Barrier Reef, parts of South Australia including Anxious Bay, parts of Western Australia, southwest Tasmania, and Australia's sub-Antarctic Islands. Quantities of debris in these areas ranged from more than 400 kg of debris per kilometre along remote parts of the northern Australian coast to 15 kg of debris per kilometre or less on heavily polluted parts of more remote southern Australian coastlines including Australia's sub-Antarctic Islands.[30]

2.26 In 2013, a study on marine plastic pollution in waters around Australia similarly noted that:

> …our current knowledge on plastic contamination in the Australian marine environment is restricted to (1) beach litter cleanups that record mainly the occurrence of relatively large objects…(2) land-based surveys of marine megafauna impacted by marine debris…and (3) inferences based on plastic pollution reports from New Zealand.[31]

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29 Department of the Environment, Water, Heritage and the Arts, *Background Paper for the Threat Abatement Plan for the impacts of marine debris on vertebrate marine life*, May 2009, p. 2.

30 Department of the Environment, Water, Heritage and the Arts, *Background Paper for the Threat Abatement Plan for the impacts of marine debris on vertebrate marine life*, May 2009, p. 2; see also Australian Institute of Marine Science, *Submission 11*, p. 3.

31 Reisser J, *et al.*, 'Marine Plastic Pollution in Waters around Australia: Characteristics, Concentrations, and Pathways', 2013, *PLOS ONE*, PLOS ONE 8(11), http://www.plosone.org/article/fetchObject.action?uri=info:doi/10.1371/journal.pone.0080466&representation=PDF (accessed 9 November 2015), pp. 1–2.

2.27 The 2013 study went on to characterise and estimate the concentration of marine plastics in waters around Australia using surface net tows. It was concluded that a high prevalence of small plastic fragments (less than 5 mm) in Australian waters is consistent with other regions of the world's oceans. Plastic pollution levels were moderate when compared to concentrations in other marine areas. The study found high amounts of plastic close to cities on the east coast, as well as in remote locations including west Tasmania and the North West Shelf.[32]

2.28 AIMS pointed to a number of research projects which reported on the density of marine debris along the northern Australian coast. For example, a 2003 survey of marine debris at Cape Arnhem found that plastic items made up around 74 per cent of all items recorded during a beach marine debris survey.[33]

2.29 Both Clean Up Australia and the Tangaroa Blue Foundation maintain data sets of the debris collected from their clean-up activities. Clean Up Australia commented that:

> Detailed studies of the materials removed on Clean Up Australia Day in 2014 found while plastics were significant in every type of site, the proportion of plastic materials recovered at beach and waterways was some 20% more than the amount found at other sites. Dive sites reported 50% of rubbish removed was plastic.[34]

2.30 The Tangaroa Blue Foundation coordinates the Australian Marine Debris Initiative (AMDI). The AMDI objectives include the removal of marine debris from the environment; the collection of scientifically robust and long-term data on what is removed and from where; and tracking the debris back to the source wherever possible. Ms Heidi Taylor, Managing Director of the Tangaroa Blue Foundation, stated that to date, more than 5.4 million marine debris items have been entered into the AMDI database. This debris has been removed from 1,729 sites and the weight of the debris has been totalled at over 500 tonnes. There are 140 categories in the AMDI with the datasets for Western Australia holding information from 2005.[35]

2.31 Other submitters provided evidence of individual clean-ups to highlight the extent of marine plastic pollution. The Waste Management Association Australia, Tasmanian Branch, for example, stated that 'the annual South-West Marine Debris

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32 Reisser J, *et al*., 'Marine Plastic Pollution in Waters around Australia: Characteristics, Concentrations, and Pathways', 2013, *PLOS ONE*, PLOS ONE 8(11), http://www.plosone.org/article/fetchObject.action?uri=info:doi/10.1371/journal.pone.0080466&representation=PDF (accessed 9 November 2015), p. 1.

33 Australian Institute of Marine Science, *Submission 11*, p. 3.

34 Clean Up Australia, *Submission 9*, p. 3.

35 Ms Heidi Taylor, Tangaroa Blue Foundation, *Committee Hansard*, 10 March 2016, pp. 28, 32.

Clean-Up collected 48,000 separate items of litter mostly plastic from five beaches in Tasmania's "pristine wilderness areas" in 2014'.[36]

2.32 Dr Frederieke Kroon, Principal Research Scientist from AIMS also commented on the information sourced from the AMDI and noted that overall, at least 80 per cent of the marine debris collected in beach clean-ups in the Great Barrier Reef and Torres Strait regions is comprised of plastic.[37]

2.33 In addition, Dr Kroon pointed to AIMS's own research projects. Dr Kroon commented that in a field campaign in November 2015, in remote marine environments in North-West Australia, including the Kimberley region and offshore in the Browse and Bonaparte basins, small plastic particles and fibres were detected. Further work is ongoing to better understand the abundance and distribution and, eventually, the sources and fates of these plastic particles in remote regions.[38]

2.34 However, Dr Kroon also noted that while research has been undertaken, it is still unclear as to the magnitude of marine plastic pollution in Australian waters, particularly those of northern Australia. Dr Kroon stated:

> Because the tropical marine environment across Northern Australia is such a large area, we are uncertain about the abundance and distribution of marine plastics. Various studies have been done. There was the CSIRO survey right around Australia and there has been work done on ghost nets in Arnhem Land, in the Gulf of Carpentaria. There has been our own work in the [Great Barrier Reef] and in the Arafura and Timor Seas, in the Kimberley. But we are not getting a general overview of the problem for the whole of Northern Australia and what the long-term effects on the marine ecosystems may be.[39]

2.35 The Tangaroa Blue Foundation also argued that a large amount of plastic debris is hidden, for example, debris is covered by sand in coastal dunes and can be released at a later date through tidal action and storm events. Debris is also trapped in vegetation in estuaries and waterways which can then impact on critical habitats. The Tangaroa Blue Foundation also noted that 'data on the abundance of debris is based on what can be observed and collected and there is no current estimate on the abundance of hidden debris in the coastal or estuarine systems'.[40] Professor Smith told the committee that erosion of coastal environments is 'liberating old plastic from the dunes' and in areas such as Coffs Harbour, items such as bottle tops from 1979 are

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36 Waste Management Association Australia, Tasmanian Branch, *Submission 13*, p. 1.

37 Dr Frederieke Kroon, Australian Institute of Marine Science, *Committee Hansard*, 10 March 2016, p. 15.

38 Dr Frederieke Kroon, Australian Institute of Marine Science,, *Committee Hansard*, 10 March 2016, p. 15.

39 Dr Frederieke Kroon, Australian Institute of Marine Science,, *Committee Hansard*, 10 March 2016, p. 18.

40 Tangaroa Blue Foundation, *Submission 60*, p. 4.

being found.[41] A committee member similarly noted personal observation of '10 feet of stratified plastic on the west coast' of Tasmania.[42]

2.36 A further area where there is a significant gap in knowledge is the plastic pollution abundance in sediments in Australian waters. Associate Professor Mark Osborn commented that this 'compromises our ability to predict the impact of these pollutants upon benthic systems'.[43]

Sources of marine plastic pollution

2.37 Plastics entering the marine environment are generally categorised as either ocean- or land-based. While land-based marine plastic pollution is recognised as the more prevalent, with it generally being considered that 80 per cent of marine plastic pollution comes from land sources, ocean-based sources still account for a significant proportion of marine plastic. The following discussion provides an overview of these two sources of marine plastic pollution. The country of origin of marine plastic is also considered.

Ocean-based marine plastic pollution

2.38 Ocean-based marine plastic pollution is material that is either intentionally or unintentionally dumped or lost overboard from vessels. Vessels include not only merchant ships but also offshore oil and gas platforms.[44]

2.39 Traditionally, ship-sourced garbage was disposed of at sea until the introduction of the International Convention for the Prevention of Pollution from Ships (MARPOL). As at 1 January 2013, MARPOL Annex V prohibits the discharge of all types of garbage into the sea, with very limited exceptions (not related to plastics). In 2014, 144 parties, representing approximately 98 per cent of the world's merchant shipping tonnage, ratified MARPOL Annex V.

2.40 While MARPOL Annex V now prohibits the disposal of waste generated on vessels, some ship operators illegally dump garbage while at sea. It is estimated that 20 per cent of marine debris originates from the shipping sector.[45] Ocean-based debris includes sewage, food scraps, oil and grease, animal carcasses, and cargo residues. Ocean-based plastic waste includes packaging, bottles, plastic parts of e-waste,

41 Professor Stephen Smith, *Committee Hansard*, 18 February 2016, p. 22.

42 Senator Peter Whish-Wilson, *Committee Hansard*, 18 February 2016, p. 22.

43 Associate Professor Mark Osborn, *Submission 16*, p. 3.

44 Vegter, AC, *et al.*, 'Global research priorities to mitigate plastic pollution impacts on marine wildlife', *Endangered Species Research*, 25: 225–247, 2014 http://www.int-res.com/articles/esr_oa/n025p225.pdf, p. 233.

45 Australian Maritime Safety Authority, *Submission 68*, p. 1.

synthetic ropes, fishing nets ('ghost nets'), floats, monofilament lines, and strapping or wrapping associated with ships' stores and cargo.[46]

Abandoned or lost fishing gear

2.41 Of particular concern in Australian waters is abandoned, lost or otherwise discarded fishing gear (ALDFG). This includes plastic nets, lines, and crab and lobster pots from both commercial and non-commercial fishing operations. ALDFG is known to pose a threat to a range of marine fauna with nets, lines, bait bags, and traps entangling marine fauna and, in some cases, being ingested by marine fauna. ALDFG can also damage underwater habitats such as coral reefs and benthic zones.

2.42 'Ghost fishing' occurs when ALDFG is no longer under the control of a fisher or fishing operation and continues to trap and kill fish, marine mammals, crustacea, turtles and birds. ALDFG can continue to ghost fish for many years once it has been lost.

2.43 Each year around 640,000 tonnes of fishing gear are lost or thrown overboard around the world. In Australia's Gulf of Carpentaria, so-called 'ghost nets' are found in densities reaching up to three tonnes per kilometre, which are some of the highest rates in the world. It is estimated that the majority of nets come from fisheries in neighbouring countries, though approximately 4 per cent of ghost nets originate in Australia.[47]

2.44 The Northern Territory Seafood Council stated that lost or discarded fishing gear from fishing activities by foreign fishing operations is of increasing concern to industry. In particular, enormous nets of predominantly Taiwanese manufacture and longline gear used by numerous fisheries to the north of Australia, or by illegal fishers in Australian waters, are pushed by the prevailing winds and currents into Australian waters.[48] The CSIRO identified that most ghost nets enter the Gulf of Carpentaria from the northwest and move in a clockwise direction.[49] The concerns with ghost nets are discussed further in Chapter 5.

2.45 In addition, the debris from recreational fishers was identified as a source of marine plastic pollution. Mr Brad Warren, Executive Chair of OceanWatch Australia told the committee that Australia has approximately five million recreational fishers, many of whom are using nylon lines, plastic lures and plastic bait bags. Many of these

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46 Australian Maritime Safety Authority, *Submission 68*, p. 2.

47 Hardesty BD and Wilcox C, 'Ghostnets fish on: marine rubbish threatens northern Australian turtles', 31 January 2013, *The Conversation*, https://theconversation.com/ghostnets-fish-on-marine-rubbish-threatens-northern-australian-turtles-11585, (accessed 24 February 2016).

48 Northern Territory Seafood Council, *Submission 63*, p. 3.

49 Hardesty BD and Wilcox C, 'Ghostnets fish on: marine rubbish threatens northern Australian turtles', 31 January 2013, *The Conversation*, https://theconversation.com/ghostnets-fish-on-marine-rubbish-threatens-northern-australian-turtles-11585, (accessed 24 February 2016).

items are lost or disposed of at sea.[50] Mr Warren also noted the ready commercial availability of crab traps which when lost or abandoned, break down and the nylon netting becomes an entanglement risk for marine fauna. The plastic then further breaks down into microplastics.[51]

2.46 Professor Smith also noted a very recent survey that suggested highly accessible sections of estuaries in areas of high population density—such as the Gold Coast seaway—support very high loads of benthic debris which is dominated by fishing-related items, most notably monofilament line.[52]

Land-based marine pollution

2.47 Land-based marine pollution originates from urban and industrial waste sites, sewage outlets, stormwater, litter transported by systems, and litter discarded by beach users. The most widely cited figure for the proportion of marine plastic originating from land-based sources is 80 per cent. However, it has been argued that 'this figure is not well substantiated and does not inform the total mass of debris entering the marine environment from land-based sources'.[53]

2.48 A study published in 2015 by an international team of experts aimed to estimate the amount of plastic entering the ocean from waste generated on land by linking worldwide data on solid waste, population density and economic status. The study estimated that 2.5 billion metric tonnes (MT) of municipal waste were generated in 2010 by 6.4 billion people living in 192 coastal countries. Approximately 11 per cent (275 million MT) of the waste generated was plastic. The study scaled this figure according to the population living within 50 kilometres of the coastline and estimated that 99.5 million MT of plastic waste were generated in coastal regions. Of this amount, 31.9 million MT were classified as mismanaged resulting in an estimated 4.8 million to 12.7 million MT entering the ocean in 2010.[54]

2.49 Similarly, the CSIRO indicated that the vast majority of marine debris entering Australian waters is land-based and generated locally.[55] In 2011, Dr Hardesty and Dr Chris Wilcox from the CSIRO released *Understanding the types, sources and at-sea distribution of marine debris in Australian waters* which found that:

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50 Mr Brad Warren, OceanWatch Australia, *Committee Hansard*, 18 February 2016, p. 61.

51 Mr Brad Warren, OceanWatch Australia, *Committee Hansard*, 18 February 2016, p. 63.

52 Professor Stephen Smith, *Submission 27*, p. 5.

53 Jambeck, J. A, *et al.*, 'Plastic waste input to the oceans from land', 13 February 2015, *Science*, Volume 347 Issue 6223, http://science.sciencemag.org/content/347/6223/768 (accessed 22 February 2016), p. 768.

54 Jambeck, J. A, *et al.*, 'Plastic waste input to the oceans from land', 13 February 2015, *Science*, Volume 347 Issue 6223, http://science.sciencemag.org/content/347/6223/768 (accessed 22 February 2016), p. 770.

55 Dr Britta Denise Hardesty, CSIRO, *Committee Hansard*, 26 February 2016, p. 1.

> Overall domestic sources are probably an important contributor to marine debris in Australia, with debris released in areas of intense human activity reaching even distant locations along our coastline and in offshore areas.[56]

2.50 While the study found that there is a contribution from international sources in some areas, Australia is likely to be responsible for plastic pollution found in the region. It stated that:

> Australia is probably a net exporter of debris to some neighbouring marine regions and surrounding countries. In particular debris from the densely populated east coast is likely transported toward New Zealand and into the southwestern Pacific. Debris from the north and west coasts is likely transported north-westward toward Indonesia and into the north-eastern Indian Ocean.[57]

2.51 The study found that in remote areas, the debris had a higher composition of refuse from marine industries such as fishing and shipping. However, in regions near urban areas however there was more debris from coastal inputs. The study concluded that 'overall, the results suggested that control of domestic inputs may be the critical issue, whether they are from economic activities offshore or from coastal sources'.[58]

2.52 More recently, the CSIRO led a major national study documenting the state of marine debris in Australia. The study included coastal and offshore surveys around the continent, analysis of the impacts of this debris on marine wildlife, and an evaluation of the likelihood of domestic and foreign sources. It also investigated the effectiveness of council, regional, and state policies in reducing the amount of debris entering the marine environment.[59] This study again suggested that most marine debris in the Australian region is domestic. It was found that debris in the marine environment appears to increase with the local population. The data also suggested that areas that have a high population in the region, but relatively isolated coast, tend to have high amounts of debris, consistent with illegal dumping.[60]

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56 Hardesty, B D, and Wilcox, C. *Understanding the types, sources and at-sea distribution of marine debris in Australian waters,* 2011, CSIRO, http://secure.environment.gov.au/coasts/pollution/marine-debris/publications/pubs/marine-debris-sources.pdf, (accessed 9 November 2015), p. 20.

57 Hardesty, B D, and Wilcox, C. *Understanding the types, sources and at-sea distribution of marine debris in Australian waters,* 2011, CSIRO, http://secure.environment.gov.au/coasts/pollution/marine-debris/publications/pubs/marine-debris-sources.pdf, (accessed 9 November 2015), p. 20.

58 Hardesty, B D, and Wilcox, C. *Understanding the types, sources and at-sea distribution of marine debris in Australian waters,* 2011, CSIRO, http://secure.environment.gov.au/coasts/pollution/marine-debris/publications/pubs/marine-debris-sources.pdf, (accessed 9 November 2015), p. 20.

59 CSIRO, *Submission 7*, p. 4.

60 CSIRO, *Submission 7*, Appendix 3, 'Input to Department of Environment Threat Abatement Plan', p. 16.

2.53 Professor Smith also stated that the source of marine plastic pollution is likely to be highly site dependent and linked to adjacent human activities. He explained that this can vary considerably over even relatively small spatial scales.[61] For example, on Rottnest Island:

> …a proportion of debris on beaches adjacent to visitor accommodation results from *in situ* deposition from beach-goers. In contrast, debris on beaches on the western side of the island is dominated by fragmented plastics, much of which can be traced to commercial fishing activities in the region.[62]

2.54 The Tangaroa Blue Foundation similarly commented that there are very significant regional differences in the proportion of ocean- and land-based debris for coastal sites due to a range of factors including population density, prevailing wind and current regimes and regional onshore and offshore activity such as industry, shipping and commercial fishing.[63]

2.55 The Adelaide and Mount Lofty Ranges Natural Resources Management Board also noted that in an assessment of 38 study sites in South Australia, those sites open to open oceans exhibited higher litter counts associated with recreational, commercial and boating related activities. The study found that sites in the metropolitan region showed the highest rate of consumer associated plastics.[64]

Urban litter in Australia

2.56 Urban litter includes lost or abandoned plastic items, items which fall out of rubbish bins due to overfilling or windy weather, and plastic debris which is inadequately secured during transportation. It can include balloons, plastic bags, single-use consumer items such as straws and food packaging, and cigarette butts.

2.57 The movement of plastic pollution from urban areas to the marine environment can occur in a variety of ways. However, a significant contributor is the stormwater system which often delivers directly to coastal areas, or to rivers which ultimately deliver to coastal areas.[65]

2.58 Professor Smith explained that the sequence of urban debris moving into the marine environment via the stormwater system is well recognised and that a number of mitigation measures have been put in place in most urbanised areas. These

61 Professor Stephen Smith, *Submission 27*, p. 5.

62 Professor Stephen Smith, *Submission 27*, p. 5; see also, Professor Stephen Smith, *Committee Hansard*, 18 February 2016, p.11.

63 Tangaroa Blue Foundation, *Submission 60*, p. 3.

64 Adelaide and Mount Lofty Ranges Natural Resources Management Board, *Submission 20*, p. 6.

65 Parks Victoria, *Submission 79*, p. 8.

measures include gross pollutant traps (GPTs) and education campaigns such as signs on drains.[66]

2.59 The committee received evidence highlighting the volumes of urban litter recovered in clean-up activities, in both the marine environment and in stormwater systems:

- the 1997 *Stormwater Gross Pollutants Industry Report* by the Cooperative Research Centre for Catchment found that over 12,000 tonnes per annum of packaging litter had entered Port Phillip Bay;[67]
- the South East Queensland Healthy Waterways Rubbish Report indicated that it collects over 250,000 items of litter each year from 210 kilometres of waterways with the most common item collected being plastic bottles followed by food packaging;[68]
- Liverpool City Council submitted that it removed 1.2 cubic tonnes of gross pollutants including plastics from 114 GPTs in the 2013–14 financial year. In addition, 99.4 tonnes of rubbish, including large quantities of plastic were removed from the Georges River Catchment in 2014–15. The Council also noted that in 2014–15, a total of 606 cubic metres of rubbish and litter were removed from riparian, creek and waterway areas;[69] and
- Georges River Combined Councils' Committee stated that between 25,000 and 50,000 plastics bottles are removed from the river annually.[70]

2.60 While it has been long held that most marine pollution is land-based, it has also been argued that 'this figure is not well substantiated and does not inform the total mass of debris entering the marine environment from land-based sources'.[71] Professor Smith stated that recent studies are challenging the assumption that 80 per cent of marine debris is sourced from adjacent terrestrial environments.[72] For example, Professor Smith presented to the committee the results of a study involving the collection of 632 bottles by volunteers in coastal areas, which found that 43 per cent were Chinese and South East Asian brands. The study found that very few of the bottles (6 per cent) had any indication that they had been in the water very long—this

66 Professor Stephen Smith, *Submission 27*, p. 5.

67 Total Environment Centre, *Submission 1*, p. 1.

68 Wildlife Preservation Society of Queensland, *Submission 5*, p.

69 Liverpool City Council, *Submission 61*, p. 3.

70 Georges River Combined Councils' Committee, *Submission 17*, p. 1.

71 Jambeck, J. A, *et al*., 'Plastic waste input to the oceans from land', 13 February 2015, *Science*, Volume 347 Issue 6223, http://science.sciencemag.org/content/347/6223/768 (accessed 22 February 2016), p. 768.

72 Professor Stephen Smith, *Submission 27*, p. 4.

would preclude them from having originated from overseas. Professor Smith hypothesised that these bottles may have been disposed of from passing ships.[73]

Country of origin of marine plastic pollution

2.61 Marine plastic pollution in Australian waters also originates from international sources. Ocean currents can transport debris over long distances. The World Economic Forum commented that according to the best available data, Asia accounts for more than 80 per cent of the total leakage of plastic into the ocean.[74] The CSIRO also noted that China and Indonesia were particularly significant sources of plastic pollution.[75]

2.62 The CSIRO study found that there is a contribution from international sources in some areas of Australia, particularly the north-eastern Coral Sea, Arafura Sea, southern Indian Ocean and Southern Ocean.[76] For example, large abandoned fishing nets in the Gulf of Carpentaria likely originate from overseas.[77]

2.63 The committee also received evidence from the Northern Territory Seafood Council based on anecdotal evidence from professional fishers, data from Marine Ranger groups and other coastal clean-ups of remote northern beaches. The Council submitted that much of the rubbish in remote northern areas is drifting into Australian waters and onto reefs and beaches from:

- fishing activities to the north of the Australian Fishing Zone (AFZ),
- illegal foreign fishing activities inside the AFZ; and
- international shipping transiting through northern waters.[78]

2.64 Similarly, OceanWatch Australia also submitted that 'the contribution from overseas sources is potentially significant and underestimated'. The submission noted that observation of microplastic debris, identification of parent material, and Australian consumption rates would indicate 'potential for significant international sources'. OceanWatch Australia went on to highlight that 'in the case of plastic bottles,

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73 Professor Stephen Smith, *Committee Hansard*, 18 February 2016, pp. 10–11.

74 World Economic Forum, *The New Plastics Economy*: *Rethinking the future of plastics*, January 2016, http://www3.weforum.org/docs/WEF_The_New_Plastics_Economy.pdf, (accessed 23 February 2016), p. 22.

75 CSIRO, *Submission 7*, Appendix 3, 'Input to Department of Environment Threat Abatement Plan', p. 21.

76 Hardesty, B D, and Wilcox, C. *Understanding the types, sources and at-sea distribution of marine debris in Australian waters*, 2011, CSIRO, http://secure.environment.gov.au/coasts/pollution/marine-debris/publications/pubs/marine-debris-sources.pdf, (accessed 9 November 2015), p. 20; see also paragraph 2.44.

77 CSIRO, *Submission 7*, p. 4.

78 Northern Territory Seafood Council, *Submission 63*, p. 2.

further evidence can be found in barcodes where the trademark of product registration originates from countries in the Pacific and Southern East Asia'.[79]

2.65 OceanWatch Australia stated that:

> There seems a reluctance to acknowledge and address the contribution of plastic waste from international sources. The current domestic environmental policy focus and funding mechanisms seek to tackle the problem through monitoring and cleanups within Australian boundaries. Little effort that we are aware of is applied within potential source countries.[80]

2.66 Professor Smith stated that 'a key problem in determining the source of all items is that fragmented plastics are often the most numerous and there is no simple way to determine their source'.[81] Professor Underwood similarly told the committee that there is 'insufficient research' to answer the question of where marine plastic pollution is sourced.[82]

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

2.67 Plastic debris found in the marine environment is either larger debris (macroplastic) or small particles (microplastic). The following provides an overview of these types of marine plastic pollution.

Macroplastics

2.68 Macroplastics are composed of a wide variety of industrial, commercial and consumer items. As noted above, plastic packaging makes up 26 per cent of plastic production. As a consequence, plastic packaging, which is designed to be disposed of after a single use and has low rates of recycling, makes up a large proportion of marine plastic pollution. Of particular concern are beverage containers and single-use plastic bags.

2.69 The Tangaroa Blue Foundation provided information on the top ranking 10 items found in clean-ups around Australia. The first eight are plastic and four of these relate directly to the packaging.

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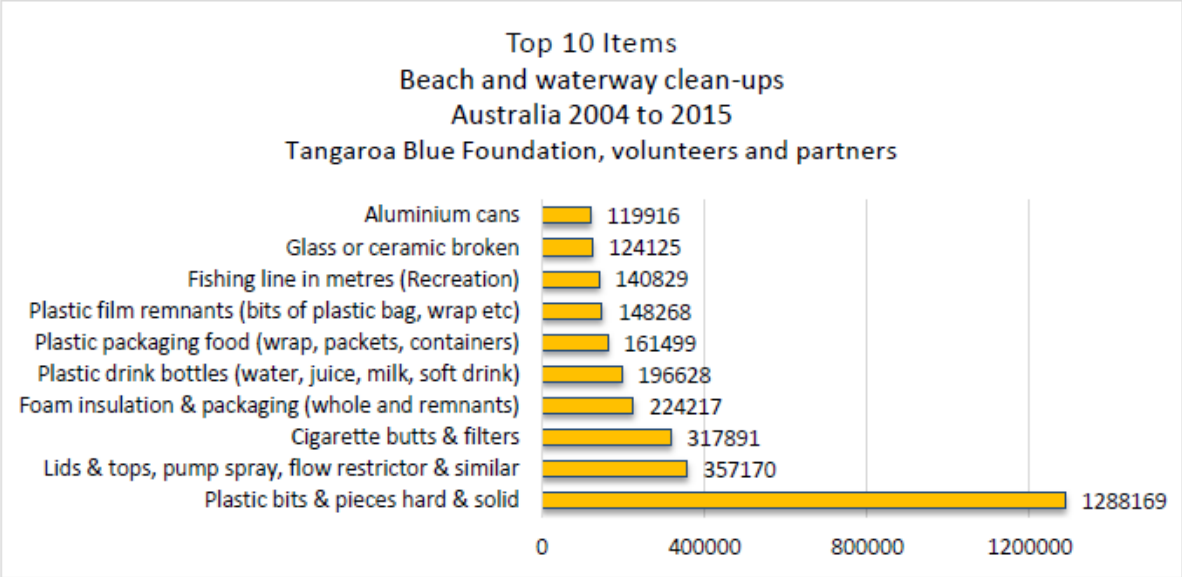
79 OceanWatch Australia, *Submission 75*, p. 3.

80 OceanWatch Australia, *Submission 75*, p. 3.

81 Professor Stephen Smith, *Submission 27*, p. 4.

82 Professor Tony Underwood, *Committee Hansard*, 18 February 2016, p. 10.

Figure 2.2: Top 10 items from Australian beaches and waterways



Source: Tangaroa Blue Foundation, Submission 60, p. 4.

2.70 Dr Hardesty noted that approximately 40 per cent of all litter found in coastal areas is from the beverage industry. Dr Hardesty went on to state that one bottle can break down into dozens of small pieces.[83] Clean Up Australia similarly noted that the prevalence of beverage rubbish, including plastic bottles, has now replaced cigarette butts as the most common product group removed during clean-ups.[84]

2.71 Clean Up Australia estimated in 2009 that over 3.9 billion single-use plastic bags are consumed each year with the Australian Government believing that around 2 per cent of these bags enter the litter stream each year. The Total Environment Centre argued that these estimates were understated. It told the committee that 'it is reasonable to expect that consumption is over 5 million p.a. and the amount of bags entering the litter stream each year is likely to be at least 100 million bags p.a.'.[85]

2.72 The committee also received evidence that balloons which have either been accidentally lost or deliberately released, contribute significantly to plastic pollution which is ingested by marine fauna.[86] Dr Kathy Townsend from the University of Queensland told the committee that:

> …people have quite a cartoon idea of what happens to balloons when they release them—they just disappear and never come back down again. Of course that is not the case at all. They go up to the stratosphere, they shred and then they drop again. They do not drop in front of your feet, so you do

83 Dr Britta Denise Hardesty, CSIRO, *Committee Hansard*, 26 February 2016, p. 2.

84 Clean Up Australia, *Submission 9*, p. 3.

85 Total Environment Centre, *Submission 1*, p. 6.

86 This is discussed further in Chapter 3.

> not see them. Any of those massed balloon releases at any of those sorts of events will eventually come down somewhere.[87]

2.73 New South Wales outlawed the mass release of balloons in 1999, and the maximum that can be released in a single event is 19.[88] Similarly, the Sunshine Council banned the intentional release of helium balloons in 2011.[89]

2.74 However, the committee received evidence that even small numbers of balloons can still travel significant distances and enter the marine environment. For example, Ms Karyn Jones submitted:

> In February 2014, I found a bunch of 14 balloons, with only 5 remaining inflated. The bunch had been released from Albury the previous afternoon, and had travelled over 300 kilometres to a beach south of Bermagui (this was confirmed by both Albury City Council and the Bureau of Meteorology). This shows how far helium filled balloons can travel in a short period of time, from far inland to the marine environment. It also shows how "up to 20" balloons is ludicrous.[90]

2.75 Evidence on the distance balloons can travel was also provided by the Capricorn Conservation Council which stated that 'balloon[s] distributed, ironically at the 2012 Gladstone EcoFest by Curtis Island LNG a company were found washed up on Keppel bay beaches 85 kilometres north west'.[91]

2.76 Dr Townsend explained that typically balloons are made from two kinds of plastic polymer—latex-type polymers or foil-type polymers. Latex-type polymers typically degrade much more quickly than other kinds of plastic, however immersion in water has been found to slow this process. Foil-type polymers are essentially the same material as traditional, lightweight plastic bags, and degrade at similar rates.[92]

2.77 Dr Townsend told the committee that researchers have found 'pretty much fully intact balloons' in the intestines of marine fauna, and that the gastrointestinal pH is not sufficient to increase degradation. Dr Townsend also explained that balloons may also be ingested while attached to ribbons or other pieces of plastic which prevent the item from passing through the animal's digestive system.[93]

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87 Dr Kathy Townsend, *Committee Hansard*, 10 March 2016, p. 2.

88 Section 146E of the *Protection of the Environment Act 1999* (NSW)

89 Sunshine Coast Council, Fact Sheet – Helium Balloons, cms.sunshinecoast.qld.gov.au/addfiles/documents/laws_regulations/scc_local_laws_2011/fs_helium_balloons.pdf, (accessed 18 March 2016).

90 Ms Karyn Jones, *Submission 117*, p. 1.

91 Capricorn Conservation Council, *Submission 32*, p. 1.

92 Dr Kathy Townsend, *Committee Hansard*, 10 March 2016, p. 2.

93 Dr Kathy Townsend, *Committee Hansard*, 10 March 2016, p. 3.

Microplastics

2.78 Microplastics are tiny plastic fragments, fibres and granules of less than five millimetres in size.[94] There are four major sources of microplastic in the marine environment:

- intentionally produced items;
- inherent by-products of other products or activities;
- emitted through accident or unintentional spill; and
- macroplastic degradation.

2.79 The committee received evidence that in Australia, sewage and stormwater systems provide important pathways for microplastics to move into the marine environment. In addition, sewage and other domestic waste is often added to soils to improve nutrients and reduce water-loss. This process contaminates soil with microplastics which eventually enter the marine environment through sediment movement.[95]

Intentionally produced items

2.80 Microbeads are commercially produced in particle sizes from 10 microns (μm) to 1000 μm (1 mm). They are generally made from polyethylene and have a range of commercial uses.[96] Microbeads are used in products as abrasives including exfoliating personal care products (PCP) such as face and body wash and toothpaste while other PCP use microbeads for bulking or slip effect such as shaving foam, lipstick, mascara or sunscreen. The Total Environment Centre stated that 'a single tube of deep facial cleanser can contain 350,000 microbeads'.[97]

2.81 Clean Up Australia submitted that researchers at Plymouth University conducted a study of facial scrubs which list plastics as an ingredient. The study subjected the scrubs to vacuum filtration to obtain the plastic particles and subsequent analysis using electron microscopy found that each 150 ml of the products could contain between 137,000 and 2.8 million microparticles of plastic.[98]

94 Australian Institute of Marine Science, *Submission 11*, p. 2.

95 Dr Mark Browne, and co-authors Professor Tony Underwood, Professor Gee Chapman, Professor Emma Johnston, *Submission 21*, pp. 1–2.

96 Total Environment Centre, *Submission 1*, p. 8.

97 Total Environment Centre, *Submission 1*, p. 8.

98 Clean Up Australia, *Submission 9*, p. 10.

2.82 Industrial products intentionally utilising microplastics include plastic blasting grit, speciality products used in oil and gas exploration and printing, and medical products such as dentistry polish.[99]

2.83 The Total Environment Centre noted that microbeads disposed of in waste water are not filtered out in treatment plants. Even with the use of sophisticated processes for the settling of solids in sewage, which could remove large amounts of microbeads from effluent, microbeads would still cause extensive pollution. The Total Environment Centre noted that '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'.[100]

Microplastic by-product

2.84 Microplastic by-product includes dust from cutting and polishing plastic items, maintaining painted metal constructions such as bridges and buildings, and high pressure washing of painted items. It also includes household and commercial building dust created through weathering and abrasion of plastic items and carpet, building maintenance, and clothing fibres loosened during laundering.

2.85 When synthetic fabrics are laundered, fabric threads are often lost. The washing machine wastewater containing these fabric fibres then enters the sewage network and is subsequently discharged into the marine environment via treatment plants. A single garment can produce >1900 fibres per wash with polyester (67 per cent) and acrylic (17 per cent) the dominant fibres found in wastewater.[101] These fibres are too small to be filtered during processing.

2.86 Road dust contains microplastic by-product from tyre friction, road paint and polymer modified bitumen. In addition, waste handling by-products often include plastic particles from the shredding and fragmenting of plastic waste such as mattresses, bottles and plastic bags.[102] European studies have identified that passenger vehicles have an emission rate of 0.1 gram of tyre dust per vehicle kilometre travelled. Commercial vehicles and trucks have more extensive tyre loss.[103] For example, the Norwegian Environment Agency estimated that 4,500 tonnes of road dust were

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99 Norwegian Environment Agency, *Sources of microplastic-pollution to the marine environment*, 4 December 2014, http://www.miljodirektoratet.no/Documents/publikasjoner/M321/M321.pdf, (accessed 23 February 2016), p. 12.

100 Total Environment Centre, *Submission 1*, p. 8.

101 Sydney Coastal Councils Group Inc., *Submission 8*, p. 3.

102 Norwegian Environment Agency, *Sources of microplastic-pollution to the marine environment*, 4 December 2014, http://www.miljodirektoratet.no/Documents/publikasjoner/M321/M321.pdf, (accessed 23 February 2016), pp. 13–14.

103 Norwegian Environment Agency, *Sources of microplastic-pollution to the marine environment*, 4 December 2014, http://www.miljodirektoratet.no/Documents/publikasjoner/M321/M321.pdf, (accessed 23 February 2016), p. 40.

produced per annum based on the number of road users, and the types of vehicles used. The Boomerang Alliance estimated that between 23–24,000 tonnes per annum of tyre dust are potentially entering the marine environment in Australia.[104]

2.87 European studies also identified that road paint, and polymers used to strengthen bitumen are released into the marine environment through urban runoff and stormwater systems. The Norwegian Environment Agency estimates that 320 tonnes of road paint per annum were lost through wear and tear.[105]

2.88 The processing of plastic products in waste-handling facilities and recycling facilities can lead to the loss of microplastic dust into the air. For example, Mr Dave West, National Policy Director and Founder, Boomerang Alliance told the committee that recent studies in Victoria found that mattress recycling facilities were losing twenty percent of the product in dust generated by shredding. Windborne microplastics from waste-handling and recycling facilities are also likely to end up in the marine environment either directly, or through transportation in the stormwater system. [106]

Unintentional release

2.89 Microplastics unintentionally released into the marine environment include pre-production plastic pellets (nurdles) being washed into stormwater drains near plastic extruder or recycling factories. The Surfrider Foundation Australia commented that studies of the presence of nurdles in five states found concentrations as high as 6000 nurdles per square metre of beach.[107]

2.90 The Total Environment Centre noted that there are a number of causes for the prevalence of nurdles found in the marine environment. These include factories having unsound spill-over cleaning practices, and a lack of mitigation measures to prevent the loss of nurdles into the environment from the factory floor. In particular, factories hose their buildings and workshop floors down at night, resulting in pellets washing into drains. In addition, hopper cars and trucks transporting nurdles are not required to have lids on their containers which can result in spills.[108]

2.91 Stormwater drains are often unfiltered or do not have sufficient filtering, and are unable to prevent the movement of nurdles into the stormwater system. The Total

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104 Boomerang Alliance, *Submission 6*, p. 9. The Boomerang Alliance acknowledged that to date there are no Australian studies conducted into sources such as tyre dust, and this figure represents an estimate.

105 Norwegian Environment Agency, *Sources of microplastic-pollution to the marine environment*, 4 December 2014, http://www.miljodirektoratet.no/Documents/publikasjoner/M321/M321.pdf, (accessed 23 February 2016), p. 40.

106 Mr Dave West, Boomerang Alliance, *Committee Hansard*, 18 February 2016, p. 53.

107 Surfrider Foundation Australia, *Submission 14*, p. 5.

108 Total Environment Centre, *Submission 1*, p. 8.

Environment Centre explained that the Tangaroa Blue Foundation has carried out a number of studies examining the prevalence of nurdles on Australian beaches. In particular, Tangaroa Blue undertook sampling across 41 broad 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.[109]

2.92 Similarly, research conducted around Brisbane has found pellets located within the Brisbane River both upstream and downstream from Brisbane's main industrial and manufacturing areas highlighting the strong possibility of domestic release.[110]

Degradation of macroplastics

2.93 Microplastics are also formed through the degradation of macroplastic items both within the marine environment, and on land. Plastic degrades through oxidation, UV exposure, wave action, and animal and insect digestion and nesting. Macroplastics are also shredded by boat and ship propellers, and released when plastic contaminated sediment is dredged. Birdlife Australia cited a study published in 2012 which reported that individual burrowing isopods (invertebrates) can generate thousands of microplastic particles by boring into styrofoam floats used in jetties, docks and aquaculture facilities. The study found that floats from aquaculture facilities and docks were heavily damaged by thousands of isopods and their burrows and concluded that:

> …one isopod creates thousands of microplastic particles when excavating a burrow; colonies can expel millions of particles.[111]

2.94 A number of witnesses told the committee that so-called 'biodegradable plastics' are particularly prone to breaking into smaller and smaller particles. For example, Ms Terri-Anne Johnson from Clean Up Australia highlighted biodegradable plastic bags which 'break down into smaller and smaller strips of plastic'.[112]

Rates of microplastic pollution in Australia

2.95 While it is generally considered that microplastic pollution is pervasive, few studies have quantified the amount of microplastics in Australian waters. However, AIMS noted a further study undertaken in 2014 where researchers from the Sydney Institute of Marine Science conducted a survey of Sydney Harbour which found 'alarming' levels of microplastic pollution.[113] Sediment samples taken at 27 sites

109 Total Environment Centre, *Submission 1*, pp. 8–9.

110 Total Environment Centre, *Submission 1*, p. 8.

111 Birdlife Australia, *Submission 76*, p. 6.

112 Ms Terri-Anne Johnson, Clean Up Australia, *Committee Hansard*, 18 February 2016, p. 34.

113 Australian Institute of Marine Science, *Submission 11*, p. 3.

across the Harbour found concentrations of microplastics ranged from 0–10 to a high of 61–100 particles per 100 square millimetres of sediment in Middle Harbour.[114]

The cost of marine plastic pollution

2.96 Dr Britta Denise Hardesty, CSIRO, commented that 'the cost of littering and debris to fisheries, small business and human health remain poorly understood, and littering costs to local government due to remediation and tourism losses are substantial'.[115] In answer to the committee's questions concerning the estimates of the damage from marine debris on Australia's tourism, fishing and shipping, the Department of the Environment added that it did not have any estimates nor did other Commonwealth agencies including the Great Barrier Reef Marine Park Authority, the Australian Maritime Safety Authority and the Australian Fisheries Management Authority.[116]

2.97 One source of evidence on the cost of marine plastic pollution is the recently released report by the World Economic Forum which commented that the externalities related to the use of plastics and plastic packaging are concentrated in three areas:

- degradation of natural systems as a result of leakage, especially in the ocean;
- greenhouse gas emissions resulting from production and after-use incineration; and
- health and environmental impacts from substances of concern.

2.98 The World Economic Forum cited a 2014 study by the UNEP which estimated the total natural capital cost of plastics in the consumer goods industry at $75 billion, of which $40 billion was related to plastic packaging.[117] The UNEP study pointed to the significant impact of ocean plastic on maritime natural capital. It was estimated that the annual damage of plastics to marine ecosystems is at least US$13 billion per year. The Asia-Pacific Economic Cooperation (APEC) also estimated that the cost of marine plastic pollution to the tourism, fishing and shipping industries was US$1.3 billion in that region.[118]

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114 Total Environment Centre, *Submission 1*, p. 7.

115 Dr Britta Denise Hardesty, CSIRO, *Committee Hansard*, 26 February 2016, p. 1.

116 Department of the Environment, *Answer to questions on notice No. 5*, 26 February 2016.

117 World Economic Forum, *The New Plastics Economy*: *Rethinking the future of plastics*, January 2016, http://www3.weforum.org/docs/WEF_The_New_Plastics_Economy.pdf, (accessed 23 February 2016), p. 13.

118 World Economic Forum, *The New Plastics Economy*: *Rethinking the future of plastics*, January 2016, http://www3.weforum.org/docs/WEF_The_New_Plastics_Economy.pdf, (accessed 23 February 2016), p. 14.

2.99 The World Economic Forum commented specifically on the costs of plastic packaging and stated:

> A staggering 32% of plastic packaging escapes collection systems, generating significant economic costs by reducing the productivity of vital natural systems such as the ocean and clogging urban infrastructure. The cost of such after-use externalities for plastic packaging, plus the cost associated with greenhouse gas emissions from its production, has been estimated conservatively by UNEP at $40 billion—exceeding the plastic packaging industry's profit pool.[119]

2.100 In addition, the World Economic Forum noted that as a consequence of low recycling rates, 95 per cent of plastic packaging material value (US$80–120 billion) is lost to the economy after a short first use.[120]

2.101 A further matter raised in submissions was the cost of clean-ups by volunteers. Clean Up Australia submitted that cost of community effort to reduce marine plastic pollution is undervalued. Clean Up Australia estimated that the cost of holding Clean Up Australia Day was $35.216 million per annum. This was based on the value of volunteers (1,052,536 volunteer hours at an average wage rate of $31.11 per hour), pro bono services (including local government rubbish collection services) of at least $1 million as well as event related expenditure and management and administration costs.[121] Similarly, the value of volunteer efforts to clean up the Georges River were estimated to be $2.8 million over four years.[122]

2.102 The cost of removing litter, including plastic debris, were provided to the committee. For example, in 2012–13, the Victorian Government spent $80 million in removing litter, including the removal of over 7,800 tonnes of litter from Melbourne waterways.[123]

2.103 The committee notes that, in addition to the direct economic costs, there are also potential adverse impacts on human livelihoods and health, food chains and other essential economic and societal systems.

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119 World Economic Forum, *The New Plastics Economy*: *Rethinking the future of plastics*, January 2016, http://www3.weforum.org/docs/WEF_The_New_Plastics_Economy.pdf, (accessed 23 February 2016), p. 10.

120 World Economic Forum, *The New Plastics Economy*: *Rethinking the future of plastics*, January 2016, http://www3.weforum.org/docs/WEF_The_New_Plastics_Economy.pdf, (accessed 23 February 2016), p. 10.

121 Clean Up Australia, *Submission 9*, p. 5.

122 Georges River Combined Councils' Committee, *Submission 17*, p. 4.

123 Associate Professor Mark Osborn, *Submission 16*, p. 2.

International initiatives on marine pollution

2.104 A range of global initiatives have been developed to ensure international cooperation in reducing the rates of marine pollution, and in reducing the harm associated with such pollution. These initiatives include The Honolulu Strategy, the Honolulu Commitment and the Global Partnership on Marine Litter. The United Nations Environment Assembly and UNEP have both also noted marine plastic as an issue of concern.

The Honolulu Strategy

2.105 In 2011, the US National Oceanic and Atmospheric Administration co-hosted the Fifth International Marine Debris Conference in conjunction with the United Nations Environment Programme. The conference resulted in the development of the Honolulu Strategy which is a framework for the global effort to reduce the impacts of marine debris.

2.106 The Honolulu Strategy Goals are:

- reduced amount and impact of land-based sources of marine debris introduced into the sea;
- reduced amount and impact of sea-based sources of marine debris (including solid waste, lost cargo, ALDFG, and abandoned vessels) introduced into the sea;
- reduced amount and impact of accumulated marine debris on shorelines, in benthic habitats, and in pelagic waters.[124]

2.107 In addition to the Honolulu Strategy, the Honolulu Commitment was also developed. This is a 12 point pledge to which international organisations, governments, non-government organisations and citizens are encouraged to commit. The pledge includes making choices to reduce waste, facilitating initiatives that turn waste into a resource in an environmentally sustainable manner, developing global, regional, national and local targets to reduce marine debris.[125]

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124 United Nations Environment Programme and the National Oceanic and Atmospheric Administration, *The Honolulu Strategy*, p. 2, http://marinedebris.noaa.gov/sites/default/files/publications-files/Honolulu_Strategy.pdf, (accessed 22 March 2016).

125 The Fifth International Marine Debris Conference, *The Honolulu Commitment* , http://www.unep.org/pdf/PressReleases/Honolulu_Commitment-FINAL.pdf, (accessed 22 March 2016), p. 2.

Global Partnership on Marine Litter

2.108 The Global Partnership on Marine Litter (GPML) was launched at the Rio+20 meeting in Brazil in 2012. It is a voluntary open-ended partnership for international agencies, governments, businesses, academia, local authorities, nongovernmental organisations and individuals.

2.109 The launch of the GPML complemented paragraph 163 of the Rio outcome document, *The Future We Want*, which noted with concern that the health of oceans and marine biodiversity are negatively affected by marine pollution, including marine debris, especially plastic and committed to take action to reduce the incidence and impacts of such pollution on marine ecosystems.

2.110 The GPML seeks:

- to reduce the impacts of marine litter worldwide on economies, ecosystems, animal welfare and human health;
- to enhance international cooperation and coordination through the promotion and implementation of the Honolulu Strategy and the Honolulu Commitment;
- to promote knowledge management, information sharing and monitoring of progress on the implementation of the Honolulu Strategy;
- to promote resource efficiency and economic development through waste prevention e.g. the 4Rs (reduce, re-use, recycle and re-design), and by recovering valuable material and/or energy from waste;
- increase awareness on sources of marine litter, their fate and impacts; and
- to assess emerging issues related to the fate and potential influence of marine litter, including (micro) plastics uptake in the food web and associated transfer of pollutants, and conservation and welfare of marine fauna.[126]

UN Environment Assembly and the UN Environment Programme

2.111 The UN General Assembly addressed the issue of marine litter in November 2005 and a resolution was passed. Following the resolution, a series of consultations occurred in cooperation with a number of UN agencies, and it was decided that the United Nations Environment Programme should take the lead in developing global and regional activities on marine litter.[127]

2.112 In June 2014, governments attending the first UN Environment Assembly noted with concern the impacts of plastics and microplastics on the marine environment, fisheries, tourism and development. They called for strengthened action,

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126 Global Partnership on Marine Litter, *Factsheet*, http://unep.org/gpa/documents/gpml/GPMLFactsheet.pdf

127 United Nations Environment Programme, http://www.unep.org/regionalseas/marinelitter/about/mandate/default.asp

in particular by addressing such materials at the source. A resolution was adopted calling for the strengthening of information exchange mechanisms, requesting UNEP to present scientific assessments on microplastics for consideration by the next session of the Assembly.[128]

Committee comment

2.113 The committee acknowledges both the magnitude, and the pervasiveness of marine plastic pollution. Evidence clearly demonstrates that this is an issue of global concern with vast quantities of plastic entering the marine environment on a daily basis. The committee understands that calculating the exact rates of plastic pollution into the future is difficult, but is of the view that estimates of current rates of pollution are sufficiently high as to warrant immediate action. The committee also accepts that marine plastic pollution in the Australian marine environment is difficult to quantify, but that amounts recovered through clean-up activities would point to the problem being significant.

2.114 Marine plastic pollution originates from both land- and ocean-based sources, and as such mitigation strategies must be designed to address both. There is evidence that in the Australian context, there are both domestic and international sources—these include urban litter, garbage from shipping, and abandoned fishing gear from international fishing operations. The committee was presented with comprehensive evidence of the enormous volume of single-use plastic packaging associated with the food and beverage industry found in marine plastic pollution.

2.115 Plastic, unless it is removed from the marine environment, will continue to exist, albeit in increasingly smaller sizes. The committee notes with concern the evidence provided on the threat posed by microplastics. In particular, the inability to easily measure the rates of microplastic pollution, the wide variety of microplastic sources, and the impossibility of removing microplastics from the marine environment through clean-up activities.

2.116 The committee accepts the evidence that plastic has a number of externalities, such as the degradation of natural systems including the marine environment, and costs to government and community. The committee is of the view that these externalities must be further explored in order to fully understand the costs associated with marine plastic pollution in Australia

128 Global Partnership on Marine Litter, *Marine Litter – The Issue*, http://unep.org/gpa/gpml/issue.asp

Chapter 3

The effects of marine plastic pollution

3.1 While public perception of the effects of plastic in the oceans has been formed by images of turtles and other marine fauna entangled in fishing lines and plastic debris, the effects of marine plastic pollution are more widespread, can be less visible and many are only now being identified. There also remain significant gaps in knowledge about the effects of marine plastic pollution including the population level impacts of ingestion, the effects on human health of plastics in the food chain, and the frequency and potential effects of invasive species via marine debris, as well as the effects of microplastics.

3.2 As the Australian Institute of Marine Science (AIMS) concluded:

> The risks of marine plastic pollution to marine life, ecosystems and fisheries are uncertain, and understanding them requires detailed information on: (i) the likelihood of exposure to plastics and (ii) the direct and indirect effects of the plastics. At present it is not possible to rank the risks posed by marine plastic pollution in the marine environment (internationally or nationally) against more comprehensively studied pressures such as climate change or land-based pollution.[1]

3.3 This chapter provides an overview of the effects of plastic pollution on marine fauna (including ingestion and entanglement), human health, fisheries and shipping, and ecosystems. It also identifies areas where more research is required.

Effects of plastic pollution on marine fauna

3.4 The committee received considerable evidence on the impact of plastic pollution on marine fauna. This evidence included research from leading Australian academics, government agencies and community organisations. The evidence indicated that plastic pollution affects marine fauna and flora through:

- ingestion;
- entanglement;
- the transport and bioaccumulation of harmful chemicals; and
- the transport of invasive species.

Ingestion

3.5 Plastic ingestion has been documented in a large range of marine species—the committee received evidence that over 200 species of marine animal are recorded as

1 Australian Institute of Marine Science, *Submission 11*, p. 2.

having ingested manufactured polymers.[2] Dr Kathy Townsend told the committee that 'on a global scale Australia has been recognised as a hot spot for marine debris ingestion for both seabirds and sea turtles'.[3] AIMS added that, based on evidence from overseas studies, 'it is highly likely that plastic ingestion is much more widespread and includes many more marine species in northern Australia than currently documented'.[4]

3.6 Studies indicate that plastic bags, cling film, food wrappers and balloons are most commonly consumed by turtles, while seabirds consume degraded hard plastics sourced from take away containers, single-use plastics and discarded consumer products.[5] Dr Townsend explained that balloons are attractive to both seabirds and turtles because they look similar to squid and jellyfish. Red and orange balloons are particularly appealing to marine fauna as they are similar colours to traditional prey species.[6] Dr Hardesty added that matter adhering to the surface of plastic, such as roe, may make objects attractive to seabirds.[7]

3.7 The committee received evidence that plastic ingested by animals is known to 'physically block their digestive tracts, alter feeding behaviour and dietary inputs'.[8] Plastic debris may also lacerate the mouth and digestive tract causing serious injury to the animal. This may also result in a greater susceptibility to predators and disease, and a decreased ability to breed and rear young.[9]

3.8 However, the committee was also informed that the ability to assign actual cause of death to plastic ingestion is 'exceptionally small.' Dr Britta Denise Hardesty, CSIRO, explained that differentiation between causality and correlation is 'really important' and that unless gut perforation or blockage is identified, cause of death can be difficult to identify. Dr Hardesty also commented that CSIRO is undertaking work to try to estimate how much plastic is required to kill a turtle or a seabird.[10]

3.9 The following discussion provides an overview of evidence received in relation to ingestion of plastics by turtles, seabirds, cetaceans and corals and zooplankton.

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2 Dr Kathy Townsend and Dr Qamar Schuyler, *Submission 141*, p. 1; see also Humane Society International, *Submission 22*, p. 2.

3 Dr Kathy Townsend, *Committee Hansard*, 10 March 2016, p. 1.

4 Australian Institute of Marine Science, *Submission 11*, p. 3.

5 Dr Kathy Townsend and Dr Qamar Schuyler, *Submission 141*, p. 1.

6 Dr Kathy Townsend, *Committee Hansard*, 10 March 2016, p. 3.

7 Dr Britta Denise Hardesty, CSIRO, *Committee Hansard*, 26 February 2016, p. 10.

8 Dr Mark Browne, and co-authors Professor Tony Underwood, Professor Gee Chapman, Professor Emma Johnston, *Submission 21*, p. 3.

9 Humane Society International, *Submission 22*, p. 2.

10 Dr Britta Denise Hardesty, CSIRO, *Committee Hansard*, 26 February 2016, p. 9.

Turtles

3.10 The committee received a range of evidence on the ingestion of marine plastic pollution by turtles. In particular, the types of plastic consumed, the species particularly susceptible to plastic consumption, and the rates of death and injury as a result.

3.11 Dr Townsend stated that ingestion by turtles has been increasing historically, with ingestion rates of over 60 per cent in some species of sea turtles since 1980. It is also estimated that over 50 per cent of the world's sea turtles have ingested marine debris worldwide as the population stands now.[11]

3.12 Studies indicate that certain species are more likely to ingest plastic, with oceanic leatherback turtles and green turtles being at the greatest risk of both lethal and sub-lethal effects of ingesting plastic debris.[12] Dr Townsend indicated that younger turtles, at both the 'lost years-stage' and at the 'benthic-stage', are particularly prone to plastic ingestion.[13] Research has found that smaller, oceanic-stage turtles are more likely to ingest plastic debris than coastal foragers, and carnivorous species are less likely to ingest debris than herbivores or gelatinovores (jellyfish eaters). The CSIRO also found that benthic-stage turtles favour soft clear plastic, possibly because it resembles jellyfish.[14]

3.13 The CSIRO in collaboration with the University of Queensland, and the Imperial College, London, identified that turtles are selective of materials and prefer to ingest items 'that are flexible, and different in colour from the background debris in the ocean'.[15] Dr Townsend also told the committee that:

> …studies have shown that for turtles, for instance, things such as plastic bags, cling film, food wrappers and balloons are the most commonly consumed plastic debris, regardless of life stage.[16]

3.14 Once plastic has been ingested by a turtle, the animals have difficulty in ridding themselves of this debris—many turtles have downward facing spines in their throats which prevent the regurgitation of plastic. The plastic subsequently remains in

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11 Dr Kathy Townsend, *Committee Hansard*, 10 March 2016, p. 1; see also CSIRO, *Submission 7*, Appendix 3, 'Input to Department of Environment Threat Abatement Plan', p. 24.

12 CSIRO, *Submission 7*, p. 5.

13 'Lost years stage' turtles are younger turtles which float on the open ocean feeding on the first one to two metres of the surface. 'Benthic stage' turtles are slightly older juveniles which live in the benthic zones, feeding primarily from the ocean floor. See Dr Kathy Townsend, *Committee Hansard*, 10 March 2016, p. 6.

14 CSIRO, *Submission 7*, Appendix 2, 'Executive Summary "Understanding the effects of marine debris on wildlife: Final report to Earthwatch Australia"', p. 10.

15 CSIRO, *Submission 7*, Appendix 3, 'Input to Department of Environment Threat Abatement Plan', p. 24.

16 Dr Kathy Townsend, *Committee Hansard*, 10 March 2016, p. 1.

the stomach where it blocks the digestion of food. In addition, plastic products often decompose within the turtle and produce gas which remains trapped inside the animal. These gases cause the turtle to float on the surface of the water, which can lead to starvation, and the inability to hide from predators.[17]

3.15 According to the Wildlife Preservation Society of Queensland, recent studies by the Queensland National Parks and Wildlife Service found that 'over 70% of loggerhead turtles found dead in Queensland waters have ingested plastic'. In addition, 30 per cent of sea turtle deaths in Moreton Bay can be attributed to the ingestion of plastic pollution.[18]

3.16 The committee received evidence from a number of organisations that provide rescue services for injured marine animals. For example, the Coolum and North Shore Coast Care explained that within its organisation there are a number of volunteers responsible for monitoring the nesting of endangered loggerhead and green sea turtles, and who attend turtle strandings. It further stated that sea turtles generally only strand when they are very ill or dead. It noted that in the past three years, there have been a total of 134 strandings, with 71 deceased animals found.[19] Necropsies were undertaken on a number of these deceased turtles at the University of Queensland Research Station. Data published by this facility in 2012 indicated that '33% of the sea turtles necropsied from the Brisbane and Sunshine Coast areas had ingested plastic debris'.[20] Similarly, the Great Barrier Reef Marine Park Authority commented that plastics make up 90 per cent of the marine debris ingested by marine turtles in Queensland.[21]

3.17 The Australian Seabird Rescue also noted that a database recording marine turtle strandings on the coast of northern New South Wales recorded a total of 142 strandings between 2001–2007. It indicated that of these strandings, 18 turtles were listed as having ingested plastic.[22]

3.18 However, the CSIRO stated that it is difficult to quantify the impact of ingestion in turtles, and as a result, it is currently working to analyse the relationship between ingestion and mortality. Preliminary results indicate that there is a 'positive relationship' between the two, and the CSIRO is currently collaborating with researchers at the University of Tasmania to estimate mortality rates.[23]

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17 Clean Up Australia, *Submission 9*, p. 10. See also Ms Kathrina Southwell, Australian Seabird Rescue, *Committee Hansard*, 10 March 2016, p. 23.

18 Wildlife Preservation Society of Queensland, *Submission 5*, p. 3.

19 Coolum and North Shore Coast Care, *Submission 56*, p. 3.

20 Coolum and North Shore Coast Care, *Submission 56*, p. 4.

21 Great Barrier Reef Marine Park, *Submission 29*, p. 1.

22 Australian Seabird Rescue Inc., *Submission 80*, p. 2.

23 CSIRO, *Submission 7*, Appendix 3, 'Input to Department of Environment Threat Abatement Plan', p. 24.

Seabirds and shorebirds

Seabirds

3.19 Seabirds live their lives in the open ocean and most only return to land to breed. Dr Hardesty commented that seabirds 'are truly pelagic…We consider seabirds as the canary in the coalmine, if you will, in the oceans. It is a really good indicator of ocean health'.[24]

3.20 The committee received extensive evidence on the ingestion of marine plastic by seabirds. This evidence included the effect of plastic ingestion on both adult and juvenile birds, the rate of plastic consumption, and the future direction of research in this field.[25]

3.21 Seabirds ingest a variety of items, with Dr Townsend informing the committee that seabirds largely consume 'balloons and degraded hard plastics, usually sourced from things like takeaway containers, water bottles and other single-use plastics and discarded consumer products'.[26] Other submitters also provide evidence of the types of plastic debris found in seabirds. For example, Dr Hardesty reported seeing toothbrushes, bottle caps and even glass bottles with metal lids inside albatross.[27] Dr Heidi Auman, submitted findings from her research and stated:

> 98% of Laysan albatross chicks from Midway Atoll National Wildlife Refuge contained marine plastic debris in their stomachs. Most of this could be measured in multiple handfuls and included: shards of unidentified plastic, bottle caps, Styrofoam, beads, fishing line, buttons, chequers, disposable cigarette lighters (up to six per bird), toys, PVC pipe and other PVC fragments, golf tees, dish washing gloves, highlighter pens, medical waste and light sticks. Non-plastic items included neoprene O-rings, rubber pieces, and a lightbulb. Naturally killed chicks had significantly greater masses of plastic and had significantly lighter body masses and lower fat indices than injured but otherwise healthy chicks.[28]

3.22 In addition, research shows that chicks of some species are being fed plastic while in the nest. Mr Ian Hutton commented that studies showed 79 per cent of flesh-footed shearwater chicks contained some ingested plastic, fed to them by their parents who picked this debris up while foraging over the Tasman Sea.[29]

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24 Dr Britta Denise Hardesty, CSIRO, *Committee Hansard*, 26 February 2016, p. 5.

25 See for example CSIRO, *Submission 7*, Mr Ian Hutton, *Submission 69*, Dr Kathy Townsend and Dr Qamar Schuyler, *Submission 141*, Australian Seabird Rescue, *Submission 80*.

26 Dr Kathy Townsend, *Committee Hansard*, 10 March 2016, p. 1.

27 Dr Britta Denise Hardesty, CSIRO, *Committee Hansard*, 26 February 2016, p. 10.

28 Dr Heidi Auman, *Submission 190*, p. 1.

29 Mr Ian Hutton, *Submission 69*, p. 1.

3.23 In 2014, the CSIRO published the results of a global risk analysis of seabirds and marine debris ingestion for nearly 200 species. It was found that 43 per cent of seabirds and 65 per cent of individuals within a species have plastic in their gut.[30] The CSIRO predicted that 95 per cent of the world's seabirds will have ingested plastic by 2050 due to the steady increase in plastics production.[31]

3.24 The committee received evidence that the Tasman Sea, between Australia and New Zealand and the Southern Ocean, has been identified as a 'hotspot' for the potential impact of plastic ingestion by seabirds.[32] For example, a study conducted by the CSIRO identified that 67 per cent of short-tailed shearwaters (*Puffinus tenuirostris*) were found to have ingested marine plastic pollution. The study found that juvenile birds were more likely to ingest plastic than adults, and that juveniles consumed larger amounts.[33]

3.25 Dr Jennifer Lavers, who conducts research with Mr Hutton into the flesh-footed shearwater (*Puffinus carneipes*) populations on Lord Howe Island, told the committee that since 2005 there has been a gradual increase in the amount of plastic and also the proportion of the population ingesting plastics. Mr Hutton added that in one instance, 274 pieces of plastic were retrieved from a deceased bird. Mr Hutton stated that this was a record and represented '14 per cent of the body weight' of the bird.[34] Mr Hutton went on to note that this 'is the equivalent of a human carrying a pillowcase full of plastic in...[their] stomach'.[35]

3.26 The committee was interested to hear that plastic items retrieved from the stomachs of seabirds on Lord Howe Island were able to be identified as items originating from Australia rather than from overseas sources. In particular, Mr Hutton told the committee that bottle lids, balloon clips, and caps from milk cartons, marked with identifiable Australian brands are regularly retrieved from the stomachs of birds.[36]

3.27 Dr Lavers told the committee that seabirds such as the shearwaters on Lord Howe Island have been found severely emaciated as a result of ingesting large amounts of plastic. In addition, the ingestion of plastic has also been found to affect

30 CSIRO, *Submission 7*, Appendix 2, 'Executive Summary "Understanding the effects of marine debris on wildlife: Final report to Earthwatch Australia"', p. 11.

31 CSIRO, *Submission 7*, p. 5.

32 CSIRO, *Submission 7*, Appendix 2, 'Executive Summary "Understanding the effects of marine debris on wildlife: Final report to Earthwatch Australia"', p. 11.

33 CSIRO, *Submission 7*, Appendix 2, 'Executive Summary "Understanding the effects of marine debris on wildlife: Final report to Earthwatch Australia"', p. 11.

34 Mr Ian Hutton, *Committee Hansard*, 18 February 2016, p. 21.

35 Mr Ian Hutton, *Committee Hansard*, 18 February 2016, p. 22.

36 Mr Ian Hutton, *Committee Hansard*, 18 February 2016, p. 13.

the growth and development of juvenile birds. Dr Lavers told the committee that on Lord Howe Island researchers:

> …very regularly find very severely emaciated birds, so the plastic has been linked with very significantly reduced body mass and also stunted wing growth. These are birds that are attempting to make their first flight out to sea with wings that are half the length of what they should be at that age. You can imagine that their survivability is, as a result of that, very low.[37]

3.28 Dr Lavers also noted that despite research being available on the impact of plastic ingestion on individual birds, there is a 'key research gap' in understanding the 'population level impact'.[38] Dr Lavers did however provide the committee with 'a very rough estimate' that the juvenile survival rate of shearwaters is reduced by 'approximately 11 per cent'.[39]

3.29 The key research gap in understanding the effect of marine plastic ingestion at the population level has been widely recognised by the scientific community. Dr Hardesty noted that while there were many papers and stories on individual species, there was a need to commence addressing the population level impacts.[40] Similarly, Professor Tony Underwood, stated that modelling of populations is not being undertaken and pointed to the work on the petrels in Europe. While sampling is carried out to measure the amount of plastic ingested, there is no improvement in understanding or any assessment of the risk to a species.[41]

3.30 Dr Hardesty went on to comment that the CSIRO has developed a method to allow assessment at the population level for seabirds. This is a non-invasive method for measuring the amount of plastic in a seabird which examines the oil secreted from a seabird's preening gland.[42] This method can be applied at the 'individual, population and species levels and it has no observed detrimental impacts'.[43] Dr Hardesty described this research as an opportunity to address the issue of marine plastic pollution 'holistically'.[44]

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37 Dr Jennifer Lavers, *Committee Hansard*, 18 February 2016, p. 18.

38 Dr Jennifer Lavers, *Committee Hansard*, 18 February 2016, p. 19.

39 Dr Jennifer Lavers, *Committee Hansard*, 18 February 2016, p. 18.

40 Dr Britta Denise Hardesty, CSIRO, *Committee Hansard*, 26 February 2016, p. 10.

41 Professor Tony Underwood, *Committee Hansard*, 18 February 2016, p. 19.

42 CSIRO, *Submission 7*, Appendix 3, 'Input to Department of Environment Threat Abatement Plan', p. 20.

43 CSIRO, *Submission 7*, Appendix 2, 'Executive Summary "Understanding the effects of marine debris on wildlife: Final report to Earthwatch Australia"', p. 11.

44 Dr Britta Denise Hardesty, CSIRO, *Committee Hansard*, 26 February 2016, p. 10; see also ANSTO, *Submission 191*.

Shorebirds

3.31 Shorebirds, also known as waders, inhabit coastal margins around the world. Resident shorebirds in Australia include the Hooded Plover and Pied Oystercatchers. Approximately 60 species of migratory shorebirds visit Australia including Sandpipers and Stints.[45] Shorebirds forage on coastlines around the world, both rocky and sandy foreshores. Many species are visual foragers, that is, they visually locate their prey on or in the sediments and beachcast seaweeds and grasses before ingestion.[46]

3.32 As with seabirds, concerns were raised about the ingestion of plastics by shorebirds. The submission from Birdlife Australia focused on the potential threat to resident and migratory shorebirds from the ingestion of microplastics and the associated absorbed chemicals. Dr Eric Woehler, Convenor, Birdlife Tasmania, argued that:

> …every single shorebird that feeds on Australia's foreshore or coastal areas would potentially be at risk from ingesting microplastics. It is clear from the literature around the world that these microplastics are not just confined to marine environments; they are also found in freshwater and estuarine environments. These foreshore areas—estuarine, freshwater and marine—are all used by migratory and resident shorebirds in Australia.[47]

3.33 In particular, Birdlife Australia submitted that shorebirds may face threats from marine microplastics through the ingestion of the particles themselves that can remain in their stomachs and potentially accumulate over time, and from the ingested microplastics that are likely to have absorbed persistent organic pollutants and metals that can be transferred to the shorebirds' body tissues.[48]

3.34 The effects of microplastics in the marine environment are canvassed in more detail in the following discussion.

Cetaceans

3.35 The committee received evidence that ingestion of plastic by cetaceans, including dolphins and whales, can cause death and injury, particularly when plastic causes fatal blockages in the animals' digestive tracts. Plastic products may also lacerate digestive tracts or cause rupturing, which leads to the death of the animal.

3.36 An example of the ingestion of plastic by a whale, was provided by the Boomerang Alliance: in August 2000, an eight metre Bryde's whale died soon after stranding on a beach in Cairns. A subsequent necropsy found that its stomach

45 Birdlife Australia, *Submission 76*, pp. 8–11.

46 Birdlife Australia, *Submission 76*, p. 13.

47 Dr Eric Woehler, Convenor, Birdlife Tasmania, 26 February 2016, p. 33.

48 Birdlife Australia, *Submission 76*, p. 13.

contained six square metres of plastic, including a large number of lightweight single-use plastic bags.[49]

3.37 However, Professor Underwood cautioned the committee against assuming that ingestion of plastic caused death in every case of whale stranding. Professor Underwood told the committee that 'very few…cases were autopsied' so there is very little evidence of the 'biological consequences' of plastic ingestion.[50]

3.38 Dr Hardesty similarly told the committee that researching the consequences of ingestion and entanglement on cetaceans was deemed important by the Australian Government as they 'are really good indicators of ocean health'. However, this work has not occurred yet.[51]

Corals and zooplankton

3.39 The committee received evidence that in addition to large marine animals, research indicates that corals and zooplankton also ingest marine plastic pollution.

3.40 A number of submissions stated that the ingestion of microplastics poses a threat to coral reefs. For example, Clean Up Australia submitted that corals are non-selective feeders and readily consume microbeads and microplastics that are present in seawater. Clean Up Australia went on to note that a study conducted by the Australian Research Council Centre of Excellence for Coral Reef Studies discovered that corals digest microplastics at almost the same rate as normal food, and are unable to expel them from their digestive systems. There is concern that eventually, corals will starve and die as their digestive cavities are filled with plastic.[52] Further research is being undertaken to determine the impact plastic has on coral physiology and health, as well as its impact on other marine organisms.[53]

3.41 Research is also being conducted into the trophic (that is, from prey to predator) transfer of plastics, and accumulated chemicals through the ingestion of zooplankton. Birdlife Australia submitted that studies have found microplastics present in planktivorous fish, which are fish that feed on zooplankton.[54]

3.42 Birdlife Australia also stated that limited evidence from a small number of studies has shown bioaccumulation of microplastics in seals from ingestion of fish

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49 Boomerang Alliance, *Submission 77*, p. 25.

50 Professor Tony Underwood, *Committee Hansard*, 18 February 2016, pp. 22–23.

51 Dr Britta Denise Hardesty, CSIRO, *Committee Hansard*, 26 February 2016, p. 8.

52 Clean Up Australia, *Submission 9*, p. 10. See also http://www.coralcoe.org.au/news/great-barrier-reef-corals-eat-plastic.

53 James Cook University, 'Great Barrier Reef corals eat plastic', *Media release*, 2015, https://www.jcu.edu.au/news/releases/news-archive2/news-and-media1111111111111111115

54 Birdlife Australia, *Submission 76*, p. 11.

which have fed on zooplankton. However, the studies were not able to demonstrate whether the zooplankton or the fish had ingested the plastic.[55]

Entanglement

3.43 Evidence was presented to the committee on the threat of entanglement posed by marine plastic pollution. Marine fauna entanglement in marine plastic pollution includes entanglement in abandoned fishing gear such as nets and lines, plastic bags, packing straps, ropes, clothing and diving gear, and six-pack rings.

3.44 Entanglement can cause restricted mobility, scoliosis, starvation, smothering and wounding, which in turns leads to infections, amputation of limbs, and death. Entanglement can also reduce the ability to avoid predators.

3.45 Entanglement is a world-wide problem. Dr Townsend told the committee that:

> Worldwide, at least 143 species of marine animals have been entangled in marine debris, including most of the world's sea turtles. Locally, in Moreton Bay, we have estimated that between six and seven per cent of the animals are being entangled in marine debris. This plastic marine debris source for entanglements is coming mainly from the fishing industry, both commercial and recreational.[56]

3.46 However, it has been noted by researchers that, to date, there is scant data overall to provide a global estimate of the number of animals which have become entangled. Vegter *et al.* observed that most reports are either restricted to opportunistic observations of animals or are from heavily visited coastal regions. The researchers concluded that 'we likely observe only a small fraction of entangled or injured wildlife', thus actual or total rates of wildlife entanglement are not known.[57]

3.47 The committee received evidence that seabirds, turtles, whales, dolphins, dugongs, sea snakes, sharks, fish, crabs and crocodiles and numerous other species are killed and maimed through entanglement.[58] Eco Barge Clean Seas detailed an incident where a large, male green sea turtle weighing 120 kg was found stranded on Whitehaven Beach in the Whitsunday Islands. The animal was found with a 'completely amputated front left flipper and wounds on the rear of its body.' It is assumed that these injuries were sustained as a result of fishing line entanglement due to the depth and cleanliness of the cuts. Eco Barge Clean Seas stated that it is likely the animal either tried to rid itself of the fishing line or the line became entangled in coral and the animal was forced to pull itself free in order to return to the surface to

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55 Birdlife Australia, *Submission 76*, p. 12.

56 Dr Kathy Townsend, *Committee Hansard*, 10 March 2016, p. 1.

57 Vegter, AC, *et al*., 'Global research priorities to mitigate plastic pollution impacts on marine wildlife', *Endangered Species Research*, 25: 225–247, 2014 http://www.int-res.com/articles/esr_oa/n025p225.pdf

58 Australian Institute for Marine Science, *Submission 11*, p. 3;

breathe. Eco Barge noted that the turtle was mature, of breeding age, in peak condition and had 'probably migrated hundreds of kilometres to reach the Whitsundays to breed, instead becoming permanently maimed by lost fishing gear'.[59]

3.48 The committee also received a number of submissions from organisations and individuals who have rescued marine fauna entangled in plastic pollution.[60] For example, the Australian Seabird Rescue stated that:

> Over 40% of the sea turtles that come into care at Australian Seabird Rescue in Ballina are affected by plastic ingestion and/or entanglement, many of these animals die…We have found in any estuary, 20% of pelicans are injured by fishing line (made of plastic). Last year we had a Green Sea Turtle (that was otherwise healthy) that had to be euthanised due to a plastic bag wrapping tight around its flipper.[61]

3.49 Ms Kathrina Southwell, Managing Director of the Australian Seabird Rescue, told the committee that over the past 25 years, pelicans entangled in fishing line have been the most common species rescued, and rehabilitated.[62] However, Ms Southwell noted that many birds 'have to be euthanised because they may have a limb missing…so they cannot survive in the wild'.[63]

3.50 An area of concern is the entanglement of animals in discarded nets. This is a particular problem in northern Australian waters. The CSIRO and Ghostnets Australia have undertaken work in the Gulf of Carpentaria. From their analysis of approximately 9,000 nets intercepted in the Gulf of Carpentaria, it was estimated that at least 15,000 turtles had been entangled. The study examined the types of nets present in the Gulf of Carpentaria and found that large gills nets have particularly high catch rates of turtles. The study also concluded that given the number of nets that wash ashore in the region, the estimated number of entangled turtles can be extended to approximately 20,000 turtles.[64]

3.51 Dr Kroon, AIMS, commented on a study which examined the impact of ghost nets on sea-turtle populations. The aim of that project was to determine the spatial distribution and movement of ghost nets in the Arafura Timor Sea and to identify the demographic composition and origin of sea turtles found entangled in those nets. It was found that derelict fishing gear enters the Arafura Timor Sea from the north, or it is discarded locally, and that a particular type of net made of thin twine of medium-

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59 Eco Barge Clean Seas Inc. *Submission 13*, p. 3.

60 See for example, Eco Barge Clean Seas Inc., *Submission 13*, Mr Mick Morley, *Submission 164*, Wild Bird Rescues Gold Coast, *Submission 110*.

61 Australian Seabird Rescue, *Submission 80*, p. 4.

62 Ms Kathrina Southwell, Australian Seabird Rescue, *Committee Hansard*, 10 March 2016, p. 25.

63 Ms Kathrina Southwell, Australian Seabird Rescue, *Committee Hansard*, 10 March 2016, p. 24.

64 CSIRO, *Submission 7*, Appendix 3,' Input to Department of Environment Threat Abatement Plan', p. 14.

size, the so-called GR24 nets, are more prone to inflict harm to marine biodiversity than other types of nets. The majority of the entangled turtles, olive ridley sea turtles, found in washed up nets come from the Tiwi, McClure and West Papua regions—so from outside of Australia in part.[65]

3.52 The CSIRO also stated that entanglement of pinniped (seals and sea lions) species in plastic pollution is common. Research has found that the majority of pinniped entanglements in Victoria involved plastic twine or rope, and seals become entangled in green items more than in any other colour. Research also indicates that in general, young seals are entangled in greater numbers than adults.[66]

3.53 Research into entanglements with lost, abandoned or derelict fishing gear was considered to be a priority in the paper published by Vegter *el al*. as links to entanglement in derelict fishing gear 'could have considerable financial, environmental and safety implications for fisheries management, as the amount of fishing gear lost to the ocean is estimated to be 640,000 tonnes per year.[67]

Chemical accumulation and plastic-sourced chemicals

3.54 Submitters raised concerns with the potential toxic impacts of marine plastic pollution.[68] Evidence was provided to the committee that marine plastic pollution serves as both a transport medium for accumulated chemicals present in seawater, and is a source of toxic chemicals. The chemicals include pesticides such as DDT, polychlorinated biphenyls, and endocrine-active substances.[69]

3.55 According to the National Toxics Network, toxicity associated with plastics can be attributed to one or more of the following factors:

- residual monomers from the manufacturing process present in the plastic or toxic additives used in the compounding of plastic, leaching out of the plastic;
- partial degradation of certain plastics; and

65 Dr Frederieke Kroon, Australian Institute of Marine Science, *Committee Hansard*, 10 March 2015, p. 15.

66 CSIRO, *Submission 7*, Appendix 2, 'Executive Summary "Understanding the effects of marine debris on wildlife: Final report to Earthwatch Australia"', p. 11.

67 Vegter, AC, *et al*., 'Global research priorities to mitigate plastic pollution impacts on marine wildlife', *Endangered Species Research*, 25: 225–247, 2014 http://www.int-res.com/articles/esr_oa/n025p225.pdf

68 Surfrider Foundation Australia, *Submission 14*, p. 4; OceanWatch Australia, *Submission 75*, p. 4.

69 National Toxics Network, *Submission 4*, p. 1.

- persistent organic pollutants[70] (POPs) present in seawater being absorbed and concentrated in microplastic fragments.[71]

3.56 POPs, which are almost universally present at very low concentration levels in seawater, are absorbed, usually by microplastic fragments. Large volumes of POPs can be absorbed by plastic, and scientists have found polypropylene pellets with up to one million times more concentrated levels of POPs than the surrounding seawater.[72]

3.57 The committee received evidence that 'microplastics have large surface area to volume ratios, thus absorbing large…quantities of chemicals, which can make them extremely toxic'.[73] The National Toxic Network commented that ingestion of pellets with even low concentrations of POPs by marine organisms is likely to present a threat to health. However, information on the extent to which ingestion of particular chemical components contributes to organism mortality, is not readily available.[74]

3.58 Some studies have been conducted on chronic dietary exposure to low-density polyethylene plastic. These studies found that ingestion may contribute towards the bioaccumulation[75] of potentially hazardous substances in fish, which can affect the health of the liver.[76] These chemicals are also known to compromise immunity and cause infertility in animals, even at very low levels.[77]

3.59 The committee also received evidence that toxic chemicals can be transferred into 'the tissues of marine worms and freshwater fish reducing functions strongly linked to health biodiversity'. In addition, ingestion of microplastics can compromise the immune systems of animals.[78] Dr Hardesty told the committee that some plastics, and the chemicals that adhere to them, act as 'hormone mimics' and that

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70 Persistent organic pollutants are organic compounds that are resistant to environmental degradation, and are known to bioaccumulate. Most persistent organic pollutants are currently or were in the past used as pesticides, solvents, pharmaceuticals and industrial chemicals. For more information see https://www.environment.gov.au/protection/chemicals-management/pops.

71 National Toxics Network, *Submission 4*, p. 2.

72 National Toxics Network, *Submission 4*, p. 2.

73 Dr Mark Browne, and co-authors Professor Tony Underwood, Professor Gee Chapman, Professor Emma Johnston, *Submission 21*, p. 2.

74 National Toxics Network, *Submission 4*, p. 3.

75 Bioaccumulation refers to the accumulation of substances such as pesticides, or other chemicals in an organism. It occurs when an organism absorbs a toxic substance at a rate faster than that at which the substance is lost.

76 Rochman C.M, Hoh E, Kurobe T, Swee J, 'Ingested plastic transfers hazardous chemicals to fish and induces hepatic stress', 2013, *Scientific Reports*, 3:3263. See National Toxics Network, *Submission 4*, p. 3.

77 Total Environment Centre, *Submission 1*, p. 9

78 Dr Mark Browne, and co-authors Professor Tony Underwood, Professor Gee Chapman, Professor Emma Johnston, *Submission 21*, p. 2.

'intergenerational transfer' (from a mother to a foetus) of some of the chemicals that are absorbed onto the plastic or that are the constituent components of the plastics themselves, can occur.[79]

3.60 However, a number of witnesses commented that there 'is little known about the long-term consequences' of exposure to plastics and accumulated pollutants.[80] Dr Lavers commented that chemical pollution from plastic ingestion is 'still poorly understood' and noted that plastic 'acts as a vector for a whole suite of pollutants, everything from metals to PCBs [polychlorinated biphenyl]'.[81] Dr Lavers went on to explain that:

> …chemical pollution is much less visible and therefore much more difficult to monitor. I think we are, at this stage, really truly underestimating the true impact of the chemical pollution that is associated with plastics, that morbidity effect. They are not necessarily dying, but perhaps they are not living as long; they are not reproducing as frequently. All of those kinds of impacts are so likely to occur, but right now we just do not have the quantitative data to back some of those statements up.[82]

Effects of microplastics

3.61 Evidence indicated that microplastics are now distributed throughout the oceans, including remote areas, and, as discussed above, are ingested by marine animals.

3.62 There is increasing concern with the effects of microplastics which enter the marine environment. These concerns are not limited to the scientific community; the committee received submissions from many organisations and individuals which identified microplastics as a major issue. For example, Parks Victoria commented:

> A growing concern for park managers is the presence of microplastics and particularly plastic nurdles in many park locations across the state, including remote areas such as Wilsons Promontory…While the full impacts of these materials are not well understood they have potential to cause significant harm to feeding chicks, and being widely distributed in the environment pose a particular risk to seabird colonies.[83]

79 Dr Britta Denise Hardesty, CSIRO, *Committee Hansard*, 26 February 2016, p. 6.

80 Dr Mark Browne, and co-authors Professor Tony Underwood, Professor Gee Chapman, Professor Emma Johnston, *Submission 21*, p. 2. See also Professor Mark Osborne, *Submission 16*, p. 3; Humane Society International, *Submission 22*, p. 2.

81 Dr Jennifer Lavers, *Committee Hansard*, 18 February 2016, p. 17.

82 Dr Jennifer Lavers, *Committee Hansard*, 18 February 2016, p. 18.

83 Parks Victoria, *Submission 79*,

3.63 Birdlife Australia also provided extensive evidence of its concerns about the effects of microplastics on shorebirds. Dr Woehler commented:

> We know, full well, the complexity of marine food webs, and we know from the work on the invertebrate sampling that has been done around the world that many of the food species that are consumed by shorebirds in Australia have been shown to ingest plastics. So it is a reasonable hypothesis or prediction to make that these birds would also be susceptible to ingesting the plastic through their food.[84]

3.64 Despite these significant concerns, Dr Woehler stated that there was no research on the impacts of microplastics on shorebirds:

> We believed that we would find a substantial volume of scientific literature detailing the ingestion of microplastics by shorebirds—as coastal, intertidal feeders—around the world, particularly in Europe and North America. But, unfortunately, we were unable to locate a single scientific study from anywhere in the world. Such a gap is remarkable and highly significant. The absence of such studies reinforces that there is still much to learn from our environment, particularly the marine environment.[85]

3.65 Dr Woehler went on to comment that Birdlife Australia considered that 'ingested microplastics and the absorbed chemicals associated with them are an unrecognised threat to resident and migratory shorebirds in Australia and elsewhere around the world'.[86] Birdlife Australia requested that the Commonwealth support directed scientific research into the interactions between shorebirds and microplastics in Australia.[87]

3.66 Dr Kroon also provided evidence on research being funded by AIMS which focuses on microplastics in zooplankton samples which were collected in the Great Barrier Reef and off Scott Reef. Plastic particles and fibres have been found in these samples. As the samples date back to 1997, they can be used to assess the presence and abundance of microplastics over time in these regions. In addition, during a field campaign in November 2015, in north-west Australia, AIMS detected small plastic particles and fibres in remote marine environments, including the Kimberley region and offshore in the Browse and Bonaparte basins. Further work will be undertaken to better understand the abundance and distribution and, eventually, the sources and fates of these plastic particles in the remote regions.[88]

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84 Dr Eric Woehler, Birdlife Tasmania, 26 February 2016, p. 34.

85 Dr Eric Woehler, Birdlife Tasmania, *Committee Hansard*, 26 February 2016, p. 33.

86 Dr Eric Woehler, Birdlife Tasmania, *Committee Hansard*, 26 February 2016, p. 33.

87 Birdlife Australia, *Submission 76*, p. 14.

88 Dr Frederieke Kroon, Australian Institute of Marine Science, *Committee Hansard*, 10 March 2016, p. 15.

3.67 Dr Mark Browne provided the committee with a number of areas where further research in relation to microplastic pollution was required, including rates of accumulation, and whether population growth of organisms is being slowed. Dr Browne added in terms of the 'unknown consequences we could be underestimating that—and that is because of a failure to put adequate research dollars behind these types of things'.[89]

3.68 The committee notes that during the consultation meetings for the revised threat abatement plan, microplastics were identified as an emerging issue. The Department of the Environment indicated that it was generally considered that the impact of microplastics needs to be better understood.[90] The threat abatement plan is discussed in detail in Chapter 4.

Possible effects of microplastics on human health

3.69 Many submitters voiced concerns about the possible effects of microplastics on humans. In response, the committee noted recent research and also sought advice from the scientists who appeared to give evidence on whether the human consumption of seafood results in the ingestion of microplastics carried by marine fauna, and what impact this may have on human health.

3.70 Studies have concluded that humans may ingest microplastics through the consumption of seafood. A study conducted on Belgian mussels identified that approximately 300 plastic particles (or 1.5 µg) would be consumed in a 300 g serving of mussels.[91] Similarly, another study estimated that in a 100 g serving of oysters, 50 particles would be consumed.[92]

3.71 It is possible that intestinal uptake of microplastics may occur in humans following the ingestion of contaminated seafood, however this may depend on the size of the plastic particles. Dr Browne told the committee that there was once an assumption that ingested plastic would simply pass through the digestive system. However there is now 'abundant evidence that when…microplastics are inhaled or ingested they pass from the point of entry into the circulatory system'.[93]

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89 Dr Mark Browne, *Committee Hansard*, 18 February 2016, p. 7.

90 Mr Stephen Oxley, Department of the Environment, *Committee Hansard*, 26 February 2016, p. 12.

91 See Bouwmeester H, Hollman PCH, Peters RJB, 'Potential Health Impact of Environmentally Released Micro- and Nanoplastics in the Human Food Production Chain: Experiences from Nanotoxicology', *Environmental science and technology*, 49(15), 2015, pp. 8932–9847.

92 See Van Cauwenberghe L and Janssen CR, 'Microplastics in bivalves cultured for human consumption', *Environmental Pollution*, 193, 2014, pp. 65–70.

93 Dr Mark Browne, *Committee Hansard*, 18 February 2016, p. 6.

3.72 There is also evidence that once in the circulatory system, microplastics can be stored for a long time.[94] In humans, particles between 0.16 µm and 150 µm have been found to translocate through the intestinal wall, mainly through lymphatic tissue.[95] Dr Browne commented that medical research into drug delivery systems has shown that the smaller the particle, the greater the rates of transfer.[96] Dr Browne also explained that the effects of the movement of microplastics into the circulatory system of animals can include 'inflammation, fibrosis, breaks in DNA, sometimes mortality and sometimes reduction in feeding behaviour'.[97]

3.73 Further evidence was provided by Dr Hardesty who stated that laboratory experiments which involved fish being fed microplastic found there were 'cellular and tissue level disruptions'. Dr Hardesty explained that a 'difference in cell growth means a cancer'.[98] Though scientific research has identified that translocation of microplastics in humans can occur, there is no current data available on the associated toxicity of such translocation. Dr Hardesty noted that the effect of microplastic ingestion on human health is a difficult issue to understand and added:

> I would say that there is not definitive, peer-reviewed, published literature that can address each of those steps all the- way up through to, and including, human health. The reason for that is that you would need to do a whole series of controlled experiments to be able to state these things definitively, to some extent, and there are ethical considerations around doing such experiments.[99]

3.74 The committee also received evidence that chemicals accumulated on the surface of microplastics, and chemicals used in the production of plastic may cause adverse health effects in humans. As previously discussed, these chemicals include substances such as phthalates and bisphenol A (BPA). These chemicals are classified as endocrine disrupting compounds (EDCs), and the human health implications of such chemicals have been well established. Research has linked EDCs to cancer, male

94 Dr Mark Browne, and co-authors Professor Tony Underwood, Professor Gee Chapman, Professor Emma Johnston, *Submission 21*, p. 3.

95 See Hussain N, Jaitley V, and Florence AT, 'Recent advances in the understanding of uptake of microparticulates across the gastrointestinal lymphatics', *Advanced Drug Delivery Reviews*, 50, 2001, pp. 107–142 in Van Cauwenberghe L and Janssen CR, 'Microplastics in bivalves cultured for human consumption', *Environmental Pollution*, 193, 2014, pp. 65-70.

96 Dr Mark Browne, *Committee Hansard*, 18 February 2016, p. 11.

97 Dr Mark Browne, *Committee Hansard*, 18 February 2016, p. 6.

98 Dr Britta Denise Hardesty, CSIRO, *Committee Hansard*, 26 February 2016, p. 4.

99 Dr Britta Denise Hardesty, CSIRO, *Committee Hansard*, 26 February 2016, p. 3; see also Dr Mariann Lloyd-Smith, National Toxics Network, *Committee Hansard*, 10 March 2016, p. 10.

and female reproductive issues, adrenal and thyroid disorder, neurodevelopmental issues in children, and disrupted immune function.[100]

3.75 A number of chemicals used in fabrics such as fire retardants, and stain and water repellents such as perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) are also of concern.[101] These chemicals have suspected causal links to cancer; and affect thyroid function, reproductive health, and neurodevelopment.[102] These chemicals may affect both marine fauna, and subsequently humans, when microplastic fabric fibres are consumed in the marine environment.

3.76 It should again be noted, however, that research on the human health implications of ingesting marine fauna which have consumed these fibres has not been conducted.

Impact on fisheries and shipping

3.77 The committee received evidence that marine plastic pollution has an impact on fisheries and shipping sectors through ghost fishing, creating navigational hazards, and providing a transport medium for invasive species. However, evidence also noted that the impact is difficult to assess and quantify.

3.78 AIMS stated that plastic pollution such as abandoned, lost and otherwise discarded fishing gear (ALDFG) can affect the economic outcomes of fisheries. In particular, studies have found that abandoned fishing traps in coastal regions can cause a reduction in annual fisheries catches of up to 5 per cent.[103] AIMS explained that though the economic impacts of ALDFG can vary from fishery to fishery, it is estimated that it 'can result in annual losses of approximately $1M AUS in individual fisheries'.[104]

3.79 Research presented to the committee also indicated that floating plastic pollution may facilitate 'recruitment and survival' of species such as 'barnacles, bryozoans, seasquirts, hydrozoans, sponges and bivalves'. This may in turn allow for

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100 See Talsness CE, Andrade AJ, Kuriyama SN, Taylor JA, and vom Saal FS, 'Components of plastic: experimental studies in animals and relevance for human health', *Philosophical Transactions of the Royal Society of London B: Biological Sciences*, 364(1526), 2009, pp. 2079-2096; Eds. Bergman A, Heindel JJ, Jobling S, Kidd KA and Zoeller RT, *State of the science of endocrine disrupting chemicals 2012*, United Nations Environment Programme and the World Health Organization, 2013.

101 Dr Mariann Lloyd-Smith, National Toxics Network, *Committee Hansard*, 10 March 2016, p. 13.

102 See Talsness CE, Andrade AJ, Kuriyama SN, Taylor JA, and vom Saal FS, 'Components of plastic: experimental studies in animals and relevance for human health', *Philosophical Transactions of the Royal Society of London B: Biological Sciences*, 364(1526), 2009, pp. 2079-2096.

103 Australian Institute of Marine Science, *Submission 11*, p. 4.

104 Australian Institute of Marine Science, *Submission 11*, p. 4.

these species to be transported to, and then invade new ecosystems.[105] For example, the Northern Territory Seafood Council noted that in 2013, the Asian green mussel (an invasive marine pest), was found on a ghost net collected by Dhimurru Rangers on Bremer Island off Nhulunbuy.[106]

3.80 Invasive marine pests can lead to an increase in operating costs associated with biofouling on vessels and infrastructure. Invasive species also compete for space and resources with native species, and can affect aquaculture operations.[107] However, the submission from Dr Browne *et al.* particularly noted that while there are confirmed reports of species travelling on marine plastic pollution, 'there are no confirmed cases of the establishment of an invasive species through this vector alone'.[108]

3.81 It was noted by Vegter *et al.* that relatively few published articles have focused on rafting of introduced species on plastic debris. The researchers identified a need for additional research in how plastic pollution contributes to the transfer of non-native species was identified.[109]

3.82 The committee also received evidence that large abandoned ghost nets can pose a navigational hazard to fishing vessels and other shipping, when they are present in shipping lanes.[110]

3.83 The Northern Territory Seafood Council commented on the potential impact of microplastics on fisheries. The Council stated that there is potential for microplastics entering the food chain but there is currently little understanding of the impact on species that consume and accumulate microplastics, including humans. Of concern is the potential in the future to microplastic contamination 'to affect the reputation of NT seafood, currently marketed as coming from pristine remote waters'.[111]

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105 Dr Mark Browne, and co-authors Professor Tony Underwood, Professor Gee Chapman, Professor Emma Johnston, *Submission 21*, pp. 2–3.

106 Northern Territory Seafood Council, *Submission 63*, p. 3.

107 Northern Territory Seafood Council, *Submission 63*, p. 3.

108 Dr Mark Browne, and co-authors Professor Tony Underwood, Professor Gee Chapman, Professor Emma Johnston, *Submission 21*, pp. 2–3.

109 Vegter, AC, et al, 'Global research priorities to mitigate plastic pollution impacts on marine wildlife', *Endangered Species Research*, 25: 225–247, 2014 http://www.int-res.com/articles/esr_oa/n025p225.pdf

110 Northern Territory Seafood Council, *Submission 63*, p. 3. See also, Mr Toby Stone, Australian Maritime Safety Authority, *Committee Hansard*, 26 February 2016, p. 26.

111 Northern Territory Seafood Council, *Submission 63*, p. 3.

Impact of marine plastic on ecosystems

3.84 Marine ecosystems can be affected by marine plastic pollution through changes of habitat and species assemblages, dispersal of marine organisms, introduction of invasive species, and alteration of marine food webs. Damage to sessile fauna and loss of benthic faunal cover can be caused by pollution by marine plastic, such as fishing gear and household items. It has also been found that along tropical coastal shorelines, marine plastic pollution has caused significant differences in species assemblages of meiofauna, diatoms and macrofauna. Of particular concern is the potential for dispersal on marine plastic debris of pathogens and invasive species.[112]

3.85 Submitters pointed to concerns about the impact of marine plastic on the Great Barrier Reef and noted that the Great Barrier Reef Outlook Report 2014 and the Great Barrier Reef Long Term Sustainability Report 2015 have identified marine debris as a major threatening process to the long-term health and sustainability of the reef. The Outlook Report states that:

> Marine debris, including that delivered through land-based run-off, continues to affect the ecosystem and is of particular concern for species of conservation concern. Many of the Region's heritage values, including its outstanding universal value, are vulnerable to land-based run-off through its effects on the ecosystem. In addition, water quality declines and marine debris are likely to be diminishing the Region's natural beauty.[113]

3.86 AIMS has conducted a qualitative risk assessment of nine different categories of emerging contaminants, including marine plastic pollution, for the Great Barrier Reef and Torres Strait marine ecosystems. Dr Kroon, AIMS, commented that 'as far as the overall outcomes of the risk assessment are concerned, marine plastics and microplastics pose one of the highest risks, if not the highest, depending on the region, of all nine different categories of emerging contaminants assessed'.[114]

3.87 However, Dr Kroon commented that as the tropical marine environment across Northern Australia is such a large area, there is uncertainty about the abundance and distribution of marine plastics. While work has been undertaken in some areas, such as the Great Barrier Reef and the Gulf of Carpentaria, there is a lack of a general overview of the problem for the whole of Northern Australia and what the long-term effects on the marine ecosystems may be.[115]

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112 Australian Institute of Marine Science, *Submission 11*, p. 4.

113 Cited in Wildlife Preservation Society of Queensland, *Submission 5*, p. 3.

114 Dr Frederieke Kroon, Australian Institute of Marine Science, *Committee Hansard*, 10 March 2016, p. 15.

115 Dr Frederieke Kroon, Australian Institute of Marine Science, *Committee Hansard*, 10 March 2016, p. 18.

3.88 Other submitters also acknowledged that much remains to be learnt about the effects of marine plastic pollution on ecosystems. Dr Mark Browne *et al.* noted that there is little available research which has investigated whether plastic debris is actually impacting organisms at the population or species level. The submission went on to state:

> The consensus of these reviews is that (i) there is evidence of ecological impacts from plastic marine debris, but over the next 5–10 years the quantity and quality of research requires improvement to allow the risk and relative importance of ecological impacts of plastic marine debris to be determined with precision; (ii) sufficient evidence exists for decision-makers to begin to mitigate problematic plastic debris now, to avoid risk of irreversible harm...[116]

3.89 Similarly, Dr Kroon told the committee that:

> The difficulty with plastic is that it is so variable—there are so many different chemical compositions, particle sizes and shapes. It is not like a standard toxin, where you can compare the risk or toxicity across many different organisms. Marine plastic pollution ranges from microplastics to fishing nets. How do you compare the risk of one versus the other? That is one of the big research questions, one of the big knowledge gaps that we have. That would also progress us towards an answer as to what the ecological impacts of marine plastics are. We know that, for individual organisms, the ingestion of plastic material or entanglement in a fishing net can be detrimental or lethal. But at a population level, for most organisms or species, we do not have a good handle on what it means for population viability.[117]

Committee view

3.90 Marine plastic pollution is known to pose a serious threat to marine fauna. The committee accepts that the ingestion of, and entanglement in marine plastic pollution are known to cause death, and injuries including limb amputation, starvation, intestinal rupture, and scoliosis. The committee was concerned by the evidence that hundreds of species of fauna including birds, turtles, cetaceans, pinnipeds and corals have been negatively affected by ingestion and entanglement. The committee was also concerned by the statistics indicating that thousands of individual animals have died as a result of marine plastic pollution, particularly through entanglement with abandoned fishing gear.

3.91 However, the committee also accepts that there remain a number of key knowledge gaps in understanding the threat of marine plastic pollution. In particular, the effect at the population and ecosystem levels, and the threat posed by ingestion of

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116 Dr Mark Browne and co-authors Professor Tony Underwood, Professor Gee Chapman, Professor Emma Johnston, *Submission 21*, pp 4–5.

117 Dr Frederieke Kroon, Australian Institute of Marine Science, *Committee Hansard*, 10 March 2016, p. 16.

microplastics by marine fauna. In addition, there is concern that trophic transfer of microplastics may have a negative impact on human health through the consumption of contaminated seafood.

3.92 The committee is of the view that there is an urgent need for research to be conducted in order to remedy these knowledge gaps.

Chapter 4

Role of the Australian Government in addressing marine plastic pollution

4.1 The responsibility for addressing marine debris is shared between the Commonwealth, the states and territories. The Australian Government manages the threat of marine plastic pollution in a variety of ways, including:

- the protection of threatened species and ecosystems;
- the implementation of the international convention on at-sea disposal of rubbish; and
- the development and implementation of national waste management policies.

4.2 This chapter examines each of the mechanisms available to the Australian Government, the need to ensure that policy is supported by rigorous scientific research and the Australian Government's role in providing leadership in addressing the threat of marine plastic across federal, and state and territory jurisdictions as well as internationally.

Protection of threatened species and ecosystems

4.3 The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a framework for the management of threats to species and ecosystems by providing for the listing of key threatening processes and the development of threat abatement and recovery plans.[1]

4.4 Key threatening processes are those that threaten the survival, abundance or evolutionary development of a native species or ecological community. The key threatening process—*Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris*—was listed under the EPBC Act in 2003.[2] Once a threatening process is listed under the EPBC Act, a threat abatement plan can be put into place if the Minister for the Environment decides that it is 'a feasible, effective and efficient way' to abate the threatening process.[3]

4.5 The *Threat Abatement Plan for the impacts of marine debris on vertebrate marine life* (TAP) was developed in response to the key threatening process listing, and released in May 2009. The plan aims to provide a national, coordinated approach to the implementation of measures for prevention and mitigation of the harmful impacts of marine debris.

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1 Department of the Environment, *Submission 18*, p. 2.

2 Department of the Environment, *Submission 18*, p. 2.

3 Section 270A(2). See also Department of the Environment, *Submission 18*, p. 2.

4.6 To achieve this aim, the TAP provides a framework for implementing measures with four key objectives:

- contribute to the long-term prevention of the incidence of harmful marine debris;
- remove existing harmful marine debris from the marine environment;
- monitor the quantities, origins and impacts of marine debris and assess the effectiveness of management arrangements over time for the strategic reduction in marine debris; and
- mitigate the impacts of harmful marine debris on marine species and ecological communities.[4]

4.7 In order to achieve these four objectives, the TAP identifies six key 'approaches' for both the Commonwealth, and state and territory governments. These include:

- improving waste management practices on land and at sea;
- raising public awareness and improving education campaigns about the prevention of littering on land and at sea;
- building and strengthening international collaboration;
- developing a national approach to information collection and management;
- improving the understanding of the origins of harmful marine debris; and
- facilitating the implementation of wildlife research and recovery plans.[5]

4.8 For each approach a set of actions are listed which 'seek to build on existing initiatives and strengthen coordination and partnerships to prevent, remove, mitigate and monitor marine debris'.[6]

4.9 The TAP lists species which are negatively affected by ingestion of, or entanglement in, harmful marine debris. This list includes over 25 vulnerable and endangered species of turtles, cetaceans, sharks, birds, dugongs and pinnipeds.[7]

4.10 The Minister for the Environment may make or adopt and implement recovery plans for listed threatened and endangered species and ecological

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4 Department of the Environment, Waters, Heritage and the Arts, *Threat Abatement Plan for the impacts of marine debris on vertebrate marine life*, May 2009, p. 2.

5 Department of the Environment, Waters, Heritage and the Arts, *Threat Abatement Plan for the impacts of marine debris on vertebrate marine life*, May 2009, pp. 3–8.

6 Department of the Environment, Waters, Heritage and the Arts, *Threat Abatement Plan for the impacts of marine debris on vertebrate marine life*, May 2009, p. 2.

7 Department of the Environment, Waters, Heritage and the Arts, *Threat Abatement Plan for the impacts of marine debris on vertebrate marine life*, May 2009, Appendix A.

communities. Recovery plans set out the research and management practices required to prevent the decline of, and support the recovery of species.

4.11 A number of recovery plans related to the threat of marine plastic pollution have been developed. These include the *Recovery Plan for Marine Turtles in Australia* (2003), *The Sub-Antarctic fur seal and southern elephant seal recovery plan* (2004–2009) and the *National Recovery Plan for threatened albatrosses and giant petrels*.[8]

Review of the Threat Abatement Plan

4.12 The EPBC Act requires a threat abatement plan to be reviewed by the Minister at intervals of not longer than five years. The TAP was made in May 2009, and reviewed in 2014.

4.13 The purpose of the five-year review is to assess the progress and effectiveness of the TAP in preventing and mitigating the impacts of harmful marine debris on vertebrate marine life. The review also compares the problem of marine debris across Australia to when the TAP was initiated, and identifies successes and failures of the plan in guiding and facilitating action. It identifies threat abatement actions funded by the Australian Government as well as work undertaken by state and territory governments, community and other organisations.[9]

4.14 The 2014 TAP Review concluded that 'despite progress particularly in cleanup efforts, it is not possible to state that these criteria have been met during the life of the plan'.[10] In particular:

> …there had not been a general decline in the presence and extent of harmful marine debris in Australia's marine environment, and there had not been a general decline in the number of marine vertebrates dying and being injured as a result of ingestion and/or entanglement in harmful marine debris…[11]

4.15 The TAP Review concluded that 'the key threatening process…has not been abated and that the objectives of the threat abatement plan have not been met'.[12] As a

8 Department of the Environment, *Submission 18*, pp. 2–3.

9 Department of the Environment, *Threat Abatement Plan for the impacts of marine debris on vertebrate marine life Review 2009–2014*, p. 4.

10 Department of the Environment, *Threat Abatement Plan for the impacts of marine debris on vertebrate marine life Review 2009–2014*, p. 32; see also Mr Stephen Oxley, Department of the Environment, *Committee Hansard*, 26 February 2016, p. 11; Mr Paul Murphy, Department of the Environment, *Committee Hansard*, 26 February 2016, p. 13.

11 Mr Stephen Oxley, Department of the Environment, *Committee Hansard*, 26 February 2016, p. 11.

12 Department of the Environment, *Threat Abatement Plan for the impacts of marine debris on vertebrate marine life Review 2009–2014*, p. 32.

result of the TAP Review, the Minister for the Environment, the Hon Greg Hunt MP, decided to revise the plan.[13]

Development of revised Threat Abatement Plan

4.16 The revised TAP is currently in preparation and is expected to be considered by the Threatened Species Scientific Committee in June 2016.[14] Following approval from the Threatened Species Scientific Committee, the draft will be released for a three-month public consultation period.

4.17 As part of the development of the revised TAP, the Department of the Environment (the department) held a workshop seeking expert advice in developing a revised TAP. This workshop included government agencies, researchers, and community and industry groups. Key pieces of advice for government generated through the workshop included:

- preventing deliberately produced microplastics such as nurdles and microbeads from entering the marine environment;
- developing a better understanding of the threat posed by microplastics;
- directing resources to the identification and reduction of the sources of marine debris in Australian waters such as ghost nets;
- improving methods for the disposal of the large amounts of plastic pollution found on remote Northern Australian beaches;
- developing new technologies, such as waste-to-energy systems, for the reduction of the volume of marine pollution; and
- developing strategies in partnership with industry to identify and reduce waste at the source.[15]

4.18 The department acknowledged the level of concern around microplastic pollution and its impact. It noted that when the original TAP was created, microplastics were not included. However, as a result of the workshop, Mr Stephen Oxley, First Assistant Secretary, Wildlife Trade and Biosecurity Branch, Department of the Environment, commented that the new TAP will 'address the emerging issues of microplastics and associated chemical contamination' as it has been acknowledged

13 Department of the Environment, *Submission 18*, p. 2.

14 Mr Stephen Oxley, Department of the Environment, *Committee Hansard,* 26 February 2016, p. 11.

15 Mr Stephen Oxley, Department of the Environment, *Committee Hansard,* 26 February 2016, p. 12.

that these 'are very important'.[16] Mr Oxley went on to comment that 'plastics will be a key theme in the threat abatement plan'.[17]

Criticism of the EPBC Act and the Threat Abatement Plan

4.19 During the inquiry, the committee received evidence which pointed to concerns with both the EPBC Act and the TAP to address the growing problem of marine plastic pollution. These concerns grew out of the recognition of the complexity and cross-jurisdictional issues of marine plastic pollution; the wide-spread nature of the pollution; the physical attributes of plastics, particularly microplastics; and the lack of action on the implementation of the approaches listed in the TAP.

4.20 EDOs of Australia, for example, commented that 'overall, the EPBC Act alone is not sufficient to regulate marine plastics, as the main sources of pollution originate with plastic production and disposal, which are chiefly within the jurisdictions of state laws'.[18] Mr Nari Sahukar from EDOs of Australia, explained further that 'the EPBC Act currently does not address those land-based sources of plastics pollution where there appears to be this regulatory gap'. He went on to question whether this was an issue that required amendment of the EPBC Act or the implementation of improved coordination of state government efforts 'to amend their pollution laws and look at how existing pollution law tools could be adapted to the new threat of plastic'.[19]

4.21 The National Environmental Law Association (NELA) also criticised the limited scope and ability of the EPBC Act and the TAP to mitigate the threat from marine plastic pollution. Dr Sarah Waddell, NELA, described the EPBC Act as 'a limited framework for viewing marine plastic pollution' which does not address the impact on non-vertebrate species, or species which are not listed as threatened or endangered.[20] Dr Waddell particularly highlighted that the effect of:

> …marine plastic pollution goes way beyond just the impact on listed species, because it is impacting on all species within the marine environment, and the actual listing of the species itself is also a fairly limited process. For example, as a trigger for the TAP we had 29 vertebrate species that were listed, but we know from the submissions that have been

16 Mr Stephen Oxley, Department of the Environment, *Committee Hansard,* 26 February 2016, p. 11.

17 Mr Stephen Oxley, Department of the Environment, *Committee Hansard,* 26 February 2016, p. 15.

18 EDOs of Australia, *Submission 74*, p. 7.

19 Mr Nari Sahukar, EDOs of Australia, *Committee Hansard*, 18 February 2016, p. 67.

20 Dr Sarah Waddell, National Environmental Law Association, *Committee Hansard*, 18 February 2016, pp. 25–26.

> made by the scientists that marine plastic pollution is having an impact on far more than 29 specifically listed species.[21]

4.22 This view was also supported by Dr Jennifer Lavers who expressed frustration that unless a species is listed as threatened or endangered, the TAP does not apply. Dr Lavers told the committee that:

> One of the things that I find incredibly frustrating and telling, I guess, about the threat abatement plan is that flesh-footed shearwaters in Australia are like the iconic poster child of the impacts of plastic pollution, yet they do not even get or render a single mention in the threat abatement plan.[22]

4.23 A further example of the limitation of the scope of the TAP was cited by the Adelaide and Mount Lofty Ranges Natural Resource Management Board. In 2013, a report on impacts and threat abatement of marine debris within the Gulf St Vincent recommended that the TAP be updated as there was scientific evidence suggesting that the compounding effects of marine debris impacts across all trophic levels and ecological communities.[23]

4.24 As well as being limited in scope, the lack of action taken under the TAP was also criticised by some witnesses. Dr Waddell commented that the TAP 'provides some good bones for addressing this problem, but in itself it is not sufficient'. Further, 'the inadequacy of the implementation of that plan means that the problem is not being sufficiently addressed'.[24]

4.25 Mr Sahukar suggested that the lack of action to progress the TAP was partly due to the TAP not being properly resourced or properly followed through. However, he added that the limitations on what the EPBC Act requires have contributed to the lack of progress under the TAP. Dr Sahukar noted that:

> There is the listing process for key threatening processes and there is the ability to make those threat abatement plans and to ensure that they are in force and to report on their progress, but we do not really have hard and fast commitments or requirements in the act to implement the actions in those plans. Even if you did, you would need to address that interface between state and federal assessments given that, as we have said, it is at the state development assessment and pollution control level that a lot of these smaller impacts are being created.[25]

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21 Dr Sarah Waddell, National Environmental Law Association, *Committee Hansard*, 18 February 2016, pp. 28.

22 Dr Jennifer Lavers, *Committee Hansard*, 18 February 2016, p. 18.

23 Adelaide and Mount Lofty Ranges Natural Resource Management Board, *Submission 20*, p. 7.

24 Dr Sarah Waddell, National Environmental Law Association, *Committee Hansard*, 18 February 2016, p. 27.

25 Mr Nari Sahukar, EDOs of Australia, *Committee Hansard*, 18 February 2016, p. 67.

4.26 The lack of action with progress of the TAP produced a degree of frustration with submitters. For example, Mr Jeff Angel from the Total Environment Centre commented that there was no expectation that the TAP will lead to substantial action, and he was particularly critical of the actions of the department:

> Clearly, they seem to be satisfied with having produced the threat abatement plan as evidence of doing something, but the actions under that plan were either not implemented or meaningless.[26]

4.27 Ms Heidi Taylor, Tangaroa Blue Foundation, also expressed her frustration that there is 'too much talking while marine debris and more garbage keeps washing into the ocean' and that this includes 'discussions revolving around the threat abatement plan'.[27]

4.28 However, the Department of the Environment reminded the committee that the TAP is a 'guide' rather than an 'implementation plan'. Mr Oxley explained that:

> The plan identifies priorities for research and management, and helps guide, at the national level, all the researchers and management actions.[28]

Lack of consultation

4.29 The committee sought evidence from witnesses as to whether the department had consulted key academics and community organisations currently engaged in research, clean-up activities, and marine fauna rescue and rehabilitation, during the development of the revised TAP. The committee was concerned by the apparent lack of engagement with some interested stakeholders. For example, the Boomerang Alliance told the committee that 34 of 40 of its member organisations were not consulted regarding the development of the TAP.[29] In addition, neither the Boomerang Alliance nor the Total Environment Centre were consulted during the development of the revised TAP.[30]

4.30 Similarly, Ms Kathrina Southwell from the Australian Seabird Rescue which conducts marine fauna rescue and rehabilitation services, stated that she was consulted during the development of the original TAP, but has not been consulted since.[31]

4.31 The lack of engagement with academics engaged in research on marine plastic pollution was also of concern. Dr Frederieke Kroon, Principal Research Scientist from AIMS, informed the committee that she was recently invited to present her research

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26 Mr Jeff Angel, Total Environment Centre, *Committee Hansard*, 18 February 2016, p. 56.

27 Ms Heidi Taylor, Tangaroa Blue Foundation, *Committee Hansard*, 10 March 2016, p. 28.

28 Mr Stephen Oxley, Department of the Environment, *Committee Hansard*, 26 February 2016, p. 17.

29 Mr Dave West, Boomerang Alliance, *Committee Hansard*, 18 February 2016, p. 56.

30 Mr Jeff Angel, Total Environment Centre, *Committee Hansard*, 18 February 2016, p. 56.

31 Ms Kathrina Southwell, Australian Seabird Rescue, *Committee Hansard*, 10 March 2016, p. 25.

findings to the department, but that she had not been previously aware that the TAP was being revised. Dr Kroon told the committee that she had initiated contact with the department 'to make sure that the research that we are conducting will inform policies put in place'.[32]

4.32 Similarly, Dr Mark Browne told the committee that although he is 'involved with the threat abatement plan, but we have not really progressed beyond the meeting stage'.[33]

4.33 During the conduct of the inquiry, the committee received evidence from local government representatives on their commitment to preventing the movement of plastic pollution into the marine environment. This commitment includes significant expenditure on infrastructure such as gross pollutant traps in stormwater systems, and clean-up programs. The department indicated that the Australian Local Government Association had been invited to participate in the workshop, but did not do so. The Australian Local Government Association has been involved in subsequent discussions with the department.[34]

Need for research-based policy

4.34 As previously discussed, the committee heard from a range of witnesses that there is a need to undertake research to better understand the sources and effects of marine plastic pollution, particularly microplastics, on marine fauna and ecosystems. In addition, it was stated that further research is required to identify effective mitigation and prevention strategies to stop plastic debris from entering the marine environment. However, it was argued that there is a lack of a coordinated approach to research, or sufficient funding of research. The committee considers that, without the necessary research, it is difficult to ensure that policy development is based on the best available evidence.

4.35 The following discussion canvasses the research elements of the TAP and concerns raised about the adequacy of the research of marine plastic pollution and its impacts.

4.36 The TAP states that the information and framework provided is intended to promote collaboration between groups such as researchers, industry, coastal managers, governments and polluters, and 'provide direction for research and management to address the key threatening process'.[35] The department added that 'the plan identifies

32 Dr Frederieke Kroon, Australian Institute of Marine Science, *Committee Hansard*, 10 March 2016, p. 20.

33 Dr Mark Browne, *Committee Hansard*, 18 February 2016, p. 5.

34 Department of the Environment, Answer to question on notice No. 1, 26 February 2016 (received 4 April 2016).

35 Department of the Environment, Waters, Heritage and the Arts, *Threat Abatement Plan for the impacts of marine debris on vertebrate marine life*, May 2009, p. 1.

the priorities for research and management, and helps guide, at the national level, all the researchers and management actions'.[36]

4.37 For example, Action 3.3 required:

> DEWHA [Department of the Environment, Water, Heritage and the Arts] to support research on the nature of degradation pathways of synthetic debris in the marine environment (including biodegradable and oxodegradable plastics), the extent that degradation products are contaminated by other potentially toxic compounds, and the potential toxicity of debris types on marine species. For example: DEWHA to support monitoring of the incidence of hatching failure due to eggshell thinning (linked with the Recovery plan for albatrosses and giant petrels).[37]

4.38 However, the TAP review found that the department has not supported specific research on the nature of degradation pathways of synthetic debris in the marine environment. The review added that, over the life of the TAP, a better understanding of this issue has developed internationally.[38] Similarly, Action 2.3 which required the development of marine debris monitoring sites, was found not to have been implemented.[39]

4.39 In addition, no specific funding mechanism for research was contained in the TAP. However, the department noted that researchers can use the priorities set out in the TAP to apply for funding for research project under other government programs and institutional schemes.[40]

4.40 The committee was also provided with the list of five research projects into marine debris funded by the department since the key threatening process was listed under the EPBC Act in 2003. These are listed in Table 4.1 below.

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36 Mr Paul Murphy, Department of the Environment, *Committee Hansard*, 26 February 2016, p. 17.

37 Department of the Environment, Waters, Heritage and the Arts, *Threat Abatement Plan for the impacts of marine debris on vertebrate marine life*, May 2009, p. 7.

38 Department of the Environment, *Threat abatement plan for the impacts of marine debris on vertebrate marine life Review 2009–2014*, p. 27.

39 Department of the Environment, *Threat abatement plan for the impacts of marine debris on vertebrate marine life Review 2009–2014*, p. 22.

40 Mr Paul Murphy, Department of the Environment, *Committee Hansard*, 26 February 2016, p. 17.

Table 4.1: Research projects into marine debris funded by the Department of the Environment since 2003

Project	Cost
Marine Debris in the Northern Australian Waters (WWF) – April 2005	$11,000
Pilot investigation of the origins and pathways of marine debris found in the northern Australian marine environment (CSIRO)	$55,000
Research on the impact of marine debris on marine turtle survival and behaviour: North east Arnhem Land, Northern Territory (Dhimurru Aboriginal Corporation) – April 2009	$116,300
Impacts of plastic debris on Australian marine wildlife (C&R Consulting) – June 2009	$25,000
Understanding the types, sources and at-sea distribution of marine debris in Australian waters (CSIRO) – 2011	$77,000

Source: Department of the Environment, Answer to question on notice No. 2, 26 February 2016

4.41 In evidence, the committee received a range of views on the gaps in research regarding marine plastic pollution with much evidence pointing to specific research needs. However, a number of academics cautioned against funding scientific research without rigorous assessment of its usefulness, and integrity of its scientific method. Academics stated that government should balance the need for further research to be undertaken with the need for urgent action to reduce sources of marine plastic pollution.

4.42 The committee also heard evidence that the research that currently exists may not assist policymakers in making informed decisions in relation to the TAP. Dr Britta Denise Hardesty from the CSIRO told the committee that:

> There are numerous issues and specifics where we could provide real value to the government in terms of helping to inform some of these things. The government really wants to know what the best bang for the buck is. That is a really important and valid question. My role or job as a scientist is to collect and provide that information, but I cannot just pull something out of the sky.[41]

4.43 Professor Tony Underwood told the committee that though there has been considerable research conducted in the past ten years on the topic of marine plastic pollution, there is little 'good research' available and that 'there is not nearly enough that is helpful for coming to any decisions'.[42] Professor Underwood explained that one

41 Dr Britta Denise Hardesty, CSIRO, *Committee Hansard*, 26 February 2016, p. 7.

42 Professor Tony Underwood, *Committee Hansard*, 18 February 2016, p. 3; see also p. 23.

of the difficulties in utilising scientific research in driving policy decisions is that studies are often impossible to compare as they utilise different methodologies and have differing aims.[43] Professor Underwood particularly encouraged policymakers to allocate funding specifically to conducting research on policy proposals. Professor Underwood stated that government 'should require some information about the effectiveness of policy rather than just making it'.[44]

4.44 However, Dr Hardesty challenged the assumption that there is a need for more information before developing policy. Dr Hardesty stated:

> With the ocean plastic pollution issue, as with many environmental issues, I think that operating under the precautionary principle is a reasonable principle to take. I do not think we want to wait until we know unequivocally and, even as a scientist, I do not think we want to see say, 'We need to wait and do more research,' and do more and more research.' We know a lot. We know enough to be able to make good, informed recommendations and management decisions. We know that we find fewer plastic bags on coastlines during clean-ups when you move away from urban centres. We know that we find fewer beverage containers when you are picking up litter—not just on the coastline but around the states and territories—when you are in South Australia. We know some of these things. We have good information.[45]

4.45 The lack of funding for research into marine plastic pollution, and the subsequent lack of understanding of its impacts was highlighted by a number of witnesses. For example, Dr Lavers told the committee that:

> Research and, particularly, conservation based research is chronically underfunded…Our understanding of the complex issues, including things like chemical pollution, is so incredibly poor. We really are just starting at the basic level, and yet there is no funding for this research. How do we begin to even grasp the complexities of the problem, never mind come up with mitigation strategies for the problem, if there is no funding to even get us off the ground? We need funding on par with things like climate change and sea level rise, because that is the challenge that we are facing. It needs to be put in that same tier.[46]

4.46 Similarly, Dr Browne told the committee that:

> If you are going to be making decisions based on proof of harm and you are not developing research programs to adequately define harm, then it is a pretty difficult situation.[47]

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43 Professor Tony Underwood, *Committee Hansard*, 18 February 2016, p. 8.

44 Professor Tony Underwood, *Committee Hansard*, 18 February 2016, p. 8.

45 Dr Britta Denise Hardesty, CSIRO, *Committee Hansard*, 26 February 2016, p. 10.

46 Dr Jennifer Lavers, *Committee Hansard*, 18 February 2016, p. 19.

47 Dr Mark Browne, *Committee Hansard*, 18 February 2016, p. 19.

4.47 A number of witnesses informed the committee that very little of the research they conduct on marine plastic pollution is funded by the Australian Government. For example, Dr Lavers told the committee that her research is largely funded through philanthropy with some grants from not-for-profit organisations[48], while Mr Ian Hutton explained that he funds his own research through his private business and occasional small grants from the Lord Howe Island Board.[49] Professor Stephen Smith commented that the majority of his funding was provided through New South Wales government agencies, and in-kind funding from the Earthwatch Institute.[50]

4.48 Dr Browne explained that he recently received funding from the Australian Research Council to examine the biomagnification of microplastics in the food web. Funding of approximately $500,000 was received and Dr Browne noted that this had only been granted after three previous applications were made. Dr Browne told the committee that:

> The previous times we were told it was not an important issue and that therefore it would not be funded.[51]

4.49 In addition, the committee notes that the Minister for the Environment, the Hon Greg Hunt MP, announced on 29 February 2016 that $60,000 will be committed to 'kick-start urgent research into the best way to reduce plastic pollution'.[52] This funding will be provided under the National Environmental Science Programme's (NESP) emerging priorities stream, and will investigate the key sources of marine plastic, and the most cost-effective options for reduction. The NESP Marine Biodiversty Hub will conduct this research in collaboration with the Tropical Water Quality Hub, and other research partners.

4.50 Dr Lavers noted that the United States has had, for many years, a targeted marine debris funding scheme so that researchers US-wide can apply specifically for that funding round. As a consequence a significant amount of research in marine debris is being undertaken by US researchers.[53]

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48 Dr Jennifer Lavers, *Committee Hansard*, 18 February 2016, p. 4.

49 Mr Ian Hutton, *Committee Hansard*, 18 February 2016, p. 4.

50 Professor Stephen Smith, *Committee Hansard*, 18 February 2016, p. 4.

51 Dr Mark Browne, *Committee Hansard*, 18 February 2016, p. 4.

52 Department of the Environment, *Australia's Marine Environment To Benefit from Plastic Waste Research*, 29 February 2016, http://www.greghunt.com.au/Home/LatestNews/tabid/133/ID/3670/Australias-marine-environment-to-benefit-from-plastic-waste-research.aspx, (accessed 11 March 2016).

53 Dr Jennifer Lavers, *Committee Hansard*, 18 February 2016, p. 16.

National marine debris database

4.51 In developing informed policy to mitigate the threat of marine plastic pollution, it is crucial to understand the rates, and types of plastic pollution. It is also important to identify the factors which influence rates of pollution, and pollution pathways. Data collection has been carried out by a variety of organisations, supported by government, industry and the non-government sector. These include the Australian Marine Debris Initiative and a coastal survey conducted by the CSIRO which were discussed during the course of the inquiry. However, the committee received evidence that significant differences exist in the methodologies utilised by these projects, and the subsequent ability to compare data may be limited.

4.52 The Tangaroa Blue Foundation, a registered charity established in 2004 coordinates the Australian Marine Debris Initiative (AMDI). The AMDI is a 'national network of volunteers, communities, schools, Indigenous rangers, industry groups and government agencies working on both removal and mitigation of marine debris from marine, coastal and estuarine environments'. Ms Taylor explained that, to date, more than 5.4 million marine debris items have been entered into the AMDI database with the assistance of 902 partner organisations.[54]

4.53 Ms Taylor stated that national consistency in recording data on marine plastic pollution, and the ability to provide a more comprehensive overview of the issue were the primary goals driving the development of the AMDI. Ms Taylor told the committee that:

> … there were a lot of community groups collecting very small datasets, and we wanted them not only to be able to utilise a system where they could get everything that they needed but also to be able to add that to the bigger-picture stuff, which is things like CDL [container deposit legislation] discussions and plastic bag bans, where you need stuff at a regional, state and national level to be able to have those discussions.[55]

4.54 Tangaroa Blue consults with government agencies and James Cook University to develop and maintain the AMDI.[56] Since its inception, the AMDI has evolved to include items such as plastic fragments and foam, which were not initially included. The AMDI currently contains 140 categories. The datasheet utilised by volunteers to record plastic debris only includes the 10 most common categories, however additional information can still be recorded and entered into the database.[57]

4.55 One of the features of the AMDI is the timeframe of some of its datasets: in Western Australia, the AMDI has maintained datasets since 2005, and in the Port

54 Ms Heidi Taylor, Tangaroa Blue Foundation, *Committee Hansard*, 10 March 2016, p. 28.

55 Ms Heidi Taylor, Tangaroa Blue Foundation, *Committee Hansard*, 10 March 2016, p. 31.

56 Ms Heidi Taylor, Tangaroa Blue Foundation, *Committee Hansard*, 10 March 2016, p. 30.

57 Ms Heidi Taylor, Tangaroa Blue Foundation, *Committee Hansard*, 10 March 2016, pp. 29–30.

Douglas area in Far North Queensland, data has been collected since 2007–08. Ms Taylor explained that in these areas, stretches of coastline are monitored monthly, however in more remote locations, monitoring occurs at three monthly intervals, or annually. It was explained to the committee that in addition to regular monitoring sites maintained by the Tangaroa Blue Foundation, individuals may 'adopt' sections of coastline and enter data on an ad hoc basis as they undertake clean-up activities.[58]

4.56 The AMDI, as a nationally consistent database, allows for the interrogation and comparison of data across sites. It also allows for the identification of sources of marine plastic pollution.[59] This was noted by the Australian Maritime Safety Authority (AMSA) which commented that it cooperates with the Tangaroa Blue Foundation to identify the origins of materials found. AMSA described the Foundation as 'adept at identifying the countries, at least where the [plastic] product was produced'.[60] AMSA added that:

> Information collected by Tangaroa Blue in the Australian Marine Debris Initiative database can also assist in the longer term identification of trends and the overall efficacy of the MARPOL Annex V regulations. This information can assist Australia in discussions in the international context and assist in ensuring the effective implementation of MARPOL Annex V both in Australian waters and in the region.[61]

4.57 The committee noted that in addition to the AMDI, other data collection programs have also been developed and implemented. The CSIRO submitted that it 'carried out a national coastal marine debris survey at sites approximately every 100km along the Australian coastline'.[62] The CSIRO told the committee that it also:

> …developed a public, online, national marine debris database. Here, members of the public can contribute data they collect about local beach litter, following our simple methodology that is freely available online.[63]

4.58 The CSIRO not only examined pollution in coastal areas but:

> …implemented a marine debris sampling program throughout Australia's exclusive economic zone, with samples approximately every 80 nautical miles surrounding the continent. This sampling program was implemented based on a statistically robust design to control variation in sampling conditions, along with local and regional heterogeneity. These data have

58 Ms Heidi Taylor, Tangaroa Blue Foundation, *Committee Hansard*, 10 March 2016, p. 32.

59 Ms Heidi Taylor, Tangaroa Blue Foundation, *Committee Hansard*, 10 March 2016, p. 31.

60 Mr Matt Johnston, Australian Maritime Safety Authority, *Committee Hansard*, 26 February 2016, p. 25.

61 Australian Maritime Safety Authority, *Submission 68*, p. 4.

62 CSIRO, *Submission 7*, Appendix 2, 'Executive Summary "Understanding the effects of marine debris on wildlife: Final report to Earthwatch Australia"', p. 9.

63 CSIRO, *Submission 7*, Appendix 2, 'Executive Summary "Understanding the effects of marine debris on wildlife: Final report to Earthwatch Australia"', p. 10.

> been integrated with other data from around the globe to form a coherent dataset covering all the major oceans, comprised of more than 13,000 samples from multiple researchers. Additional samples are being added to the database as they become available. CSIRO developed a set of statistical tools to standardize the data and create maps of debris densities at the regional, national, and international scale.[64]

4.59 Dr Hardesty described the national marine debris survey as being different from other clean-up activities in that it was:

> …aiming at doing a rigorous, reputable survey method around the entire continent. We were looking at material types. We did not look at things the way they do on the clean-ups, such as how many bottle caps or lids. We were looking at plastics and thin film-like plastics. We had some particular categories such as cigarette butts and things like that. But typically it was hard plastic and soft plastic and film-like plastic, and ropes and twines, which also are plastic—and those sorts of categories.[65]

4.60 While the AMDI and the CSIRO have provided significant insight into marine debris, it was argued that a national database for marine pollution monitoring reporting was required.[66] For example, the Australian Seabird Rescue told the committee that:

> …it is really important to be able to keep gathering all of that information and to continue doing that for years and years so that we have that research in place to see where all of the rubbish is coming from and what beaches it is washing up onto.[67]

4.61 Similarly, Ms Leah Page, a post-graduate researcher at the University of Tasmania, submitted:

> A national database for marine debris monitoring and reporting would facilitate the involvement of the community; coordinate and standardise data collection and processing; and thereby enable more powerful interrogation of datasets. Consistent data collection and reporting would also help Australia meet international reporting requirements and facilitate participation in regional initiatives.[68]

4.62 Ms Taylor acknowledged that, despite the need for a nationally consistent marine debris database, the differing work aims of research organisations should still be supported. In particular, databases need to be suited to the work being undertaken. Ms Taylor told the committee that though the CSIRO's debris survey differed from the

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64 CSIRO, *Submission 7*, Appendix 3, 'Input to Department of Environment Threat Abatement Plan', p. 18.

65 Dr Britta Denise Hardesty, CSIRO, *Committee Hansard*, 26 February 2016, p. 5.

66 Adelaide and Mount Lofty Ranges Natural Resource Management Board, *Submission 20*, p. 5.

67 Ms Kathrina Southwell, Australian Seabird Rescue, *Committee Hansard*, 10 March 2016, p. 23.

68 Ms Leah Page, *Submission 51*, p. 3.

AMDI, it was designed to examine ingestion impacts rather than sources.[69] Similarly, Ms Page told the committee that while 'coordination has benefits' it 'should not come at the cost of disempowering existing networks'.[70]

4.63 The need for coordination and cooperation was also acknowledged by the CSIRO which submitted that during the course of the national marine debris survey, it:

> …also engaged with existing initiatives such as Clean Up Australia, Tangaroa Blue and Surf Rider Foundation, as well as other remarkable NGOs and state based organizations that are cleaning up Australia's beaches. Together, all of these organisations and citizen scientists contribute to the improved understanding of the types, amounts and sources of debris that arrives on Australia's coastline.[71]

4.64 The value of a national database has been recognised and the Tangaroa Blue Foundation has received funding from the Australian Government to support upgrades to the AMDI.[72]

National waste policy

4.65 The department noted that waste management in Australia is primarily the responsibility of states and territories, and the role of the Australian Government has been, and is, to ensure that Australia meets its obligations to a number of international agreements through measures implemented by the Commonwealth or the states and territories.[73]

4.66 Both the Commonwealth and state and territory governments have addressed the issue of waste policy. For example, in 2009, Australia's environment ministers released the *National Waste Policy: Less waste, more resources* which set an agenda for a nationally coordinated approach to waste management and resource recovery. Regular reporting occurs in order to measure resource recovery, recycling and waste management in each jurisdiction.

4.67 Further, arising out of the Intergovernmental Agreement on the Environment endorsed by the Council of Australian Governments (COAG) in May 1992, the National Environment Protection Council (NEPC) was established under the *National Environment Protection Council Act 1994* (Cth), and mirror legislation was passed in state and territory jurisdictions. It has two primary functions under these Acts—to

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69 Ms Heidi Taylor, Tangaroa Blue Foundation, *Committee Hansard*, 10 March 2016, p. 31.

70 Ms Leah Page, *Submission 51*, pp. 3–4.

71 CSIRO, *Submission 7*, Appendix 2, 'Executive Summary "Understanding the effects of marine debris on wildlife: Final report to Earthwatch Australia"', p. 10.

72 Ms Heidi Taylor, Tangaroa Blue Foundation, *Committee Hansard*, 10 March 2016, p. 31.

73 Mr Stephen Oxley, Department of the Environment, *Committee Hansard*, 26 February 2016, p. 12.

make National Environment Protection Measures (NEPMs), and to assess and report on the implementation and effectives of NEPMs.[74]

4.68 NEPMs are a set of national objectives designed to assist in protecting or managing particular aspects of the environment. In 1998, the NEPM was made in relation to used packaging. In 2011, Ministers endorsed the National Environment Protection (Used Packaging Materials) Measure 2011 which incorporated previous iterations, and included the Australian Packaging Covenant (APC). The APC is the third iteration of the previously named National Packaging Covenant which had been a key instrument in managing the environmental impacts of packaging since 1999.[75]

4.69 The Used Packaging Materials NEPM is intended to reduce environmental degradation resulting from the disposal of used packaging. It is also intended to encourage the conservation of virgin materials through an increase in the re-use and recycling of used packaging material. These outcomes are intended to support and complement the voluntary strategies in the APC.

4.70 The APC is a sustainable packaging initiative which aims to change the culture of business to encourage the use of more sustainable packaging, increase recycling rates and reduce packaging litter.[76] It is an agreement between companies in the supply chain and government to reduce the environmental impacts of consumer packaging.[77] The APC is considered to be the key national mechanism for the implementation of Strategy 3 of the National Waste Policy—better management of packaging to improve the use of resources, reduce the environmental impact of packaging design, enhance away from home recycling and reduce litter.[78]

4.71 The Commonwealth, state and territory governments, and the packaging industry are currently negotiating new Covenant arrangements to be implemented from 1 July 2016, including future funding arrangements. Under the current APC, Commonwealth, state and territory funding is provided to support the Covenant. However, under the new arrangements, no government funding will be mandated.[79]

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74 National Environment Protection Council, http://www.nepc.gov.au/, (accessed 7 March 2016).

75 Department of the Environment, http://www.environment.gov.au/protection/national-waste-policy/packaging-covenant, (accessed 7 March 2016)

76 Department of the Environment, *Submission 18*, p. 5.

77 *Australian Packaging Covenant* (2011), http://www.packagingcovenant.org.au/data/Resources/Aust_Packaging_Covenant_amended_10_October_2011.pdf, (accessed 30 November 2015).

78 Department of the Environment http://www.environment.gov.au/protection/national-waste-policy/packaging-covenant

79 Department of the Environment, *Submission 18*, p. 6.

4.72 In relation to the TAP and the APC, the department informed the committee that 'there is no reason why we would not in some way seek to underline the significance or importance of the Packaging Covenant in the threat abatement plan'.[80]

4.73 The APC is discussed further in Chapter 7.

The need for national leadership

4.74 Submitters noted that in Australia, the states and territories have primary responsibility for environmental laws—particularly in relation to waste management and pollution. However, it was observed that marine plastic pollution is not restricted by state boundaries so that it 'will clearly pass from state waters to Commonwealth waters and, clearly, pass on currents to different jurisdictions'.[81] As a consequence, it was argued that there is a need for a coordinated approach across all jurisdictions to addressing marine plastic pollution. Nevertheless, it was observed that this is not the case with Dr Waddell, NELA, commenting that:

> …there seems to be a lot of acknowledgement that the coordination between the Commonwealth level and the state levels is not working very well across the marine jurisdiction.[82]

4.75 Dr Waddell went on to comment that there were options for the Commonwealth to take a greater role in addressing pollution issues and stated that:

> But in the past the Commonwealth has stepped away from assuming that leadership role and has always sought to work within the Intergovernmental Agreement on the Environment and that NEPM system, which was established back in 1994. Perhaps it is time we revisited that.[83]

4.76 The call for the Commonwealth to take on a greater role and assume leadership was repeated by other submitters. For example, the Sydney Coastal Councils Group commented:

> As the impacts of plastic are many and varied, solutions must be equally diverse. A whole-of-government approach is required, that includes industry and communities. Due to the scale of the problem, national leadership is essential.[84]

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80 Mr Stephen Oxley, Department of the Environment, *Committee Hansard,* 26 February 2016, p. 19.

81 Ms Rachel Walmsley, EDOs of Australia, *Committee Hansard*, 18 February 2016, p. 69.

82 Dr Sarah Waddell, National Environmental Law Association, *Committee Hansard*, 18 February 2016, p. 26. See also Chapter 5.

83 Dr Sarah Waddell, National Environmental Law Association, *Committee Hansard*, 18 February 2016, p. 28.

84 Sydney Coastal Councils Group, *Submission 8*, p. 7.

4.77 Similarly, the Port Phillip EcoCentre stated:

> The long-standing efforts of noble not-for-profit organisations have not been able to keep pace with the consumption and poor disposal of consumer plastics generated by the growing human population. As marine plastics are not constrained by state or local government borders Federal government leadership is required on this issue.[85]

4.78 EDOs of Australia argued that 'there is a lack of national leadership on the environment at the moment'.[86] Ms Walmsley, EDOs of Australia, commented further that the Commonwealth has provided national leadership in other areas and should do so in relation to implementing mechanisms to address marine plastic pollution:

> That comes back to my point on national leadership. It has worked effectively in other areas—for example, in gene technology, where the Commonwealth played a role in getting uniform legislation in the states on a new and emerging issue when the science was not necessarily clear or it was a new area for legislation to address. I think there is a role for Commonwealth coordination to get state standards or mechanisms in line.[87]

4.79 Similarly, NELA urged the 'Australian government to exercise leadership and to play a central role in developing a national strategy that should cover prevention, removal, mitigation and monitoring the spread of marine plastic pollution'.[88]

4.80 One way of increasing national coordination and leadership was put forward by Dr Waddell who commented that NELA promoted the establishment of a national oceans commission and possibly an Oceans Act as:

> …there seems to be a lot of acknowledgement that the coordination between the Commonwealth level and the state levels is not working very well across the marine jurisdiction. When you have the state jurisdiction going out to, in most cases, three nautical miles and then the Australian Commonwealth waters starting after that, there is not a great deal of coordination going on.[89]

4.81 Mr Sahukar, EDOs Australia, also called for the establishment of a National Environment Commission based on the recommendations of the 2009 Hawke Review of the EPBC Act.[90] He stated that a National Environmental Commission could:

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85 Port Phillip EcoCentre, *Submission 81*, p. 4.

86 Mr Nari Sahukar, EDOs of Australia, *Committee Hansard*, 18 February 2016, p. 69.

87 Ms Rachel Walmsley, EDOs of Australia, *Committee Hansard*, 18 February 2016, p. 69.

88 Dr Sarah Waddell, National Environmental Law Association, *Committee Hansard*, 18 February 2016, p. 26.

89 Dr Sarah Waddell, National Environmental Law Association, *Committee Hansard*, 18 February 2016, p. 26.

90 See http://www.environment.gov.au/legislation/environment-protection-and-biodiversity-conservation-act/epbc-review-2008

> …provide arm's length and strategic oversight of environmental issues and advise the minister, and to play a sort of foresight role to foresee some of these emerging issues and to provide national leadership and coordination in addressing some of those issues.[91]

4.82 Mr Sahukar went on to explain that a National Environment Commission could ensure that best-practice environmental measures could be implemented across jurisdictions.[92]

4.83 However, as an alternative to a specific body to further marine environmental matters, NELA supported COAG as an appropriate body for the development of an intergovernmental framework for the coordination of marine and coastal management. NELA stated that:

> This issue goes to arrangements under our federal system of government and as Council of Australian Governments (COAG) is the peak intergovernmental forum in Australia it is the most appropriate body.[93]

4.84 It highlighted that the inclusion of the President of Australian Local Government Association (ALGA) in COAG is important as a number of measures which are critical for the prevention of marine plastic pollution are the responsibility of local governments.[94]

4.85 While NELA supported coordination of marine matters under COAG, it went on to comment that currently marine issues are not on the COAG agenda. It pointed to COAG's most recent Communiqué which included water, climate change and the environment under the heading of 'A new economic and Federation reform agenda'. However, coastal or marine issues are not mentioned.

4.86 In addition, NELA observed that in December 2013, COAG replaced the 22 Standing Councils, Select Councils and governance fora with eight Councils, and that this revoked the Standing Council on Environment and Water (SCEW). SCEW provided a forum for intergovernmental agreement on environmental protection and water management issues and challenges. It also enabled governments to coordinate environment and water related programs and funding. NELA concluded that:

> It is notable that SCEW appears to have been focused more on fresh water than the coastal and marine environment. However, the revocation of SCEW indicates the low priority being given to the environment and water within COAG and this extends to the coastal and marine environment.[95]

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91 Mr Nari Sahukar, EDOs of Australia, *Committee Hansard*, 18 February 2016, p. 69.

92 Mr Nari Sahukar, EDOs of Australia, *Committee Hansard*, 18 February 2016, p. 69.

93 National Environment Law Association, Answer to question on notice, 10 March 2016, p. 1.

94 National Environment Law Association, Answer to question on notice, 10 March 2016, p. 1.

95 National Environment Law Association, Answer to question on notice, 10 March 2016, p. 2.

4.87 Though SCEW has been disbanded, the department informed the committee that the Minister for the Environment, and state and territory environment ministers, continue to meet as a body that has come to be known as 'the meeting of environment ministers'. These meetings occur on a 'reasonably regular basis, at least a couple of times a year' and there is a 'senior officials' network and committee system' that provides advice to the ministers.[96]

4.88 The department commented that in relation to marine plastic pollution, the focus of the meeting of environment ministers has been on packaging and waste. In particular, it has considered banning microbeads, and the phase-down of lightweight single use plastic bags.[97]

International leadership

4.89 Submitters also commented on the role of the Australian Government in international areas. Ms Ellen Geraghty, NELA, saw an opportunity for Australia to be more involved in regional environment programs 'as they seemed to offer some useful mechanisms' for addressing marine plastic pollution. For example, Australia is a member of the Pacific Regional Environment Programme. The Programme focuses more on pollution generally in the marine environment rather than plastics but it was seen as way of improving action at a regional level.[98] In addition, NELA commented that 'the problem of [marine plastic pollution] is suitable to be raised in regional forums and to become the focus for international aid provided to Indonesia and neighbouring countries'.[99]

4.90 The Sydney Coastal Councils Group went further and suggested that Australia initiate a regional approach in the Asia-Pacific:

> …the Federal Government should lead the development of an international agreement with neighbouring countries throughout the Asia-Pacific to facilitate a regional approach to reducing marine plastic pollution. Given that plastics can travel extensive distances through ocean currents and wave action, a regional approach is essential.[100]

4.91 The committee notes that the TAP recognised the Asia-Pacific region as a source of marine debris, and that the Australian Government should contribute to raising awareness of marine debris in the region. Action 1.15 of the TAP required the department and relevant agencies 'to examine introducing awareness-raising and

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96 Mr Stephen Oxley, Department of the Environment, *Committee Hansard*, 26 February 2016, p. 16.

97 Mr Andrew McNee, Department of the Environment, *Committee Hansard*, 26 February 2016, p. 17.

98 Ms Ellen Geraghty, National Environmental Law Association, *Committee Hansard*, 18 February 2016, p. 29.

99 National Environmental Law Association, *Submission 132*, p. 17.

100 Sydney Coastal Councils Group, *Submission 8*, pp. 7–8.

outreach programs aimed at relevant groups contributing to marine debris in the Asia-Pacific region'. It appears from the TAP Review that no progress was made in relation to this action.

4.92 Action item 1.17 required the department, in collaboration with the Department of Foreign Affairs and Trade, to strengthen relations with regional neighbours on marine debris through relevant fora, and develop collaborative project proposals to address the sources and impacts of harmful marine debris. The TAP Review noted the work undertaken in relation to derelict fishing gear from Indonesia. In addition, there have been exchange visits and study tours on community-based marine planning and management in East Timor, Rote Island in eastern Indonesia and Indigenous communities in Australia's north.[101]

4.93 AMSA also commented that Australia is a participant in the Pacific Ocean Pollution Prevention Programme which was updated in 2014 and recognises marine plastics and marine debris more generally as a significant source of pollution. There are a number of proposed actions (subject to funding) including investigating sources of abandoned lost or discarded fishing gear (ALDFG); regional workshop on ALDFG training; improved ghost net management; opportunistic sampling of ocean plastic debris; and develop Secretariat for the Pacific Regional Environment Programme (SPREP) region marine debris network. AMSA has also assisted SPREP to undertake gap analyses of ports in the region that could act as waste hubs. This will help Pacific small island developing states to meet their MARPOL requirements.[102]

Committee view

4.94 The EPBC Act and the TAP are the primary mechanisms for the management of the threat of marine plastic pollution to listed species, however the 2014 review of the TAP found that the threat had not been abated. The committee is disappointed with the apparent lack of action on this issue. However, the committee is encouraged to learn that the revised TAP will recognise that plastic, and microplastics in particular, pose a threat to the marine environment. The committee looks forward to the release of the revised TAP, and is of the view that urgent implementation is required.

4.95 The committee is of the view that there is a need for increased national leadership on marine plastic pollution abatement. Further, there is a need for greater sound, peer-reviewed research on the effects of marine plastic pollution and for this research to inform future government policy. Funding for this research should be provided a range of stakeholders. The committee believes that consistency in reporting and data collection is critical to such research and policy development. As such, the

101 Department of the Environment, *Threat abatement plan for the impacts of marine debris on vertebrate marine life Review 2009–2014*, p. 19.

102 Australian Maritime Safety Authority, *Submission 68*, pp. 5–6.

implementation and support for a nationally consistent marine debris database should be priority for the Australian Government.

4.96 Given that COAG brings together representatives from Commonwealth, state and territory, and local government, the committee believes the Australian Government should support the inclusion of marine plastic pollution on the agenda as a matter of urgency. The committee is of the view that COAG will provide an appropriate mechanism for an increased level of national leadership, and national consistency in policy development.

4.97 In the absence of a COAG council to address marine plastic pollution, the committee is of the view that the environment ministers group provides an important opportunity for national coordination and leadership.

Chapter 5

Strategies for the removal of marine plastic pollution

5.1 This chapter examines the scope and effectiveness of current strategies to remove existing pollution from the marine environment. This includes community- and volunteer-based clean-up programs, and efforts to remove discarded, lost and abandoned fishing gear.

Clean-up programs

5.2 Since the 1980s and 1990s, clean-up programs involving the collection and removal of litter and debris from the marine environment have formed a key component in strategies designed to reduce the threat from marine plastic pollution. These programs are undertaken by both community and not-for-profit organisations, and Commonwealth, state and territory, and local governments. Clean-up and debris removal remains a key strategy of the Threat Abatement Plan.[1]

Government funding for clean-up initiatives

5.3 The Australian Government funds a number of initiatives which focus on marine debris removal in conjunction with industry, community groups, and state, territory and local governments. These initiatives include beach and waterway clean-up projects, and the removal of debris from ecologically sensitive areas such as the Great Barrier Reef. In addition, a number of community and not-for-profit organisations are engaged in clean-up programs designed to remove plastic pollution from the marine environment.

5.4 The Australian Government currently provides funding for clean-up programs covering an area of 30–40 kilometres of beach in Queensland. These funds are provided through the Department of the Environment's Green Army Project.[2] The Australian Government has also provided $700,000 through the Reef Trust to remove marine debris form the Great Barrier Reef Marine Park. The *Great Barrier Reef Marine Debris Clean-Up Project* is being delivered by the Great Barrier Marine Park Authority over two years until 30 June 2017. The project aims to reduce the sources and occurrence of marine debris, and its impact on protected species such as turtles and dugongs. It will involve coordinated on-ground clean-up activities and a public education campaign.[3]

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1 Department of the Environment, *Threat Abatement Plan for the impacts of marine debris on vertebrate marine life*, May 2009, p. 6.

2 Department of the Environment, *Submission 18*, p. 4.

3 Department of the Environment, *Submission 18*, p. 4.

5.5 The Australian Government also funds community-based clean-up and marine debris monitoring program in the Gulf of Carpentaria and Arnhem Land, and on the Cape York Peninsula. This funding is provided through the Queensland Government for community-based programs on the east and west cost of Cape York Peninsula and the Torres Strait.[4]

5.6 The Australian Government also provides funding through the National Landcare Programme to organisations engaged in clean-up activity. Clean Up Australia currently receives $300,000 over three years to assist in its campaigns.[5]

Effectiveness of clean-up programs

5.7 Organisations and individuals engaged in clean-up programs provided evidence of the large volumes of plastic pollution collected by volunteers, and the commitment of volunteers be it on one day or over large periods of time.

5.8 One of the largest clean-ups is organised by Clean Up Australia, a national non-profit organisation which was founded in 1989 in response to significant levels of plastic pollution in the marine environment. It coordinates community-based volunteer clean-up programs designed to collect debris from beaches, natural areas, parks and streets. Clean Up Australia submitted that over 25 years, some 28.75 million hours have been volunteered in Australia and over 302,213 tonnes of rubbish have been removed.[6]

5.9 Similarly, the Tangaroa Blue Foundation, a registered charity established in 2004 coordinates the Australian Marine Debris Initiative (AMDI). The AMDI is a 'national network of volunteers, communities, schools, Indigenous rangers, industry groups and government agencies working on both removal and mitigation of marine debris from marine, coastal and estuarine environments'.[7] Ms Heidi Taylor, Managing Director, explained that:

> To date, more than 5.4 million marine debris items have been entered into the AMDI database with the assistance of 902 partner organisations. This debris has been removed from 1,729 sites and the weight of the debris has been totalled at over 500 tonnes, with 152,693 volunteer hours being logged. If these hours were valued at $30 an hour, that is a contribution of $4.58 million for the removal of marine debris nationally.[8]

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4 Department of the Environment, *Submission 18*, p. 5.

5 Minister for the Environment, the Hon Greg Hunt MP, 2 March 2016, http://www.greghunt.com.au/Home/LatestNews/tabid/133/ID/3676/Tackling-waste-and-litter-to-keep-Australia-clean.aspx (accessed 8 March 2016).

6 Clean Up Australia Inc. *Submission 9*, p. 2.

7 Ms Heidi Taylor, Tangaroa Blue Foundation, *Committee Hansard*, 10 March 2016, p. 28.

8 Ms Heidi Taylor, Tangaroa Blue Foundation, *Committee Hansard*, 10 March 2016, p. 28.

5.10 Other organisations provided evidence of their clean-up efforts including Eco Barge Clean Seas, a not-for profit organisation established in Airlie Beach, Queensland. Since the inception of the Whitsunday Marine Debris Removal Program in 2009, over 130,000 kilograms of marine debris have been removed from the Whitsunday Region.[9]

5.11 The committee also received a number of submissions from individuals who engage in clean-up activity on an ad hoc basis as part of their engagement in leisure activities in the marine environment.[10]

5.12 Despite the large volumes of debris removed from the environment during clean-ups, it is evident that the amount of marine plastic pollution continues to grow. Ms Terrie-Ann Johnson, Managing Director, Clean Up Australia, commented that over the years in which Clean Up Australia has been engaged in litter collection activities, the amount of plastic pollution collected has not reduced. Ms Johnson stated that 'individual beaches might be doing better, but as a whole, the sector of beaches is not doing better'.[11] Similarly, Eco Barge Clean Seas noted that marine pollution continues to arrive at rates in excess of two kilograms per day at some locations in the Whitsunday Region. As a result, approximately 40 maintenance clean-up trips are required per year to prevent significant accumulation from occurring.[12]

5.13 Notwithstanding the considerable efforts of volunteers, submitters stated that clean-up programs are insufficient to reduce the ever-increasing volume of plastic pollution, particularly in the marine environment. For example, Wide Bay Burnett Environment Council commented:

> NRM groups and members of the public with the Wide Bay Burnett region spend many thousands of dollars from government funding initiatives and countless man hours conducting clean ups on beaches and islands within our local area and the issue is not improving over time.[13]

5.14 Similarly, Mr Brendan Donohoe, President of the Northern Beaches Branch, Surfrider Foundation Australia, told the committee:

> Our hundreds of volunteers are involved in many beach clean-ups around the country each year and it is essentially a simple fact that where we feel as though we are standing on the porch and mopping it while there is a fire hydrant of plastic just gushing out behind us.[14]

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9 Eco Barge Clean Seas Inc., *Submission 13*, p. 1.

10 For example Dr Fiona Whitelaw, *Submission 62*, p. 1; Ms Cheryl Cooper, *Submission 82*, p. 1; Mr Scott Bell-Ellercamp, *Submission 84*, p. 1.

11 Ms Terrie-Ann Johnson, Clean Up Australia, *Committee Hansard*, 18 February 2016, p. 38

12 Eco Barge Clean Seas Inc., *Submission 13*, p. 1.

13 Wide Bay Burnett Environment Council, *Submission 34*, p. 3.

14 Mr Brendan Donohoe, Surfrider Foundation Australia, *Committee Hansard*, 18 February 2016, p. 58.

5.15 Clean-up activities in remote areas of Australia are a particular challenge. Ms Taylor noted that in Cape York there is a high level of debris coming from other places and up to one tonne per kilometre is being removed annually. However, there is no recycling and limited waste management infrastructure in the region. This results in debris being burned causing an additional environmental issues.[15]

5.16 It was also argued that the general community should not rely on the small number of dedicated volunteers 'to bear the responsibility for cleaning up after everybody'.[16] Mr Dave West, environmental economist advising Clean Up Australia, added that:

> The community's effort and the support of local government, individual members of parliament, community leaders and those sorts of things on litter are something that we should not diminish or at any point not congratulate, because we do not want to disincentivise that. The point is probably that you just cannot rely on volunteers trying to deal with that if you want to fix the problem rather than hide the problem.[17]

5.17 Other witnesses also challenged the value of singular clean-up events. While commenting that clean-ups are vital, the Tangaroa Blue Foundation stated that 'one-off clean-ups are a waste of money and investment'.[18] Similarly, Mr Jeff Angel, Executive Director of the Total Environment Centre, told the committee that the core problem with clean-up programs is:

> …the irregularity of the clean-ups. Clean Up Australia does an enormous job, but it is once a year, mainly. Sorry, but the other 11 months there is stuff progressively building up in the environment.[19]

5.18 The scale and cost of collection of marine debris in Australia was also recognised by the Department of the Environment which stated:

> …you are talking about a pollution load, a marine debris load, that is spread across a huge coastal area and a huge marine environment, and there is not going to be an economic or efficient way to capture and collect all of that material.[20]

5.19 The cost effectiveness of clean-up activities was also discussed in the context of at-sea collection initiatives. In particular, the committee noted public discussion of

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15 Ms Heidi Taylor, Tangaroa Blue Foundation, *Committee Hansard*, 10 March 2016, p. 28.

16 Ms Terrie-Ann Johnson, Clean Up Australia, *Committee Hansard*, 18 February 2016, pp. 38–39.

17 Mr Dave West, Environmental Economist advising Clean Up Australia, *Committee Hansard*, 18 February 2016, p. 38.

18 Ms Heidi Taylor, Tangaroa Blue Foundation, *Committee Hansard*, 10 March 2016, p. 28.

19 Mr Jeff Angel, Total Environment Centre, *Committee Hansard*, 18 February 2016, p. 50.

20 Mr Stephen Oxley, Department of the Environment, *Committee Hansard*, 26 February 2016, p. 18.

the Ocean Cleanup Project which proposes removing marine pollution using surface nets.[21] However, Dr Britta Denise Hardesty from the CSIRO told the committee that despite there being public discussion around 'going out and cleaning up the garbage patches' in the open ocean, 'scientists around the world…are pretty much in agreement that that is not really a practical or viable solution'.[22] Dr Hardesty explained that not all the pollution floats on top of the water—plastic moves throughout the water column—and it would be economically expensive to remove the plastic in these locations.[23]

5.20 Despite concerns with the reliance on volunteers and effectiveness, clean-ups were still seen as having a place in marine plastic pollution mitigation efforts but it was argued that long-term strategic clean-up effort is needed and funding should be secured for these.[24]

5.21 However, submitters commented that the major thrust of any policies to address marine plastic pollution must be source reduction. For example, Ms Taylor, Tangaroa Blue Foundation, stated that:

> …if all we do is clean up, that is all we will ever do. Debris needs to be tracked to the source and practical, cost-effective source-reduction plans implemented to stop at the source.[25]

5.22 Similarly, Clean Up Australia told the committee that:

> …while volunteer and infrastructure efforts are commendable and are having an effect on the problem…addressing the problems of rubbish at the point of consumption is a far more cost effective approach than trying to recover packaging and products one they have entered our environment.[26]

5.23 Source reduction is further discussed in Chapters 6 and 7.

Value of clean-up programs in raising awareness

5.24 Despite evidence indicating that clean-up programs cannot effectively mitigate the threat of marine plastic pollution, the committee also heard that participation in clean-up programs can provide valuable public education.

5.25 Clean Up Australia stated that those who participate in events such as Clean Up Australia Day 'will probably go home and have changed their attitudes to what

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21 For more information see The Ocean Cleanup Project, http://www.theoceancleanup.com/.

22 Dr Britta Denise Hardesty, CSIRO, *Committee Hansard*, 26 February 2016, p. 5.

23 Dr Britta Denise Hardesty, CSIRO, *Committee Hansard*, 26 February 2016, p. 5.

24 Ms Heidi Taylor, Tangaroa Blue Foundation, *Committee Hansard*, 10 March 2016, p. 28.

25 Ms Heidi Taylor, Tangaroa Blue Foundation, *Committee Hansard*, 10 March 2016, p. 28.

26 Clean Up Australia, *Submission 9*, p. 2.

they are finding'.[27] This was also supported by evidence given by Mr Donohoe from the Surfrider Foundation who stated:

> The great feature of getting the public involved in a beach clean is that once you have done one of our beach cleans properly, and you weigh it and you look at it, you could never ever just drop something anywhere again.[28]

5.26 The value of awareness raising activities and education campaigns is further discussed in Chapter 6.

Research developments

5.27 The committee notes that research into clean-up strategies, and technological solutions to reduce the amount of plastic in the environment is ongoing. For example, during the conduct of this inquiry, the committee noted an announcement from research scientists in Japan who discovered a species of bacteria capable of degrading PET plastic, and utilising the plastic as a food source.[29]

5.28 The researchers, in an article published in the journal *Science*, described the bacteria *Ideonella sakaiensis* 201-F6 as having evolved enzymes specifically capable of breaking down PET in response to the accumulation of plastic in the environment. The bacteria were capable of rapidly hydrolysing plastics, with tests revealing that almost complete degradation of low-quality plastic occurred within six weeks.[30]

5.29 The research team noted however that though these bacteria could prove useful in industrial recycling or pollution clean-up efforts, there remains significant research to be conducted. Similarly, the plastics industry is reported as having stated that the potential for biological processes to replace current mechanical recycling processes is small.[31]

5.30 The committee also notes that Dr Hardesty cautioned against trying to develop bacterial species to break down plastic as 'the issue is so ubiquitous and pervasive that it is sure to be compounded by some other significant challenges should such an approach be taken'.[32]

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27 Ms Terrie-Ann Johnson, Clean Up Australia, *Committee Hansard*, 18 February 2016, p. 38.

28 Mr Brendan Donohoe, Surfrider Foundation, *Committee Hansard*, 18 February 2016, p. 60.

29 Yoshida S., Hiraga K., Takehana T., Taniguchi I., Yamaji H., Maeda Y., Toyohara K., Miyamoto K., Kimura Y., Oda K., 'A bacterium that degrades and assimilates poly(ethylene terephthalate)', *Science*, Vol 351 Issue 6278, 11 March 2016, pp. 1196–1199.

30 Karl Mathiesen, 'Could a new plastic-eating bacteria help combat this pollution scourge?', *The Guardian*, 11 March 2016, http://www.theguardian.com/environment/2016/mar/10/could-a-new-plastic-eating-bacteria-help-combat-this-pollution-scourge, (accessed 18 April 2016).

31 Karl Mathiesen, 'Could a new plastic-eating bacteria help combat this pollution scourge?', *The Guardian*, 11 March 2016, http://www.theguardian.com/environment/2016/mar/10/could-a-new-plastic-eating-bacteria-help-combat-this-pollution-scourge, (accessed 18 April 2016).

32 Dr Britta Denise Hardesty, CSIRO, *Committee Hansard*, 26 February 2016, p. 4.

Reporting and collection of abandoned, lost and discarded fishing gear

5.31 As previously discussed, ALDFG poses particular risk to marine fauna through entanglement, and it can also pose risks to fisheries and shipping. As a result, the importance of reporting and collection has been given recognition under both international and domestic regulatory frameworks.

Regulation and government coordinated collection

5.32 Fishing gear, when lost, abandoned or discarded at sea is classified as garbage and there is a requirement under MARPOL Annex V, and associated domestic legislation, to report its loss. Fishing vessels are required to retrieve, where practicable, fishing gear which has been lost or damaged. In addition, ships' masters are required to record the loss of fishing gear in the Garbage Record Book or ship's log.[33]

5.33 In addition to Commonwealth legislation, the National Environmental Law Association (NELA) noted that there are also legislative provisions for the reporting of lost fishing gear in New South Wales, Victoria, and the Northern Territory.[34]

5.34 Along with reporting requirements when fishing gear is lost, there are legislative provisions for the collection and destruction of lost and abandoned fishing nets. At the Commonwealth level, the Department of the Environment has legislative oversight for managing harmful marine debris. The Threat Abatement Plan states that 'Australian Government agencies in collaboration with state and territory governments [are] to identify appropriate responses and responsibilities for recovery of hazardous debris at sea, notably large derelict fishing nets'.[35] These government agencies include:

- Australian Fisheries Management Authority;
- Australian Maritime Safety Authority;
- Border Protection Command;
- Department of Agriculture;
- Great Barrier Reef Marine Park Authority; and
- Department of the Environment.[36]

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33 Australian Maritime Safety Authority, *Pollution from Fishing Vessels*, https://www.amsa.gov.au/environment/legislation-and-prevention/pollution-fishing-vessels/index.asp#pollution, (accessed 8 March 2016).

34 National Environmental Law Association, *Submission 132*, p. 12.

35 CSIRO, *Submission 7*, Appendix 3, 'Input to Department of Environment Threat Abatement Plan', p. 14.

36 Department of the Environment, *Threat abatement plan for the impacts of marine debris on vertebrate marine life – Review 2009–2014*, p. 11.

5.35 Ms Kerry Smith, Senior Manager, Foreign Compliance Policy from AFMA told the committee that the 'management of ghost nets is a complex issue'. In addition, the arrangements for reporting and collection are dependent on the origins of the net, and where it is encountered, that is in the Australian Fishing Zone (AFZ) or coastal waters.[37]

5.36 The AFZ was established under the *Fisheries Management Act 1991* (Cth) and relates to the management of Commonwealth waters which extend from three nautical miles from the coastline out to 200 nautical miles. Australian states and territories are responsible for management of coastal waters, that is, up to three nautical miles from the coastline.[38]

5.37 Ghost nets which are found within three nautical miles of the coast are the responsibility of state and territory governments, while those found in the AFZ fall within the Commonwealth's jurisdiction.[39] Ms Smith explained that the Australian Border Force, within the Department of Immigration and Border Protection, is responsible for the management of eight key maritime threats within the AFZ. These threats include marine pollution, and the illegal exploitation of natural resources.[40]

5.38 Ms Smith commented that under existing arrangements, reports on ghost net sightings within the AFZ are made initially to the Australian Border Force Maritime Border Command, and then information is disseminated to other government agencies if required.[41] The Australian Maritime Safety Authority (AMSA) also told the committee that its 24-hour Rescue Coordination Centre can receive notifications of ghost net sightings—particularly if the net is large and poses a danger to the navigation of vessels.[42] Under the Safety of Life at Sea (SOLAS) Convention, ships' masters are obliged to report dangers to navigation.[43]

5.39 AFMA and the Department of the Environment have utilised a Memorandum of Understanding (MOU) for ghost net retrieval in Commonwealth Marine Reserves and adjacent Commonwealth waters. A civil contractor or Australian Border Force

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37 Ms Kerry Smith, Australian Fisheries Management Authority, *Committee Hansard*, 26 February 2016, p. 27.

38 Department of Agriculture and Water Resources, *The Australian Fishing Zone*, http://www.agriculture.gov.au/fisheries/domestic/zone, (accessed 8 March 2016).

39 Ms Kerry Smith, Australian Fisheries Management Authority, *Committee Hansard*, 26 February 2016, p. 29.

40 Ms Kerry Smith, Australian Fisheries Management Authority, *Committee Hansard*, 26 February 2016, p. 27.

41 Ms Kerry Smith, Australian Fisheries Management Authority, *Committee Hansard*, 26 February 2016, p. 27.

42 Mr Toby Stone, Australian Maritime Safety Authority, *Committee Hansard*, 26 February 2016, p. 26.

43 Mr Toby Stone, Australian Maritime Safety Authority, *Committee Hansard*, 26 February 2016, p. 14.

assets are required to collect ghost nets.[44] Under the terms of the MOU, the cost of ghost net recovery is split equally between AFMA and the Department of the Environment. The average cost of ghost net recovery operations is $30,000; however this does not include the cost of Australian Border Force surveillance activity or the costs associated with the destruction of the ghost net.[45]

5.40 The committee received evidence that non-government organisations are also engaged in ghost net identification and retrieval programs. In particular, the GhostNets Australia program which initially commenced in 2004 with funding from the National Heritage Trust. GhostNets Australia is an alliance of Indigenous communities from coastal northern Australia who work with researchers to identify and remove derelict fishing nets from the coastal environment. It has also undertaken engagement with Indonesian communities to better understand the regional origins of ghost nets.[46]

5.41 Though GhostNets Australia no longer receives funding from the Department of the Environment,[47] it continues to operate in conjunction with both public and private support. The federally-funded Working on Country program provides funding and support for the training and employment of Indigenous rangers who contribute to the work undertaken by GhostNets Australia.[48]

5.42 The committee also received evidence that Australian industry bodies are actively participating in the identification and removal of ghost nets. AMSA informed the committee that the Northern Prawn Fishery Industry Association has developed a partnership with World Animal Protection, to monitor and where possible, retrieve nets in the Gulf of Carpentaria.[49]

Difficulties in detection and disposal

5.43 A number of submitters highlighted the difficulties associated with the reporting and collection of ghost nets. These include difficulties in detection due to the nets being situated below the surface of the water, the remoteness of sighting

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44 Australian Fisheries Management Authority, *Submission 33*, p. 2.

45 Ms Kerry Smith, Australian Fisheries Management Authority, *Committee Hansard*, 26 February 2016, p. 28.

46 Department of the Environment, *Threat Abatement Plan for the impacts of marine debris on vertebrate marine life Review 2009-2014*, p. 2.

47 Mr Stephen Oxley, Department of the Environment, *Committee Hansard*, 26 February 2016, p. 14.

48 Department of the Prime Minister and Cabinet, *Indigenous Rangers – Working on Country*, http://www.dpmc.gov.au/indigenous-affairs/about/jobs-land-and-economy-programme/indigenous-environment-branch/indigenous-rangers-working-country, (accessed 8 March 2016).

49 Ms Kerry Smith, Australian Fisheries Management Authority, *Committee Hansard*, 26 February 2016, p. 29.

locations, and the size of ghost nets. In addition, the disposal of ghost nets can create environmentally harmful by-products.

5.44 Ms Smith commented that nets that travel below the surface can be difficult to detect by Australian Border Force air surveillance programs, though occasionally surface disturbances can allow for identification.[50]

5.45 Work is being undertaken by the CSIRO to identifying the pathways travelled by ghost nets in the Gulf of Carpentaria. This research identified points where interdiction can occur before nets travel into areas of high biodiversity.[51] The study found that the majority of nets found in the Gulf of Carpentaria travel close to the Port of Weipa, where they could be intercepted and removed. This could potentially provide a significant cost saving in recovery efforts; in addition, existing surveillance efforts currently service this area and would provide necessary reporting.[52]

5.46 The Department of the Environment submitted that large fishing nets collected in remote locations are often too difficult to transport to waste facilities, and are burnt on-site to prevent them from re-entering the marine environment. However, this form of waste disposal results in 'significant clumps of cement-like burnt plastic' left on the beach.[53] This residue can prevent turtles from nesting in these locations.[54]

5.47 In addition, though most nets are often recovered in fragments,[55] these fragments can still be of considerable size.[56] For example, in 2012, an 11 tonne ghost net was detected in coastal waters in the Northern Territory. The net was so large that it had to be cut it into pieces which were lifted from the site by helicopter, for destruction.[57]

5.48 Mr Stephen Oxley, Department of the Environment, noted that seeking alternative methods of disposing ghost nets in remote areas was identified as a priority at the expert workshop held in August 2015 to discuss the development of the revised

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50 Ms Kerry Smith, Australian Fisheries Management Authority, *Committee Hansard*, 26 February 2016, p. 29 and p.31.

51 Dr Britta Denise Hardesty, CSIRO, *Committee Hansard*, 26 February 2016, p. 9. See also CSIRO, *Submission 7*, Appendix 3, 'Input to Department of Environment Threat Abatement Plan', p. 14.

52 CSIRO, *Submission 7*, Appendix 3, 'Input to Department of Environment Threat Abatement Plan', p. 14.

53 Department of the Environment, *Submission 18*, p. 4.

54 Mr Stephen Oxley, Department of the Environment, *Committee Hansard*, 26 February 2016, p. 12.

55 Ms Kerry Smith, Australian Fisheries Management Authority, *Committee Hansard*, 26 February 2016, p. 28.

56 Department of the Environment, *Submission 18*, p. 4.

57 Northern Territory Seafood Council, *Submission 63*, p. 4.

Threat Abatement Plan. The workshop also advised that new technologies such as waste-to-energy systems should be explored,[58] and this was acknowledged in the Department of the Environment's submission. It noted that such systems could improve waste management in remote communities.[59]

5.49 The committee received evidence that the aquaculture and fisheries industries are also engaged in developing innovative strategies to ensure that the owners of lost fishing gear can remain responsible for collection and removal. Dr Jennifer Lavers told the committee that in Tasmania, following complaints from local communities regarding lost items being washed ashore, a number of aquaculture companies developed a system to tag their equipment. Dr Lavers stated that local communities can now contact the responsible company to collect their nets.[60]

5.50 The CSIRO indicated that it is exploring innovative technologies which will allow for fishing gear to be marked so that it can be identified as originating from a particular fishery. The CSIRO stated that microdots encoding information on small dots could be incorporated into fishing gear. In addition, chemical marking of the ropes used to make fishing nets would enable ownership identification even in small fragments. The CSIRO stated that both microdot technology and chemical marking are widely used in other industries, but have not been previously used in the fishing industry.[61]

Need for national coordination

5.51 The committee received evidence from submitters who were concerned that there is an apparent lack of coordination in the reporting and collection of ghost nets.

5.52 The Northern Territory Seafood Council stated that nets are currently removed on an 'ad hoc basis' by a range of government departments at both the Commonwealth and the state and territory level. The Northern Territory Seafood Council also expressed frustration that there appears to be a 'lack of responsibility' for the retrieval of lost and discarded fishing gear in the AFZ. It highlighted that Australian fishers are required to report ghost nets as a navigational hazard, and this information is added to marine chart updates, but there does not appear to be anybody responsible for ghost net removal.[62] It noted that there can be a long lag time between the reporting of ghost net sightings, and collection and removal. This lag time results in the net sinking or drifting to another location, rendering the report useless. The lack

58 Mr Stephen Oxley, Department of the Environment, *Committee Hansard*, 26 February 2016, p. 12.

59 Department of the Environment, *Submission 18*, p. 4.

60 Dr Jennifer Lavers, *Committee Hansard*, p. 8.

61 CSIRO, *Submission 7*, Appendix 3, 'Input to Department of Environment Threat Abatement Plan', p. 22.

62 Northern Territory Seafood Council, *Submission 63*, p. 4.

of timely response also renders the practice of updating marine charts useless, as the nets' locations are no longer accurate.[63]

5.53 The Northern Territory Seafood Council noted favourably the work undertaken by organisations such as GhostNets Australia but highlighted that there is little coordination between non-government organisations. It also stated that these organisations operate with little funding certainty, or a plan for managing the issue at a regional level.[64]

5.54 NELA also commented that coordination of relevant Commonwealth agencies to retrieve and dispose of ghost nets was 'ineffective'. It considered that this matter should be 'resolved as a matter of urgency'.[65]

Need for regional cooperation

5.55 As the majority of ghost nets found in the north of Australia have been identified as originating from regional countries, the Australian Government has designated regional cooperation as a key mitigation strategy.

5.56 The Department of the Environment informed the committee that it supported project work undertaken by GhostNets Australia, and the CSIRO in conjunction with the National Oceanic and Atmospheric Administration (US) and the Indonesian Ministry for Marine Affairs and Fisheries. The intention of this project is to reduce the incidence of derelict fishing gear in the Arafura Sea and through engagement with local fishers, port authorities, local communities and stakeholders. The project is designed to identify the reasons for fishing gear loss, and potential mitigation strategies.[66] Dr Hardesty added that work is being undertaken with overseas neighbours to look at fisheries related gear and when, how and why fisheries are losing their gear. Issues will then be able to be addressed.[67]

5.57 The Department of the Environment also provides overseas development aid to support the Coral Triangle Initiative for Coral Reefs, Fisheries and Food Security. This includes $70,000 for the development of a pilot fisheries management strategy for the Arafura Sea. The aim of the project is to assist small scale commercial fishers in managing the loss of fishing gear, and prevent the eventual movement of ghost nets into Australian waters.[68]

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63 Northern Territory Seafood Council, *Submission 63*, p. 4.

64 Northern Territory Seafood Council, *Submission 63*, p. 4.

65 National Environmental Law Association, *Submission 132*, p. 17.

66 Department of the Environment, *Submission 18*, p. 5

67 Dr Britta Denise Hardesty, CSIRO, *Committee Hansard*, 26 February 2016, p. 7.

68 Department of the Environment, *Submission 18*, p. 5

5.58 The need for enhanced regional cooperation and the prevention of fishing gear loss at the source was also supported by NELA. It submitted that there 'is a need for technical support to help Indonesian fishermen aggregate location data on derelict nets'. In addition, it submitted that the Australian government should also provide aid through low interest loan programs for fishing gear labelling, and inventory and reporting systems.[69]

Committee view

5.59 The committee accepts that though clean-up activities are an important strategy in removing existing pollution, and raising public awareness, they alone cannot reduce the threat of marine plastic. It was consistently highlighted throughout the inquiry that the rate of plastic pollution entering the marine environment far outstrips any clean-up activity, and that source reduction should be the focus of research, policy and investment.

5.60 The committee also notes that the processes currently utilised in the identification, retrieval and disposal of ALDFG are complex, and involve multiple agencies across both Commonwealth and state and territory governments. Additionally, non-government organisations such as GhostNets Australia play a significant role in clean-up activities. The need for a review of such processes was emphasised by a number of witnesses, as it would provide an opportunity for the identification of areas for improvement and role clarification.

5.61 The evidence indicated that the need for cooperation and coordination is not only required domestically, but regionally. There are a number of opportunities for Australia to demonstrate regional leadership on this issue, and to further develop relationships with regional governments and communities.

69 National Environmental Law Association, *Submission 132*, p. 18.

Chapter 6

Source reduction – consumer behaviour and infrastructure

6.1 Submitters and witnesses supported the reduction of plastic debris at source in order to address the growing problem of marine plastic pollution. The CSIRO, for example, stated that 'the most effective way to reduce and mitigate the harmful effects of marine debris is to prevent it from entering the marine environment: cleaning up our oceans is a much less practical solution'.[1] Similarly, Professor Tony Underwood commented that, while recognising the contribution of science to identifying solutions, marine plastic pollution is a waste management issue.[2]

6.2 The committee received considerable evidence on source reduction strategies with many submitters supporting the banning of products including microbeads and single-use plastic bags and the introduction of container deposit schemes. Other strategies canvassed in submissions included improvements to stormwater systems, improved product stewardship and greater enforcement of existing regulations targeting waste.

6.3 Many of these strategies operate in conjunction with programs and measures designed to change consumer behaviour, for example, through anti-littering campaigns, and education on recycling and plastic alternatives.

6.4 This chapter will focus on the importance of community awareness and education campaigns, infrastructure to prevent litter moving into the marine environment, and beverage container deposit schemes. Chapter 7 canvasses product stewardship and legislative and regulatory frameworks.

Community awareness and education campaigns

6.5 Community awareness and education campaigns on the threat to marine ecosystems from plastic pollution, key sources of pollution, and source reduction strategies, have been an integral component of threat reduction frameworks. These education campaigns have been implemented in schools and local communities, and there have also been education campaigns targeting specific user groups. Community-based organisations such as Clean Up Australia and the Tangaroa Blue Foundation, and state and territory and local governments have all implemented education campaigns.

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1 CSIRO, *Submission 7*, p. 11.

2 Professor Tony Underwood, *Committee Hansard*, 18 February 2016, p. 23.

6.6 The committee received evidence that education campaigns have proven more effective in reducing marine pollution than clean-up programs. The CSIRO found that education programs and campaigns against illegal dumping have proven particularly successful in reducing the amount of debris found in coastal areas.[3]

6.7 The importance and value of education campaigns was also supported by the Sydney Coastal Councils Group which stated that education and behaviour change programs should be a major focus in developing mitigation strategies. It also suggested that a national educational campaign for plastic avoidance and correct disposal should be developed as it has been found that the promotion of descriptive norms[4] to influence behaviour is valuable in mediating community action and change.[5]

6.8 Mr Kiernan AO, Founder of Clean Up Australia, stated that Clean Up Australia particularly targets young Australians in education campaigns because they are 'the environmental watchdogs' who often encourage parents to make environmentally positive behavioural changes.[6] Similarly, Ms Rowan Hanley, Committee member for the Northern Beaches Branch of the Surfrider Australia Foundation, informed the committee that programs in schools can be particularly useful because 'it feeds into a much larger educational understanding and awareness'.[7]

6.9 The value of community awareness has also been recognised by the Australian Government with a number of organisations providing evidence of educational campaigns being delivered. For example, the CSIRO pointed to its school-based education campaigns. It stated:

> We also developed curriculum content using marine debris as a teaching tool for science and mathematics to meet the Australian national curriculum guidelines. CSIRO scientists inspired students to explore their world through science in ways that were meaningful and relevant, motivated teachers through innovative learning, and helped increase capacity and networks for educators and citizen scientists, in Australia and

3 CSIRO, *Submission 7*, Appendix 2, 'Executive Summary "Understanding the effects of marine debris on wildlife: Final report to Earthwatch Australia"', p. 11; see also CSIRO, *Submission 7*, Appendix 3, 'Input to Department of Environment Threat Abatement Plan', p. 11.

4 Descriptive norms are typical patterns of behaviour, which are generally accompanied by the expectation that people will behave accordingly. These norms are generally informal and emerge through social interaction rather than being enforced by the criminal justice system or other formal authority.

5 Sydney Coastal Council Groups Inc., *Submission 8*, p. 6.

6 Mr Ian Kiernan, Clean Up Australia, *Committee Hansard*, 18 February 2016, p. 38.

7 Ms Rowan Hanley, Surfrider Foundation Australia, *Committee Hansard*, 18 February 2016, p. 62.

> beyond…Overall, we reached more than one million Australians, helping to educate them about and increase their understanding of marine debris.[8]

6.10 Similarly, the Great Barrier Reef Marine Park Authority (GBRMPA) noted that under the Reef Trust Fund's Great Barrier Reef Marine Debris Clean-Up project, funds had been allocated to 'presentations to key stakeholders, school activities, community clean-up days, source reduction workshops and community installations'.[9] It explained that $90,000 had been allocated to marine plastic source reduction awareness campaigns with local communities and stakeholders within the Great Barrier Reef catchment, including source reduction workshops delivered by the Tangaroa Blue Foundation. GBRMPA also stated that $10,000 had been allocated to engage with Reef Guardian Schools to promote awareness. A further $94,000 has been allocated to targeted marine debris communications throughout the operation of the Reef Marine Debris Clean-Up project.[10]

6.11 Local government is also active in increasing awareness of the effects of litter and debris and reduction at source. Dr Madhu Pudasaini, Manager, Technical Support from the Liverpool City Council, commented that local governments regularly provide education programs. However, Dr Pudasaini went on to note that resourcing for education programs remains a challenge. He stated that:

> One of the agendas in our water quality improvement strategy is to focus on the community education source control—that is what I call it—because that is a more sustainable way of reducing litter in our system. If people are aware of those things it becomes a culture in households. That gets carried over from generation to generation, so it is a more sustainable way of reducing litter. We are trying to focus on that. Again, funding can be challenging for us, but we are trying to look at every opportunity to implement those initiatives.[11]

6.12 The committee received evidence in support of education campaigns targeting particular user groups. For example, the Sydney Coastal Council Group submitted that education campaigns should be targeted at specific user groups such as boat users, fishers, and beach visitors.[12] The National Environmental Law Association also supported the use of targeted campaigns.[13]

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8 CSIRO, *Submission 7*, Appendix 2, 'Executive Summary "Understanding the effects of marine debris on wildlife: Final report to Earthwatch Australia"', pp. 10–11.

9 Great Barrier Reef Marine Park Authority, answers to questions on notice, 10 March 2016, (received 24 March 2016), p. 2.

10 Great Barrier Reef Marine Park Authority, answers to questions on notice, 10 March 2016, (received 24 March 2016), p. 2.

11 Dr Madhu Pudasaini, Liverpool City Council, *Committee Hansard*, 18 February 2016, p. 42.

12 Sydney Coastal Council Groups Inc., *Submission 8*, p. 7.

13 National Environmental Law Association, *Submission 132*, p. 14

6.13 OceanWatch Australia is one group engaged in education campaigns specifically targeting the recreational fishing community and the issues around the disposal of fishing line. Mr Brad Warren, Executive Chair of OceanWatch Australia, stated that the *T'Angler Bin* campaign was designed to raise awareness, as well as providing a responsible method of fishing line disposal.[14] Mr Warren stated that through raising awareness and fostering a sense of fishing location stewardship, OceanWatch Australia is attempting to influence people to do the right thing.[15] Mr Warren also told the committee that OceanWatch Australia ran a campaign regarding responsible crabbing practices which included television ads and community outreach.[16]

6.14 OceanWatch Australia noted that it has engaged with the commercial fisheries and aquaculture industries in order to influence behavioural changes. It has developed codes of practice and environmental management systems with a number of seafood producers. However, Mr Warren commented that at a forum with representatives from the fisheries sector, there was a lack of understanding of the potential implications of marine plastic pollution.[17] Mr Warren stated:

> …we held a national fishing and aquaculture forum in June 2014, bringing together 20 representatives of commercial, recreational and Indigenous customary fishing sectors, and aquaculture operators from around Australia. While marine debris was identified as a threat to the health of the marine environment, when participants were asked to prioritise the identified threats not one vote out of the total of 54 votes cast was assigned to marine debris.[18]

6.15 A number of community-based organisations provided evidence that they are also undertake awareness-raising and education campaigns on the issue of marine plastic pollution. For example, Ms Heidi Taylor, Managing Director, stated that the Tangaroa Blue Foundation has an education program on its website that is aligned to the national curriculum and also runs school presentations whenever it can. Ms Taylor concluded that education was vital but it could be not relied upon to 'fix this problem'.[19]

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14 Mr Brad Warren, OceanWatch Australia, *Committee Hansard*, 18 February 2016, p. 61; see also OceanWatch Australia, *Submission 75*, p. 7.

15 Mr Brad Warren, OceanWatch Australia, *Committee Hansard*, 18 February, p. 61.

16 Mr Brad Warren, OceanWatch Australia, *Committee Hansard*, 18 February, p. 63.

17 Mr Brad Warren, Oceanwatch Australia, *Committee Hansard*, 18 February 2016, p. 63.

18 Mr Brad Warren, Oceanwatch Australia, *Committee Hansard*, 18 February 2016, p. 58.

19 Ms Heidi Taylor, Tangaroa Blue Foundation, *Committee Hansard*, 10 March 2016, p. 33.

6.16 However, the committee received evidence that in order to effect further reductions in the amount of plastic debris, adequate funding for education campaigns, particularly those provided by not-for-profit organisations, is necessary. Australian Seabird Rescue stated:

> More funding for non-profit groups to increase education and awareness is so important and funding has dropped dramatically over the last ten years. It is difficult for wildlife rescue groups to find the time to fundraise as well as caring for the creatures affected by plastic pollution.[20]

6.17 Ms Susie Crick, Board Member of the Surfrider Foundation Australia told the committee that the community:

> …want funding and subsidising for educational programmes and advertising. They want state government run advertising, information and education programs to shine a big light on this program so that everybody is informed. People will comply with anything once they know the reason why. Nobody wants to pollute.[21]

6.18 Similarly, Ms Taylor noted the funding constraints around providing education campaigns and commented that 'it is a funding thing for us as well. We try to maximise our dollars so that they go as far as possible, but we cannot cover everywhere in Australia'.[22]

6.19 Mr Warren stated that as a federally recognised Natural Resources Management (NRM) organisation, OceanWatch Australia currently receives funding under the National Landcare Programme. Administration and funding is a joint undertaking by the Department of Agriculture and Water Resources, and the Department of the Environment. However, Mr Warren noted that OceanWatch is the only NRM which does not receive funding from the Department of the Environment. This is despite being the 'first and only national marine focused NRM organisation'.[23]

Improvements to infrastructure

6.20 Infrastructure such as stormwater drainage systems and rubbish bins are both contributors to the problem of plastic pollution in the marine environment, and important source reduction measures. Stormwater drainage systems in particular are known to facilitate the transport of plastics from the urban environment into the marine environment. However, the installation of infrastructure such as gross pollutant traps provides an opportunity for urban litter to be collected and removed before it reaches the marine environment.

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20 Australian Seabird Rescue, *Submission 80*, p. 5.

21 Ms Susie Crick, Surfrider Foundation Australia, *Committee Hansard*, 18 February 2016, p. 62.

22 Ms Heidi Taylor, Tangaroa Blue Foundation, *Committee Hansard*, 10 March 2016, p. 33.

23 Mr Brad Warren, OceanWatch Australia, *Committee Hansard*, 18 February 2016, p. 58.

6.21 Similarly, litter which overflows from public rubbish bins has also been found to contribute to marine plastic pollution. However, the provision of public rubbish bins has also been found to change consumer behaviour, and reduce levels of littering.

Stormwater systems

6.22 The committee received evidence that stormwater systems provide a well-recognised pathway for urban litter to reach the marine environment.[24] For example, Mr Kiernan told the committee that:

> …whatever you drop on the ground, whether it be on a mountaintop or a beach or a riverside, has every chance of ending up driven by the stormwater system through the rivers and creeks into the world's oceans, where it accumulates.[25]

6.23 Associate Professor Mark Osborn, provided a case study which explained the extent of litter transported by stormwater systems:

> Across Melbourne, stormwater systems (comprising ~1,400 km of drains around Melbourne, including over 300 stormwater drains emptying directly into the bay) transport rainwater runoff and flush our litter into creeks, rivers and ultimately into Port Phillip. The extent of this litter transport is evidenced by the need for frequent, sometimes daily emptying of Parks Victoria litter traps on the Yarra River and that the Victorian government spent $80 million in 2012/13 alone on removing litter, including the removal of over 7,800 tons of litter and debris (including plastics) from Melbourne waterways.[26]

6.24 Since the 1990s stormwater treatment devices designed to remove plastic pollution from waterways have been deployed by local councils.[27] These include gross pollutant traps (GPT) which are designed to trap and isolate pollutants, only allowing filtered stormwater to continue on to the marine environment. There are a variety of gross pollutant traps available, and they can remove contaminants such as litter, oil, grit, and sediment.

6.25 The stormwater system in Australia is generally the responsibility of local government with Mr Nari Sahukar, from EDOs of Australia, commenting that local councils 'are often on the front line' in responding to the issue.[28]

6.26 This was supported by evidence provided by Dr Pudasaini who stated that the Liverpool City Council has installed 114 GPTs, and has assessed that a further 150 are required to adequately manage stormwater in the Liverpool area. Dr Pudasaini

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24 This is further discussed in Chapter 2.

25 Mr Ian Kiernan, Clean Up Australia, *Committee Hansard*, 18 February 2016, p. 32.

26 Associate Professor Mark Osborn, *Submission 16*, p. 2.

27 SPEL Environmental Integrated Water Solutions, *Submission 138*, p. 4.

28 Mr Nari Sahukar, EDOs of Australia, *Committee Hansard*, 18 February 2016, p. 62.

acknowledged that 'when it comes down to implementation it is a huge cost burden to council. It is outside the capacity of local government areas'. Dr Pudasaini commented that:

> My rough estimate of 150 GPTs is about $20 million in capital investment and various ongoing costs associated with cleaning the GPTs. We are also talking about other devices that can improve water quality in our river system. That is the sort of cost we are talking about.[29]

6.27 Dr Pudasaini explained that the Liverpool City Council currently collects $1.2 million per annum through a stormwater levy. However this levy is used to service the entirety of the stormwater system, rather than gross pollutant traps specifically. Dr Pudasaini estimated that the Liverpool City Council spends $300,000 per annum (on average) for the installation of new gross pollutant traps.[30] In addition to capital costs, maintenance costs are also an issue. The Liverpool City Council is currently undertaking a review of its cleaning regime. Dr Pudasaini explained:

> …we normally clean them every three months. At the moment we are reviewing that and the effective frequency of cleaning and the costs involved. We are looking at optimising that process. For example, in the rainy season we may need to clean more frequently than in autumn or when there is not much rain.[31]

6.28 While it was recognised that stormwater infrastructure has improved, witnesses pointed to continued concerns with current systems. Professor Underwood, for example, commented that:

> …we have improved immensely over the last 30 years with stormwater outfalls, trapping of waste and so on. But I am not sure we are doing it well enough. Even in those things, if you have a big storm, a lot of material goes out of the traps and into the sea. It solves a day-to-day running issue, but I do not know if anyone has evaluated how much is still going out. So I think there are areas where we still need substantial improvement.[32]

6.29 A further issue raised was that of the costs associated with gross pollutant costs which act as a disincentive for councils. SPEL Environmental Integrated Water Solutions submitted:

> Many Councils are actively discouraging the implementation of these devices [gross pollutant traps] in their area because they don't have an adequate budget to empty the litter once it is captured. SPEL feels that this is a false economy that simply shifts the cost from the catchment management 'silo' to the beaches 'silo'.[33]

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29 Dr Madhu Pudasaini, Liverpool City Council, *Committee Hansard*, 18 February 2016, p. 41.

30 Dr Madhu Pudasaini, Liverpool City Council, *Committee Hansard*, 18 February 2016, p. 41.

31 Dr Madhu Pudasaini, Liverpool City Council, *Committee Hansard*, 18 February 2016, p. 42

32 Professor Tony Underwood, *Committee Hansard*, 18 February 2016, p. 12

33 SPEL Environmental Integrated Water Solutions, *Submission 138*, p. 5.

6.30 SPEL Environmental Integrated Water Solutions recommended that the Australian Government develop policy to ensure that gross pollutant traps are installed on all stormwater outfalls, and that the maintenance of these devices be ensured. It also commented that incentive and grant schemes would encourage the implementation of gross pollutant trap projects.[34] SPEL also recommended that effective management of water catchments should occur at a regional level as this would prevent the 'ad hoc planning observed with Council boundaries that pay no regard to catchment boundaries'.[35]

6.31 The problems with the maintenance of GPTs was also noted by Professor Smith who commented that while most coastal local councils have protocols for removing accumulated debris from GPTs, these are not often met due to staffing and/or funding issues. In addition, Professor Smith commented that recent research indicated that GPTs were effective in removing larger items of debris from stormwater but this was not the case for smaller items which are more likely to be ingested by wildlife.[36]

6.32 SPEL Environmental Integrated Water Solutions commented that the 'stormwater industry has a range of innovative measures available for its practitioners to use to capture plastic pollution and improve water quality'. These measures were developed in response to the regulatory requirement to remove gross pollutants from Port Phillip Bay and Sydney Harbour. SPEL explained that the EcoRecycle and Stormwater Trust NSW funded the introduction of innovative proprietary designed gross pollutant traps across Australia. SPEL encouraged the Australian Government to provide leadership and require the national implementation of innovative gross pollutant traps which comply with both domestic and international protocols.[37]

6.33 Stormwater Australia also stated that 'there should be a level of investment in complementary technologies that trap and retain litter and make the management of the water flowing towards marine environments more effective'.[38] However, as noted by Tangaroa Blue, retrofitting of existing systems is expensive 'so that it is not as common as it should be'.[39]

6.34 The value of gross pollutant traps in reducing pollution, has been acknowledged by the Australian Government, and the Department of the Environment

34 SPEL Environmental Integrated Water Solutions, *Submission 138*, p. 7.

35 SPEL Environmental Integrated Water Solutions, *Submission 138*, p. 6.

36 Professor Stephen Smith, *Submission 27*, pp. 6–7.

37 SPEL Environmental Integrated Water Solutions, *Submission 138*, p. 6. See also Take 3, *Submission 72*, p. 4.

38 Stormwater Australia, *Submission 67*, p. 2.

39 Ms Heidi Taylor, Tangaroa Blue Foundation, *Committee Hansard*, 10 March 2016, p. 29.

committed $1 million over four years from 2014–2018 for the installation of floating litter traps in the lower Yarra River, and raising community awareness.[40]

6.35 In 2015, the Senate Environment and Communications References Committee conducted an inquiry into stormwater management in Australia. This inquiry examined a number of issues including the implementation and management of stormwater infrastructure, and associated government policy. The committee made a number of recommendations, including the implementation of a National Stormwater Initiative and new funding models.[41]

Rubbish bins

6.36 Like stormwater systems, public rubbish bins can be a source of marine plastic pollution, and an important mitigation measure. The widespread implementation of infrastructure such as rubbish bins can encourage significant changes in consumer behaviour, and result in a reduction of marine plastic pollution.

6.37 The committee received a number of submissions which provided anecdotal evidence of the amount of plastic pollution which escapes into the marine environment from overflowing bins, or when rubbish bins are emptied. For example, Ms Erin Rhoads submitted that:

> While there are bins around the [Maribyrnong] river I believe the fundamental cause of the plastic pollution to be from rubbish brought down to the river from local households during storms, rain or high winds… Most of the trash I pick up is either done on a Thursday and Friday after the garbage and recycling bins have been collected. Bins up and down the street are full to overflowing.[42]

6.38 Similarly, Mr Robert McAlpine stated bins in his area of Wollongong are frequently blown over and spill rubbish which is subsequently blown into the ocean.[43] Professor Stephen Smith also commented on the problems with rubbish escaping from bins and submitted that:

> …even if people "do the right thing" placing items in the bins provided, these items may be transported onto the beach through: strong winds which lift the lids and mobilise lighter items; birds and animals that scavenge and remove items.[44]

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40 Department of the Environment, *Threat Abatement Plan for the impacts of marine debris on vertebrate marine life Review 2009–2014*, p. 46.

41 See Senate Environment and Communications References Committee, *Stormwater Management in Australia*, December 2015.

42 Ms Erin Rhoads, *Submission 162*, p. 1.

43 Mr Robert McAlpine, *Submission 122*, p.1.

44 Professor Stephen Smith, *Submission 27*, p. 6.

6.39 A number of submitters identified that the regular emptying of public rubbish bins is crucial in reducing the amount of plastic pollution escaping into the marine environment. For example, Professor Smith stated that the frequency of emptying bins is a key issue but this is 'often too low to deal with the rate of disposal leading to the placement of items outside the bins where they are more likely to be blown/transported into coastal habitats'.[45] Professor Smith added that 'flexible management by Councils, such as more frequent servicing during busy periods or at sites where litter disposal rates are high' could reduce the amount of pollution.[46]

6.40 An example of the problems of overloaded bins in popular areas was highlighted by Mr Dave West, Environmental Economist advising Clean Up Australia. Mr West told the committee that:

> …we have to recognise is that littering is not largely the 'tosser' any more. Government campaigns on that have had a profound effect.
>
> You would be staggered at the level of what we call 'bin bounce'. Go down to Darling Harbour at lunchtime. You cannot empty that bin fast enough, and bottles go 'ptoing!'. They hit the concrete and then they are down there. Or people put their bag down to eat their lunch and it blows away.[47]

6.41 However, despite the evidence that rubbish bins may be contributing to marine plastic pollution, the committee also received evidence that targeted infrastructure can in fact reduce pollution levels. Coca-Cola Amatil highlighted the 2008 *Litter Management in Australia* report published by the then Environment Protection and Heritage Council which found that of those surveyed, the most common reason given for littering was 'no bin nearby'.[48] Similarly, the Australian Food and Grocery Council submitted that 'research and studies have found that littered areas attract more litter'.[49]

6.42 The CSIRO told the committee that research into state, territory, regional and local government infrastructure, policy and expenditure has identified that coastal rubbish bins have been found to significantly reduce the amount of plastic pollution reaching the ocean. The CSIRO also explained that further research is being

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45 Professor Stephen Smith, *Submission 27*, p. 6.

46 Professor Stephen Smith, *Submission 27*, p. 6.

47 Mr Dave West, environmental economist advising Clean Up Australia, *Committee Hansard*, 18 February 2016, p. 39.

48 Coca-Cola Amatil, *Submission 192*, p. 4. See also, Environment Protection and Heritage Council, *Litter Management in Australia*, November 2008, http://www.nepc.gov.au/system/files/resources/020c2577-eac9-0494-493c-d1ce2b4442e5/files/wastemgt-rpt-litter-management-australia-200811.pdf, (accessed 31 March 2016), p. 4.

49 Australian Food and Grocery Council, *Submission 193*, p. 5.

conducted in order to assess the cost-effectiveness of local, regional and state initiatives. [50]

Container deposit schemes

6.43 Container deposit schemes (CDS) refer to programs for the collection of used beverage containers in exchange for a small amount of cash (for example, 10 cents per container). Containers can be returned to manufacturers via retailers, collected at designated depots, returned though reverse vending machines, or recovered as part of existing waste or recycling collection systems. Both South Australia and the Northern Territory have successfully implemented container deposit schemes.[51]

6.44 Previous iterations of the Environment and Communications Committee have conducted inquiries into the implementation, and management of container deposit schemes. These inquiries received evidence both in support of, and in opposition to, container deposit schemes. The committees found that there was widespread community support for such schemes and that there was generally evidence to support the claim that the schemes reduced litter in the environment. However, there were concerns raised regarding potential associated costs of operation both to manufacturers, retailers, consumers, and the broader community. There were also concerns regarding a lack of consensus on an appropriate model for implementation.[52]

6.45 The committee accepts the findings of these previous inquiries and has chosen to examine the evidence provided in the context of identifying mitigation strategies to reduce the threat of marine plastic pollution.

6.46 Container deposit schemes work on littering behaviour by providing 'an incentive for people to change their behaviour to try and redeem the reward'.[53] Not only is the person consuming the beverage encouraged to hold onto the empty container for later redemption, but also other people are provided with an incentive to pick up littered containers to receive the redemption. This increases the number of beverage containers entering the recycling stream rather than landfill or litter, and ultimately the marine environment.

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50 CSIRO, *Submission 7*, p. 16.

51 For more information on the operation of these schemes see http://www.epa.sa.gov.au/environmental_info/container_deposit and http://www.ntepa.nt.gov.au/container-deposits.

52 See Senate Environment and Communications References Committee, *Operation of the South Australian and Northern Territory container deposit schemes*, November 2012; Senate Environment, Communications and the Arts Legislation Committee, *Environment Protection (Beverage Container Deposit and Recovery Scheme) Bill 2009*, September 2009; and Senate Standing Committee on Environment, Communications and the Arts, *Management of Australia's waste streams (including consideration of the Container Recycling Bill 2008)*, September 2008.

53 Australian Food and Grocery Council, *Submission 193*, p. 6.

6.47 The following discussion canvasses the effectiveness of CDSs in reducing marine plastic pollution and community and government support for CDSs. The various models of CDSs are outlined and the evidence provided by industry is examined.

Effectiveness of container deposit schemes

6.48 The Total Environment Centre submitted that the single largest source of marine plastic pollution is beverage sector waste, with plastic bottles, lids, straws and cups representing about half of the material (by volume) in the litter stream, and 60 per cent of all plastic rubbish recovered from beaches and waterways.[54] Similarly, Dr Britta Denise Hardesty, CSIRO, commented that beverage containers make up a significant proportion of litter found in coastal areas. Dr Hardesty stated:

> Globally, it is approximately 40 per cent of all the litter that is found in coastal areas. That is based upon several decades of clean-up data through the International Coastal Cleanup. Within Australia, we find similar amounts that are beverage industry associated.[55]

6.49 Apart from South Australia and the Northern Territory, 'the predominant form of recycling is kerbside collection…which captures material that is consumed largely at home'. Mr Ian Kelman, Executive Officer of the Association of Container Deposit Scheme Operators, commented that kerbside recycling 'does not capture material consumed in clubs, pubs, entertainment and sporting venues' and this material generally goes into landfill or is littered.[56]

6.50 As has previously been noted, the CSIRO has conducted an analysis of litter found in Australian coastal areas. The results of this analysis indicate that in states which have implemented beverage CDSs there is a noticeable reduction in this type of litter. Dr Hardesty stated:

> We used the Clean Up Australia Day data from 2012 and did an analysis across all the different sites and all the states and territories. What we find is that there is a highly significant difference in the number of beverage container items in South Australia, compared to the other states and territories. For example, in some of the other states and territories, one of three items that you pick up on the beach would be a beverage container—we limited it very strictly to caps, glass bottles, plastic bottles and aluminium cans. When you look in South Australia, it is one in 12 items that you find. That is a very notable difference, and it is a highly statistically significant difference. It would appear that that could be correlated with the existing container deposit scheme in South Australia.[57]

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54 Total Environment Centre, *Submission 1*, p. 5.

55 Dr Britta Denise Hardesty, CSIRO, *Committee Hansard*, 26 February 2016, p. 2.

56 Mr Robert Kelman, Association of Container Deposit Scheme Operators, *Committee Hansard*, 18 February 2016, p. 73.

57 Dr Britta Denise Hardesty, CSIRO, *Committee Hansard*, 26 February 2016, p. 2.

6.51 The CSIRO concluded that South Australia's CDS was 'very successful, reducing the number of beverage containers, the dominant plastic item in the environment, by a factor of three'.[58]

6.52 CDSs have been implemented in forty other jurisdictions around the world. Professor Smith commented that 'container deposit schemes have been shown to be effective everywhere they have been introduced'.[59] Mr Angel added that CDSs provide a means to address a large percentage of marine plastic pollution quickly and effectively as overseas schemes have proven.[60]

6.53 Witnesses commented on the expected benefits of the implementation of a CDS by all states and territories. Mr Kelman explained that a national CDS could be estimated to remove an additional 35,000 tonnes from the waste stream. This material is currently either littered or disposed of in landfill. Mr Kelman stated that globally, CDSs achieve a recycling capture rate of between 80 and 96 per cent of beverage containers. This is in comparison to the overall recycling rate of 42 per cent currently achieved in Australia.[61]

6.54 Mr Kelman also noted that in New South Wales, 44 per cent of the volume of litter recorded is estimated to be waste associated with the beverage container industry. The introduction of a CDS could reduce the volume of litter by up to 40 per cent, in line with the New South Wales Government litter reduction target.[62]

6.55 The benefits of introducing a CDS are also seen in the differences in recycling rates between South Australia and New South Wales:

> In South Australia the recycling rates are as high as 85 per cent. In the Northern Territory the diversion from landfill is coming to millions and millions of containers. In New South Wales we are lucky to get 35 per cent. In Tasmania you are lucky to get 30 per cent.[63]

6.56 Clean Up Australia noted that improved recycling rates with CDSs are due in part to addressing 'the most problematic aspect of the waste stream—providing both the collection infrastructure and interface with consumers to address away from home

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58 CSIRO, *Submission 7*, Appendix 2, 'Executive Summary "Understanding the effects of marine debris on wildlife: Final report to Earthwatch Australia"', p. 11.

59 Professor Stephen Smith, *Committee Hansard*, 18 February 2016, p. 7.

60 Mr Jeff Angel, Total Environment Centre, *Committee Hansard*, 18 February 2016, p. 48.

61 Mr Robert Kelman, Association of Container Deposit Scheme Operators, *Committee Hansard*, 18 February 2016, p. 73.

62 Mr Robert Kelman, Association of Container Deposit Scheme Operators, *Committee Hansard*, 18 February 2016, p. 73.

63 Ms Terrie-Ann Johnson, Clean Up Australia, *Committee Hansard*, 18 February 2016, p. 36.

consumption i.e. hospitality outlets, public venues and recreational consumption'. In these areas recycling rates are very low, often less than 10 per cent.[64]

Community support for beverage container deposit schemes

6.57 The committee received over 100 submissions supporting the introduction of a national CDS. In addition to the submissions, the committee also received approximately 700 form letters calling, in part, for the introduction of a national scheme.

6.58 Clean Up Australia submitted that market research conducted by Newspoll for both Clean Up Australia and the Boomerang Alliance has shown high levels of community support for CDSs over the past decade. It commented that the most recent poll conducted in February 2015 showed that 85.10 per cent of respondents supported the introduction of CDSs.[65]

6.59 Clean Up Australia also submitted that in follow-up activity conducted with clean-up volunteers, discontent has been expressed in the perceived lack of leadership in developing and implementing plastic pollution mitigation measures, including CDSs. Ms Johnson commented further:

> There is petition after petition being run around the country…for the integration of container deposits. They are looking for assistance on being able to bring in preventative measures, because there is a level of fatigue on cleaning it up. We are actually working with people now on preventing it in the first place.[66]

6.60 A number of witnesses also highlighted the additional benefits arising from the introduction of a CDS. Mr Sahukar told the committee that container deposit schemes have been proven successful because they 'internalise the costs of littering and create community incentives to recycle more'.[67] The encouragement of widespread community-based litter collection and recycling was also noted by Mr Angel from the Total Environment Centre, who stated:

> The point about container deposits that attracts us very strongly is that you are essentially creating hundreds of litter collectors out there every week looking for the empty containers that have a 10 cent refund on them. You do not actually have to pay anybody—the system motivates that collection and the 10 cent refund changes behaviour, where some people may say, 'I am not going to throw it away anymore, because I want my 10 cents back.[68]

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64 Clean Up Australia, *Submission 9*, p. 7.

65 Clean Up Australia, *Submission 9*, pp. 4–5.

66 Ms Terrie-Ann Johnson, Clean Up Australia, *Committee Hansard*, 18 February 2016, p. 40.

67 Mr Nari Sahukar, EDOs of Australia, *Committee Hansard*, 18 February 2016, p. 66.

68 Mr Jeff Angel, Total Environment Centre, *Committee Hansard*, 18 February 2016, p. 50

6.61 Mr Kelman also commented that in South Australia the introduction of a CDS has resulted in a 'cultural phenomenon' where:

> …individuals…perhaps pensioners or homeless people in those areas, have an area of the state which is their turf, as they describe it. It might be a couple of beaches or a few parks. That individual generally goes through the area and collects whatever empty containers they can. They obviously make some additional income for themselves.[69]

6.62 Community groups have also benefited from the implementation of container deposit schemes. In particular, Beachpatrol Australia pointed to the Scouts in South Australia who have been able to generate significant profits through engagement with CDSs.[70]

State and territory, and local government support for container deposit schemes

6.63 As has already been noted, South Australia and the Northern Territory have both established state-based CDSs. Other states are currently investigating the implementation of such schemes.

6.64 South Australia established a CDS in 1977, which is now administered under the state's *Environment Protection Act 1993*. In 2011, the Northern Territory also passed legislation to establish a CDS which commenced in 2012. The Northern Territory scheme was designed to operate in alignment with the South Australian CDS. In 2011, an Intergovernmental Agreement was signed between the South Australian and Northern Territory governments which provided for mutual assistance, and where possible, alignment of each jurisdiction's CDS. This Agreement also called for the promotion of consistency in the regulation, development and administration of the schemes, in particular ensuring that similar types of containers are regulated.[71]

6.65 On 12 February 2015, the New South Wales Premier, the Hon Mike Baird MP, announced that New South Wales will implement a CDS by July 2017. The CDS is designed to complement litter reduction strategies currently implemented under the $465.7 million project, *Waste Less, Recycle More*.[72] The NSW Government is

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69 Mr Robert Kelman, Association of Container Deposit Scheme Operators, *Committee Hansard*, 18 February 2016, pp. 73–74.

70 Beachpatrol Australia, *Submission 168*, p. 3. See also: Environment Protection Authority South Australia, http://www.epa.sa.gov.au/environmental_info/container_deposit/testimonials.

71 Northern Territory Environment Protection Authority, *Review of containers regulated under the NT Container Deposit Scheme*, February 2014, p. 8, http://www.ntepa.nt.gov.au/__data/assets/pdf_file/0006/352815/cds_review_containers_report_rawtec.pdf, (accessed 10 March 2016).

72 New South Wales Environment Protection Authority, http://www.epa.nsw.gov.au/waste/cds-intro.htm, (accessed 10 March 2016).

currently exploring CDS models, governance, and alignment with other state and territory jurisdictions.[73]

6.66 Similarly, the Queensland Department of Environment and Heritage Protection established an Advisory Group in 2015 to investigate state-based options for the implementation of a CDS. Recommendations from the Advisory Group are expected to be released in early 2016.[74]

6.67 Support for the implementation of CDSs has also come from local governments. Dr Pudasaini commented that the Liverpool City Council is:

> …actively lobbying to get a container deposit scheme implemented. We really want to get that implemented ASAP, and the state government has got a plan to do that from 1 July 2017. We are actively participating in the discussion on how that could be implemented effectively. Any forum that gives us an opportunity to raise this and talk about what we experience we participate in.[75]

6.68 In discussing state and territory support for the implementation of CDSs, Mr West noted that over the past 12 years, 'every single opposition [party] has been pro container deposits' however once in government, they continue to express support for such schemes but:

> …play a disingenuous game of "We would like a national scheme. Oops—the national scheme did not get up!" The national leadership—rightfully—says it's the state's responsibility and we didn't get an accord.' And it bounces backwards and forwards, backwards and forwards.[76]

Container deposit scheme models

6.69 The committee received evidence on the relative effectiveness of a variety of CDS models. The committee also received evidence on the costs associated with these models.

6.70 CDSs operate through a system where a deposit value is added to the cost of a beverage, and this deposit is redeemed when the container is returned to a collection point. In South Australia and the Northern Territory the deposit is 10 cents per

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73 New South Wales Environment Protection Authority, *NSW Container Deposit Scheme: Discussion Paper*, 19 December 2015, http://www.epa.nsw.gov.au/resources/waste/container/150286-CDS-discussion-paper.pdf, (accessed 10 March 2016).

74 Queensland Department of Environment and Heritage Protection, https://www.ehp.qld.gov.au/waste/container-deposit-scheme.html, (accessed 10 March 2016).

75 Dr Madhu Pudasaini, Liverpool City Council, *Committee Hansard*, 18 February 2016, p. 41.

76 Mr Dave West, environmental economist advising Clean Up Australia, *Committee Hansard*, 18 February 2016, p. 36.

container, but in Europe the deposit is much higher, up to 25 Euro cents, about A35c to A40c.[77]

6.71 Mr Kelman described the deposit as the 'primary mechanism' of a CDS. The deposit is 'an incentive to retain that container' rather than letting it enter the waste stream or become litter.[78] Mr Kiernan similarly stated 'instead of seeing some waste on the beach, beside the road or in the park, you are seeing money'.[79]

6.72 Ms Johnson commented that incentive-based models are 'world's best practice' and that:

> It is a well-worked model and it encourages people so that even if you leave it to one side you can be sure that some smaller person will go and collect that for you because they want that 10c. It puts a value on the container.[80]

6.73 Mr Kelman highlighted the importance of establishing infrastructure for the collection of containers, and the ability for consumers to redeem their deposit. The operation of return mechanisms such as reverse vending machines, and container recycling depots can either fall under the jurisdiction of the beverage industry, the retail sector, or private sector operators. Mr Kelman provided examples from a variety of jurisdictions. For example, Norway sets:

> …a target rate for recycling, and if the industry does not achieve that target rate then the industry is taxed a certain amount. So the industry have an incentive to make sure that they reach their target, which is in the range of 90 per cent return rates. The industry then manage the scheme on their own. They run the scheme and have a private organisation that operates it. That organisation then buys reverse vending machines from the market. They have other people operate those systems and, again, they apply a handling fee for that service by the recycling sector.[81]

6.74 This is in comparison to what Mr Kelman described as jurisdictions which apply a 'retailer obligation' which requires retailers having an obligation to recover containers which have been purchased wholesale from producers and brand owners. For example:

> In Europe…you will generally find that reverse vending machines and automatic collection centres are established inside the Aldi or the Lidl supermarket itself. Consumers will go in and dispose of their containers

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77 Mr Robert Kelman, Association of Container Deposit Scheme Operators, *Committee Hansard*, 18 February 2016, p. 74.

78 Mr Robert Kelman, Association of Container Deposit Scheme Operators, *Committee Hansard*, 18 February 2016, p. 73.

79 Mr Ian Kiernan, Clean Up Australia *Committee Hansard*, 18 February 2016, p. 32.

80 Ms Terrie-Ann Johnson, Clean Up Australia, *Committee Hansard*, 18 February 2016, p. 35.

81 Mr Robert Kelman, Association of Container Deposit Scheme Operators, *Committee Hansard*, 18 February 2016, p. 74.

> through the reverse vending machines. At the back of the machine are a whole lot of sorting and compaction conveyors et cetera which put the materials straight into a certain bin—an aluminium bin, a three colours of glass bin et cetera. They get a coupon, which they then take to the checkout, and they get that redeemed amount of deposits—if they put 10 bottles in, let's say it is 2.5 euros, and they will get that discounted off their shopping.[82]

6.75 Globally, CDS infrastructure is paid for through private sector investment. This investment is achieved through the payment of handling fees. Mr Kelman stated that:

> Every container has a 10c deposit placed on it that the consumer pays and gets back. In addition to that, in New South Wales there is likely to be something like 3½c to 4½c per container that is recouped by the private sector operator via either a manual depot or, potentially, an automated reverse vending machine or some facility like that...Every scheme in the world has a payment system to the private sector to collect.[83]

6.76 There are a number of different ways to set handling fees under CDSs. In some jurisdictions, handling fees are mandated by legislation, while others are negotiated between beverage manufacturers and recycling companies. However, Mr Kelman argued that a CDS can be managed at a neutral cost through unredeemed deposits, and offsets to handling fees through the sale of collected material. Mr Kelman stated that:

> …for 100 per cent of containers that are sold, the consumer pays a deposit. An 80 per cent return rate, as occurs in South Australia, means that you have got 20 per cent of deposits that have been paid but not redeemed by the consumer. That is a considerable amount of money. In New South Wales I think they are working on the basis of 4.5 billion containers; that is $450 million worth of deposits. Twenty per cent of $450 million is $90 million worth of unredeemed deposits. That then offsets the producer's handling fees.[84]

6.77 Mr Kelman explained that in South Australia, collected material has been valued at 2 cents per container. This money, in addition to the amount collected through unredeemed deposits, can result in a scheme which should be cost neutral to the producer.[85]

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82 Mr Robert Kelman, Association of Container Deposit Scheme Operators, *Committee Hansard*, 18 February 2016, p. 74.

83 Mr Robert Kelman, Association of Container Deposit Scheme Operators, *Committee Hansard*, 18 February 2016, p. 74.

84 Mr Robert Kelman, Association of Container Deposit Scheme Operators, *Committee Hansard*, 18 February 2016, p. 75.

85 Mr Robert Kelman, Association of Container Deposit Scheme Operators, *Committee Hansard*, 18 February 2016, p. 75.

6.78 Costs can also be reduced through technological efficiencies. Mr Kelman told the committee that the net handling fee in South Australia (after the use of unredeemed deposits) is 5 cents per container as 'it is a manual scheme and it has not automated…with all the efficiencies and cost gains as a result of that'.[86] Mr Kelman told the committee that there are currently 100,000 automated reverse vending machines operating globally, and that the majority operate on a coupon system. Coupons are able to provide a refund while reducing the risk of vandalism to the machine which may occur if cash refunds were provided. Reverse vending machines also play a pivotal role in data collection as they are able to scan a barcode and report back to a central system which allows for the invoicing of the brand owner.[87]

Industry views

6.79 The committee received evidence that the Australian beverages industry 'recognises that marine plastic pollution is a complex and very real problem and therefore needs an informed and considered approach to any solutions framework'.[88] However, there is widespread industry concern that 'in 2016, we must be beyond litter and recycling models that are nearly 50 years old'.[89] Mr Kelman told the committee that in relation to the implementation of container deposit schemes, 'Coca-Cola are very much a driver of the opposition globally'.[90]

6.80 In particular, Coca-Cola Amatil raised concerns with the associated costs of refund-based container deposit schemes and commented on the proposed CDS in New South Wales. While stating that 'the first priority of any waste solution must be a cleaner NSW', it went on to comment that:

> …we believe it must also minimise the cost impact on consumers and industry, avoid duplication of existing waste collection and disposal infrastructure and ensure NSW remains an attractive place to do business.[91]

6.81 Coca-Cola Amatil submitted that the introduction of a CDS in New South Wales would have set-up costs of approximately $120 million and annual operating costs of approximately $200 million. Coca-Cola Amatil was also concerned that it will increase the cost of beverages to consumers.[92] The Australian Food and Grocery Council (AFGC) also estimated that there will be a $63 million impact on the

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86 Mr Robert Kelman, Association of Container Deposit Scheme Operators, *Committee Hansard*, 18 February 2016, p. 75.

87 Mr Robert Kelman, Association of Container Deposit Scheme Operators, *Committee Hansard*, 18 February 2016, p. 75.

88 Mr Geoff Parker, Australian Beverages Council, *Committee Hansard*, 31 March 2016, p. 2.

89 Mr Geoff Parker, Australian Beverages Council, *Committee Hansard*, 31 March 2016, p. 2.

90 Mr Robert Kelman, Association of Container Deposit Scheme Operators, *Committee Hansard*, 18 February 2016, p. 75.

91 Coca-Cola Amatil, *Submission 192*, p. 2.

92 Coca-Cola Amatil, *Submission 192*, p. 4.

beverage industry through reduced consumer demand.[93] The AFGC went on to submit that the reduction in demand will effect investment and employment in the sector. The AFGC stated:

> Modelling by ACIL Allen forecast a national Refund CDS to result in the loss of 1,700 jobs (or 3.5%) from the Australian beverage and related packaging industry. This equates to a reduction in cumulative labour incomes of $2.6 billion or a net present value of –$1.0 billion and a reduction in cumulative gross value added of $6.3 billion or a net present value of –$2.6 billion.[94]

6.82 The beverages industry, represented by the AFGC, has developed a program which offers an alternative to the proposed introduction of a refund-based CDS in New South Wales. Coca-Cola Amatil submitted that the *Thirst for Good* program involves:

> …funding bin infrastructure, collection and litter clean collection and litter clean-up activities in hotspots such as roads and public places, Reverse Vending Machines (RVMS) in convenient areas and donations to local charities and community groups when individuals return their drink containers.[95]

6.83 The Boomerang Alliance challenged the beverage industry's assertion that *Thirst for Good* would provide a more cost effective initiative than the introduction of a refund-based CDS. The Boomerang Alliance stated that from its analysis of the *Thirst for Good* program, it is 'apparent' that the initiative 'operates at a rough cost of 95c per container recovered ($8983.20 per tonne)' which is 'around 4 times the current cost of litter abatement ($2900/tonne)'. It concluded that 'it is clear that Thirst for Good is less cost efficient—coming at a cost some 20 times greater (per unit recovered) than the gross operating costs of a modern CDS'.[96]

6.84 The 100 reverse vending machines proposed under the *Thirst for Good* program will offer non-financial incentives such as movie vouchers or tickets to sporting events.[97] However, Mr Ian Kiernan from Clean Up Australia criticised this initiative as it will remove 'the commercial incentive' from container deposit schemes.[98] Ms Johnson added that internationally, schemes which used donation rather than a direct commercial incentive have been shown not to work.[99] The

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93 Australian Food and Grocery Council, *Submission 193*, p. 5.

94 Australian Food and Grocery Council, *Submission 193*, p. 6.

95 Coca-Cola Amatil, *Submission 192*, p. 3.

96 Boomerang Alliance, *Supplementary Submission 77.1*, p. 2.

97 Australian Beverages Council, *Submission: NSW Container Deposit Scheme—Discussion Paper*, http://australianbeverages.org/wp-content/uploads/2013/10/Australian-Beverages-Council-NSW-CDS-Discussion-Paper-Submission1.pdf, (accessed 10 March 2016).

98 Mr Ian Kiernan, Clean Up Australia, *Committee Hansard*, 18 February 2016, p. 36.

99 Ms Terrie-Ann Johnson, Clean Up Australia, *Committee Hansard*, 18 February 2016, p. 35.

Boomerang Alliance further noted that globally, the two most successful non-financial based schemes—the *Reimagine* program rolled out in Texas, and the Tesco rewards program in the UK—were 'better researched and supported' than *Thirst for Good*, but still ultimately failed. Both of these programs were abandoned after four years, and recorded low participation rates with *Reimagine* only achieving 20 per cent of its monthly target at its peak. The Boomerang Alliance described the reverse vending component of the *Thirst for Good* program as 'basically pointless and will have little impact other than a visible face to promote the beverage industry'.[100]

6.85 Mr Gary Dawson, Chief Executive Officer of the AFGC, told the committee that the program provides a viable alternative to a refund-based CDS and that it meets the five criteria that the New South Wales Government has set for the introduction of a CDS. Mr Dawson stated:

> It is particularly targeted at those five criteria…that it be cost effective, use financial incentives, target away-from-home consumption, not undermine kerbside, and use reverse vending machines and modern technology. Over the last year, that Thirst for Good package has been developed to specifically target that. We believe it can deliver that target that New South Wales has set faster than any alternative scheme. It is an example of very constructive engagement on this broader challenge around litter and recycling, which contributes to the issues around marine pollution…[101]

6.86 Similarly, the Australian Beverages Council submitted that:

> …action must first start with identifying the exact nature of the problem, targeting strategies to where they are most needed and addressing consumer behaviour. This last piece must include initiatives like education programs, greater penalty enforcement, targeting coordination of hotspots and more away-from-home recycling options of unique, innovative and tailored models for reducing litter and increasing recycling, like the industry-funded Thirst for Good scheme in New South Wales, which achieves these objectives.[102]

6.87 The AFGC argued that 'while a refund CDS incentivises people to clean up beverage containers, it does not address the existing stock of non-beverage container litter'.[103] Ms Tanya Barden, Director of Economics and Sustainability explained that:

> …to be effective in the litter space you need to be really active across a number of areas: cleaning up existing litter, because litter acts as a magnet and will attract other sources of litter; education to try and get behaviour change amongst consumers; enforcement of littering behaviour when it occurs; and infrastructure…Under a CDS, if only beverage containers are

100 Boomerang Alliance, *Supplementary Submission 77.1*, p. 3.

101 Mr Gary Dawson, Australian Food and Grocery Council, *Committee Hansard*, 31 March 2016, pp. 1–2.

102 Mr Geoff Parker, Australian Beverages Council, *Committee Hansard*, 31 March 2016, p. 2.

103 Australian Food and Grocery Council, *Submission 193*, p. 5.

cleaned up, then remaining litter could still be a magnet for attracting other types of litter, including beverage containers.[104]

6.88 The AFGC submitted that the *Thirst for Good* program seeks to 'reduce not only beverage litter, but all litter'.[105] Mr Dawson told the committee that 'any effective approach has to be broader than just beverage containers'.[106] Similarly, Mr Geoff Parker, Chief Executive Officer of the Australian Beverages Council, commented that 'to focus on just one part of the waste system is antiquated, inefficient and ineffective'.[107]

6.89 However, the Boomerang Alliance criticised the litter collection component of the *Thirst for Good* program as being insufficient to recover an amount of litter that would 'make a meaningful difference'.[108] It also submitted that litter would build up between litter collection activities, and expressed doubt that additional bins would have a significant impact, noting that the existing widespread availability of public bins in New South Wales has done little to prevent littering.[109]

6.90 Coca-Cola Amatil argued that in New South Wales, where 4.2 billion beverages are sold per annum, 'ninety-six per cent of beverage containers are already collected through existing systems'[110] and that a container deposit scheme fails to address other types of litter. The committee notes that the remaining four per cent of beverage containers not captured through landfill or recycling are littered, and in New South Wales alone, this constitutes an estimated 160 million containers entering the environment annually. This is a significant number of containers and in New South Wales, beverage containers represent 44 per cent of the litter volume, almost twice the volume of the next largest category—take-away cups and food containers.[111]

6.91 Further, the committee notes that a capture rate of 96 per cent includes both 32 per cent entering landfill, and 64 per cent entering existing recycling systems. The New South Wales Government has stated that the objective of a CDS is to make sure that 'containers that are diverted away from litter, or that would have otherwise been

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104 Ms Tanya Barden, Australian Food and Grocery Council, *Committee Hansard*, 31 March 2016, p. 4.

105 Australian Food and Grocery Council, *Submission 193*, p. 3.

106 Mr Gary Dawson, Australian Food and Grocery Council, *Committee Hansard*, 31 March 2016, p. 6.

107 Mr Geoff Parker, Australian Beverages Council, *Committee Hansard*, 31 March 2016, p. 2.

108 Boomerang Alliance, *Supplementary Submission 77.1*, p. 4.

109 Boomerang Alliance, *Supplementary Submission 77.1*, p. 1.

110 Ms Liz McNamara, Coca-Cola Amatil, *Committee Hansard*, p. 3.

111 New South Wales Environment Protection Authority, *NSW Container Deposit Scheme: Discussion Paper*, 19 December 2015, p. 4, http://www.epa.nsw.gov.au/resources/waste/container/150286-CDS-discussion-paper.pdf, (accessed 10 March 2016).

landfilled, are recycled'.[112] The committee is unconvinced that the *Thirst for Good* campaign would achieve such outcomes for recycling given the apparent focus on increasing rates of litter collection.

6.92 Evidence of industry support for research specifically targeting the threat of marine pollution was also provided to the committee. The AFGC explained that that the National Packaging Covenant Industry Association (NPCIA), as the service delivery body for the Australian Packaging Covenant is contributing to research efforts understand the pathways of land-based litter into the marine environment. The NPCIA is jointly funding a study with the CSIRO that will use spatial statistical modelling across the Australian coastline to evaluate likely routes for debris to move into the marine environment. The study will also examine the effectiveness of government initiatives in reducing marine plastic pollution.[113]

6.93 Coca-Cola Amatil also submitted that it is 'committed to working collaboratively with industry, government and environmental groups to help reduce litter and increase recycling outcomes across Australia'.[114] It provided evidence of its commitment to seeking new technologies and initiatives to reduce its environmental impact across the supply chain. These include a reduction in the amount of PET used in the production of bottles, increasing the amount of recycled content in PET packaging, the introduction of lightweight label packaging, and the self-manufacture of bottles at all Australian manufacturing facilities.[115]

Impact on kerbside recycling

6.94 The beverage industry raised concerns that the implementation of new CDSs would have negative effects on existing kerbside recycling schemes. For example, the AFGC submitted that a Refund CDS would divert a substantial number of beverage containers from the kerbside system into the new scheme. AFGC argued that a CDS, by its nature, 'provides an incentive for people to change their behaviour to try and redeem the reward' but the incentive does not distinguish between containers consumed at home versus those consumed away from home and potentially littered. It concluded that 'a 10c deposit would devastate the existing kerbside system, with only an estimated 7% of containers remaining in the system'.[116]

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112 New South Wales Environment Protection Authority, *NWS Container Deposit Scheme: Discussion paper*, 19 December 2015, p. 4, http://www.epa.nsw.gov.au/resources/waste/container/150286-CDS-discussion-paper.pdf, (accessed 10 March 2016).

113 Australian Food and Grocery Council, *Submission 193*, pp. 3–4. See also, Australian Packaging Covenant, correspondence dated 15 April 2016, p. 2.

114 Coca-Cola Amatil, *Submission 192*, p. 4.

115 Coca-Cola Amatil, *Submission 192*, p. 2.

116 Australian Food and Grocery Council, *Submission 193*, p. 6.

6.95 Ms McNamara, Group Head of Public Affairs and Communications for Coca-Cola Amatil similarly expressed concern about the 'cannibalisation of the existing kerbside system' through the introduction of a CDS. Ms McNamara argued that consumers will hold the container and return it directly rather than through the kerbside system.[117]

6.96 Mr Jeff Maguire, Director of Statewide Recycling, a subsidiary of Coca-Cola Amatil, pointed to the rates of kerbside recycling in South Australia to support this argument and commented that:

> My organisation only receives about 12 per cent of its recycled content from kerbside in South Australia because the CDS system has been there and has been entrenched in South Australia for a long time. If we were to introduce a CDS system in New South Wales, it would certainly cannibalise what is an existing low-cost system in kerbside, to a large extent.[118]

6.97 However, this view was challenged by Clean Up Australia and the Boomerang Alliance. Clean Up Australia noted that currently, in states and territories that have not implemented a CDS, 'we do not have any incentives for recycling' and as a result, only 20 per cent of items are recycled—and this is largely achieved through kerbside recycling.[119]

6.98 The Boomerang Alliance pointed to a study by PricewaterhouseCoopers conducted in 2010 into ways to recover used beverage containers. Systems in Europe, North America, Japan and Australia were evaluated. The findings included that:

- Deposit Systems are more sustainable than kerbside collection of beverage containers;
- Deposit Systems for beverage containers enable higher collection rates and better recycling;
- One way deposit systems are not necessarily more expensive than kerbside collection;
- Deposit Systems are more cost effective than kerbside collection; and
- Deposit Systems and kerbside collection can co-exist very well.[120]

Committee view

6.99 The committee accepts the evidence that source reduction rather than clean-up should be the focus of mitigation strategies. Source reduction encompasses changes in consumer behaviour, implementation and maintenance of infrastructure such as gross

117 Ms Liz McNamara, Coca-Cola Amatil, *Committee Hansard*, 31 March 2016, p. 7.

118 Mr Jeff Maguire, Statewide Recycling, *Committee Hansard*, 31 March 2016, p. 7.

119 Ms Terrie-Ann Johnson, Clean Up Australia, *Committee Hansard*, 18 February 2016, p. 33.

120 Boomerang Alliance, *Submission 77*, p. 29.

pollutant traps and public rubbish bins, and waste management initiatives such as beverage container deposit schemes that both change consumer behaviour and provide a disposal mechanism.

6.100 Community awareness and education campaigns which provide information designed to change the choices and behaviour are crucial to effective threat mitigation. These campaigns are frequently conducted with limited funding by non-government and community organisations, and local government. Similarly, the implementation and management of infrastructure such as gross pollutant traps and rubbish bins have associated financial impost on local government. The evidence indicates that such infrastructure is critical to reducing the amount of urban litter moving into the marine environment. The committee is of the view that education and awareness-raising campaigns, and infrastructure should be adequately funded and supported by Commonwealth, and state and territory governments.

6.101 Evidence that CDSs provide a simple, cost-effective mechanism that will reduce the number of beverage containers found in urban litter, and in marine debris, was presented to the committee. Such schemes create behavioural change as containers are diverted from landfill and litter by those seeking to redeem the deposit. Further, it was argued that they reduce costs associated with clean-up activities and landfill management.

6.102 The committee notes industry concerns regarding costs associated with the implementation of refund-based schemes. The committee also notes the alternative models proposed by the beverages industry.

6.103 However, the committee accepts the evidence that CDSs provide a cost-effective and efficient mechanism to successfully reduce the volume of beverage containers found in the marine environment. The committee is of the view that the Australian Government should actively encourage the implementation of container deposit schemes by states and territories which have not already done so.

Chapter 7

Source reduction – product stewardship and legislative and regulatory frameworks

7.1 Many submitters argued that the marine plastic pollution should be addressed through greater product stewardship. As one submitter noted, 'the problem is not so much with the plastic itself, but with the custodianship of plastic in its production and use cycle'.[1] Submitters also commented on the need to focus on design and innovation particularly in relation to plastic packaging while others supported the immediate ban of single-use plastic bags and microbeads.

7.2 This chapter explores reducing the sources of marine plastic pollution through improvements in product stewardship, regulatory and legislative changes and enforcement activities.

Product stewardship

7.3 A number of submitters emphasised the importance of increased product stewardship and producer responsibility in reducing the sources of marine plastic pollution. Product stewardship is an approach to managing the impacts of products and materials. It acknowledges that those engaged in the production, sale, use and disposal of products and materials have a shared responsibility to ensure that these products and materials are managed in a way that reduces their impact on the environment, and human health and safety.[2]

7.4 The Commonwealth *Product Stewardship Act 2011* provides the framework for the effective management of a range of products and materials, including packaging. The Act allows for co-regulatory and voluntary product stewardship schemes such as the Australian Packaging Covenant (APC).[3]

The Australian Packaging Covenant

7.5 The APC aims to encourage the use of more sustainable packaging, increase recycling rates and reduce packaging litter. As noted in Chapter 4, the Australian Government, state and territory governments, and the packaging industry are currently negotiating new Covenant arrangements. The committee received evidence which canvassed the effectiveness of the APC to address pollution arising from packaging.

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1 Mr Stephen Mitchell, *Submission 71*, p. 3.

2 Department of the Environment, http://www.environment.gov.au/protection/national-waste-policy/product-stewardship, (accessed 10 March 2016).

3 This is further discussed in Chapter 4.

Criticism of voluntary participation

7.6 The voluntary nature of the APC was criticised by some submitters as being detrimental to achieving a reduction in plastic pollution associated with product packaging. Submitters argued that compliance with measures under the APC should be mandatory, and that enforcement and application of penalties would significantly improve the effectiveness of the scheme.

7.7 Ms Rachel Walmsley, Policy and Law Reform Director from EDOs of Australia commented that the voluntary approach lacks 'regulatory teeth'[4] while Mr Jeff Angel from the Total Environment Centre went further and described the APC as an 'utter failure'.[5]

7.8 Dr Sarah Waddell from the National Environmental Law Association (NELA) told the committee that:

> The voluntary approach is often seen as a way of government stepping back from taking a regulatory approach…But I think that, because it started as a voluntary approach, it has allowed the government to drop the ball in backing it up with a regulatory approach.[6]

7.9 NELA also noted that under the APC, failure to adhere to certain obligations 'theoretically results in the organisation being referred to the relevant government for review and a possible fine'.[7] However, fines are not applied as:

> …while the required mirror legislation has been enacted in each jurisdiction in Australia, the associated regulations under which signatories can be fined for non-compliance with their obligations have not yet been implemented.[8]

7.10 NELA went on to suggest that implementing regulations and enforcing them could significantly increase the effectiveness of the APC, 'as well as any expanded or complementary scheme intended to address plastic life cycles more generally'.[9]

7.11 In addition to implementing the regulations, Ms Terrie-Ann Johnson from Clean Up Australia argued that there is a need for follow up and review under the APC. Ms Johnson stated:

> Not only does there need to be mandatory signatures; there needs to be mandatory follow-up and review, and reporting and recording of the outcomes. Unfortunately, what is happening is a lot of people are signing

4 Ms Rachel Walmsley, EDOs of Australia, *Committee Hansard*, 18 February 2016, p. 69

5 Mr Jeff Angel, Total Environment Centre, *Committee Hansard*, 18 February 2016, p. 46.

6 Dr Sarah Waddell, National Environmental Law Association, *Committee Hansard*, 18 February 2016, p. 30.

7 National Environmental Law Association, *Submission 132*, p. 6.

8 National Environmental Law Association, *Submission 132*, p. 6.

9 National Environmental Law Association, *Submission 132*, p. 6.

> up, but it is not being monitored, it is not being reviewed. Therefore, the statistics that are coming out of the covenant are not necessarily representative of what is really happening.[10]

7.12 A failure as a consequence of the voluntary nature of the APC was highlighted by the Total Environment Centre which argued that very few of the APC's recycling achievements have occurred through voluntary programs. Rather:

> …the majority of the Australian Packaging Covenant's recycling achievements have occurred through kerbside programs and market for the materials…Voluntary programs often lack the resources to develop effective recycling regimes, as evident by several lapsed voluntary incentive programs for drink containers.[11]

Inadequate reporting under voluntary schemes

7.13 The committee received evidence that APC reporting, particularly in relation to recycling rates in Australia may be incorrect. Under the APC, two reports on the production of waste and the level of recycling are produced a year, one of which focuses on plastic. Some reports indicate that the APC has had some success with a gradual increase in the total number of tonnes of plastic recycled from year to year.[12]

7.14 However, Mr Angel noted that an independent review found that the APC data on recycling was 'utterly wrong and overstated'. Mr Angel went on to point to the recently issued report on Australia's packaging recycling rate which claimed that there was a growth in recycling. He stated:

> That may be true in terms of tonnes, but what they did not say in that press release was that they had consumption figures particularly wrong—by over 30 per cent. A recycling rate is the proportion of the amount of consumed plastic material versus the tonnage recycled. What they did not mention at all in that press release—and what I think is absolutely dishonourable as an agency, as a covenant, with government and industry people on it—was that the plastic recycling rate under their new assessments of consumption had dropped from 44 per cent to 28 per cent. That is not a new low recycling rate. It is the lowest recycling rate we have had for ages. That is one of the reasons why we are having such a serious plastic litter problem.[13]

7.15 The Boomerang Alliance was also critical of industry data and commented that assessments of plastic consumption rates are 'well below their true amounts', and that 'untested industry data that dramatically exaggerates the recovery and recycling

10 Ms Terrie-Ann Johnson, Clean Up Australia, *Committee Hansard*, 18 February 2016, p. 33.

11 Total Environment Centre, *Submission 1*, p. 2.

12 National Environmental Law Association, *Submission 132*, p. 5.

13 Mr Jeff Angel, Total Environment Centre, *Committee Hansard*, 18 January 2016, p. 46.

performance in key products and materials' are published under existing stewardship programs such as the APC.[14]

7.16 The concerns with inaccurate data were outlined by the Boomerang Alliance and the Total Environment Centre. The Boomerang Alliance stated that this incorrect data has 'played a fundamental role in distorting cost benefit analysis undertaken to consider adopting a national container deposit scheme'.[15] Mr Angel added that:

> …when you undervalue the environmental costs—whether it is litter management or other things—it becomes very difficult in the regulatory impact statement process and cost-benefit studies to justify intervention. So the cost-benefit studies and the RISs overstate the cost to business and understate the benefits. That is really the core of why we have not had effective action: the decision-making framework, the economic analysis framework and the capacity to actually get robust information about environmental costs have not been put in place inside government.[16]

7.17 In addition, the Boomerang Alliance argued that Commonwealth Regulation Impact Statement (RIS) reports for a range of products containing plastic (for example, plastic bags, tyres, mobile phones, packaging) have failed to consider contributions to marine plastic pollution from these items. It was added that cost benefit analyses conducted as part of the RIS process have also failed to consider the costs associated with marine plastic pollution.[17]

Polluter pays principle

7.18 The committee received evidence that the adoption of a 'polluter pays' principle would encourage innovation in packaging development, and an acknowledgment that plastic pollution mitigation has associated costs. For example, EDOs of Australia told the committee that manufacturers and producers should be encouraged to consider their business models and their reliance on plastic products. Mr Nari Sahukar, EDOs of Australia, stated:

> But it also goes to thinking about manufacturers and producers really thinking about what is going into their products…If their business models rely on an ever-expanding amount of plastic being created, then that is not a very sustainable business model.[18]

7.19 Mr Brendan Donohoe, Surfrider Foundation Australia, similarly highlighted the reliance on plastic products in the business models of fast-food companies and suggested the taxation of plastic packaging, with the revenue then be used to subsidise

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14 Boomerang Alliance, *Submission 77*, p. 21.

15 Boomerang Alliance, *Submission 77*, p. 22.

16 Mr Jeff Angel, Total Environment Centre, *Committee Hansard*, 18 February 2016, p. 48.

17 Boomerang Alliance, *Submission 77*, p. 21.

18 Mr Nari Sahukar, EDOs of Australia, *Committee Hansard*, 18 February 2016, p. 68.

clean-up programs.[19] Mr Donohoe also suggested that consumers need to be willing to pay extra for non-plastic alternatives so that the impost does not fall on small businesses to move away from cheap plastic products.[20] Mr Ian Hutton similarly supported a change in business practices and told the committee that:

> …there needs to be the removal of the word 'disposable' in consumer goods and packaging. Any packaging material is a resource and I think your idea of getting companies to be responsible is a big one and, wherever possible, government should be encouraging companies to be responsible with packaging.[21]

7.20 The committee discussed Germany's 1991 *Ordinance on the Avoidance of Packaging Waste* which made industry responsible for packaging (including packaging used in the transportation of goods) to the end of its life cycle—including the costs of collecting, sorting and recycling after consumer disposal. It required retailers to install bins where consumers could leave both primary and secondary packaging, and manufacturers were responsible for the collection and subsequent disposal. The Ordinance operated in conjunction with container deposit schemes.[22]

7.21 Professor Tony Underwood supported the notion that retailers should be held responsible for the disposal of plastic packaging. Professor Underwood suggested that if legislation was passed allowing consumers to leave plastic packaging at the point of retail, then retailers would refuse to stock products that have plastic packaging, and manufacturers would be forced to consider alternatives.[23]

7.22 The Victorian Marine Animals Defence Conservation Society also submitted that:

> Plastic product manufacturers need to be made financially responsible for their end users' behaviour. This will force them to ensure that they employ the best practices and it will force them to have to accrue significant revenue as possible clean-up costs. Once you target their financial bottomline, they will start to take notice.[24]

7.23 Professor Stephen Smith told the committee that there is also a global movement towards understanding the economic value of better environmental management through a concept known as 'natural capital'. Professor Smith stated that

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19 Mr Brendan Donohoe, Surfrider Foundation, *Committee Hansard*, 18 February 2016, p. 61.

20 Mr Brendan Donohoe, Surfrider Foundation, *Committee Hansard*, 18 February 2016, p. 62.

21 Mr Ian Hutton, *Committee Hansard*, 18 February 2016, p. 12.

22 For more information see 'Germany, Garbage, and the Green Dot: Challenging the Throwaway Society', http://www.informinc.org/pages/research/waste-prevention/fact-sheets/germany-garbage-and-the-green-dot-challenging-the-throwaway-society-executive-summary.html

23 Professor Underwood, *Committee Hansard*, 18 February 2016, p. 15.

24 Victorian Marine Animals Defence Conservation Society, *Submission 174*, p. 3.

'educating companies that they are completely dependent on the functioning environment' has led to:

> …changes in practices where people can see that having better environmental stewardship guarantees supply…Therefore, it is advantageous for companies to actually build that into their operating plans.[25]

7.24 The committee also received evidence that associating an economic value to plastic waste itself may lead to changes in practices by manufacturers and producers. Dr Jennifer Lavers pointed to the World Economic Forum's estimates that plastic packaging waste, worth $80 billion to $120 billion per year, is lost through landfill and pollution. Dr Lavers stated that this value needs to be brought to the forefront of discussions so that awareness can lead to a reduction in consumption and subsequently, production.[26] Professor Smith added that change is 'going to be driven by economy, and if we can find those economic incentives then I am sure we can actually get things happening'.[27]

7.25 The submission from TopInfo Consulting also suggested that a system of market-based financial incentives could promote a reduction in the amount of plastic entering the waste. It was suggested that manufacturers and distributors of plastic product should be expected to develop strategies to recover it after use, and that financial benefit such as tax incentives could be provided when they are successfully implemented.[28] TopInfo Consulting also suggested that plastic products be subjected to levies which can be partially offset through the contracting of recycling and collection services.[29]

Design and innovation

7.26 A number of witnesses noted that innovative packaging design can lead to substantial reductions in plastic entering the waste stream. However, witnesses also commented that manufacturers and producers may be reluctant to make changes to packaging due to concerns that products may be damaged in transit, or in the case of food packaging, hygiene requirements. Evidence was also received regarding the use and labelling of 'biodegradable' and 'degradable' plastic and whether these items provide a less harmful alternative to traditional plastics.

7.27 Clean Up Australia told the committee that 'producer responsibility' is critically important to making changes to product packaging that will reduce plastic

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25 Professor Stephen Smith, *Committee Hansard*, 18 February 2016, p. 20.

26 Dr Jennifer Lavers, *Committee Hansard*, 18 February 2016, p. 13.

27 Professor Stephen Smith, *Committee Hansard*, 18 February 2016, p. 12.

28 TopInfo Consulting, *Submission 10*, p. 7.

29 TopInfo Consulting, *Submission 10*, pp. 7–8.

pollution.[30] Mr West explained that currently, 'every bottle has five pieces—tamper seal, lid and label, as well as the bottle'.[31] If the bottle caps and the lids could be permanently attached to the bottle the number of pieces of rubbish would be reduced.[32]

7.28 Ms Johnson highlighted that changes to beverage container design which resulted in ring-pulls remaining attached to cans had already resulted in a significant reduction in the number of ring-pulls found during clean-ups.[33] Coca-Cola Amatil also pointed to changes in the design of its beverage containers noting that over the past decade many new technologies and initiatives have been implemented to reduce the environmental impact through the supply chain across the total package life cycle. These have included continual decreases in the weight of PET packages since 1997 which has delivered a 33 per cent reduction in small PET, a 37 per cent reduction in POWERADE PET and a 42 per cent reduction in 600 millilitre PET.[34]

7.29 Professor Smith also told the committee that alternatives to plastic packaging are available. For example, packing 'peanuts' made from starch rather than plastic. These packing peanuts are made from starch and can be dissolved in water or composted following use. However, in discussions with a leading packaging manufacturer, it was indicated that companies would not adopt starch based external packaging as items may become damaged in transit and companies would then be liable to litigation.[35] Other replacements noted by Professor Smith included compostable lids for hot beverage containers, and bamboo cutlery. He went on to suggest that there should be support through appropriate incentives to encourage further substitution.[36]

Biodegradable and degradable products

7.30 In 2002, two consultancy reports, *Biodegradable Plastics—Developments and Environmental Impacts*, and *The Impact of Degradable Plastic Bags in Australia* recommended that Australian Standards be developed in relation to biodegradable plastics. In 2003, the Environment Protection and Heritage Council agreed to initiate the development of Australian Standards with Standards Australia.[37]

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30 Mr Ian Kiernan, Clean Up Australia, *Committee Hansard*, 18 February 2016, p. 34.

31 Mr Dave West, environmental economist advising Clean Up Australia, *Committee Hansard*, 18 February 2016, p. 34.

32 Ms Terrie-Ann Johnson, Clean Up Australia, *Committee Hansard*, 18 February 2016, p. 34.

33 Ms Terrie-Ann Johnson, Clean Up Australia, *Committee Hansard*, 18 February 2016, p. 34.

34 Ms Liz McNamara, Coca-Cola Amatil, *Committee Hansard*, 31 March 2016, p. 2.

35 Professor Stephen Smith, *Committee Hansard*, 18 February 2016, p. 21.

36 Professor Stephen Smith, *Submission 27*, p. 7.

37 Department of the Environment, *Threat abatement plan for the impacts of marine debris on vertebrate marine life Review 2009–2014*, p. 28.

7.31 In 2006, Australian Standard AS4736 for biodegradable plastics suitable for composting and other microbial treatment (in commercial systems) was released. In 2010, Australian Standard AS5810 for biodegradable plastics suitable for home composting was released. These standards are designed to provide confidence to consumers and retailers in relation to products described as biodegradable, and to provide support for state and territory governments to ban non-biodegradable single-use plastic bags.[38]

7.32 So-called 'biodegradable' and 'degradable' plastics are frequently offered as better alternatives to traditional plastic items. However, the committee received evidence that such products may, in fact, significantly contribute to levels of microplastic pollution in the marine environment. In addition, evidence highlighted that there is considerable public confusion regarding the difference between biodegradable, compostable, degradable and traditional plastic bags, and the ways in which these items should be disposed.

7.33 The terms 'degradable' and 'biodegradable' are sometimes used interchangeably to describe plastics which contain additives to accelerate the disintegration of the product. However, the term biodegradable may also refer to 'fully biodegradable' or 'compostable' plastics which are generally made from plant-materials and which will return to base organic components when disposed of through commercial composting facilities. For the purposes of this report, the term 'compostable' will be used to describe fully biodegradable plastics while 'biodegradable' will refer to products with accelerated degradation (that is, degradable products).

7.34 Dr Kathy Townsend told the committee that there is 'a high degree of consumer confusion regarding the difference between degradable, biodegradable and compostable bags'.[39] Dr Townsend explained that:

> Unfortunately, degradable and biodegradable are interchangeable in the minds of the general public. They find that very confusing and often feel that they are doing the right thing, when in fact they are not.[40]

7.35 A number of witnesses stated that degradable plastic does not offer an alternative to traditional plastic as it simply disintegrates into increasingly smaller pieces until it becomes microplastic. Professor Underwood commented that 'it is not a solution to anything much, unless we are quite happy to shift it all into particle-sized plastics rather than plastic bag-sized plastics'.[41] Indeed, it was noted that the rapid

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38 Department of the Environment, *Threat abatement plan for the impacts of marine debris on vertebrate marine life Review 2009–2014*, p. 28.

39 Dr Kathy Townsend, *Committee Hansard*, 10 March 2016, p. 1.

40 Dr Kathy Townsend, *Committee Hansard*, 10 March 2016, p. 2. See also Ms Terrie-Ann Johnson, Clean Up Australia, *Committee Hansard*, 18 February 2016, p. 34.

41 Professor Underwood, *Committee Hansard*, 18 February 2016, p. 21. See also, Mr Ian Kiernan, Clean Up Australia, *Committee Hansard*, 18 February 2016, p. 34.

disintegration of degradable plastic also makes it 'available to animals much faster than it would be otherwise'.[42]

7.36 Dr Mark Browne pointed to research which showed that there are no differences between biodegradable and traditional plastic bags:

> We did research which looked at a biodegradable bag versus a normal plastic bag. We put them on a mudflat and looked at the changes in animals and plants that lived amongst them, and they both caused the same impact.[43]

7.37 A number of witnesses also expressed concern that degradable plastics do not encourage social change. Dr Lavers stated that degradable plastic 'encourages the status quo and it encourages people to continue to treat plastic, which is a non-renewable resource, like a disposable item.'[44] Similarly, Dr Townsend told the committee that:

> …when people have a degradable or biodegradable bag they feel that it is fine to just throw it, because they have this perception that it is going to degrade and go away. It inspires littering behaviour more than it would otherwise, because they have in their mind that it is not going to cause any harm.[45]

7.38 A further matter was raised by Ms Johnson, who stated that Clean Up Australia is aware that a large retailer in Australia introduced compostable bags for a period of time, however 'they had customer backlash…because they were not strong enough'.[46]

7.39 There is also evidence that the correct disposal of degradable and compostable items is a source of community confusion. For example, Ms Johnson stated that:

> We have seen examples of biodegradable containers, but nobody knows how to dispose of them. They are told that they can break down in compost, so people then think they can put them in their backyard compost, but they do not break down in that; they need to be broken down in commercial composting units, and there are not enough commercial composting units in the country to take them.[47]

7.40 Consumer confusion regarding the correct disposal mechanism for different types of bags can also lead to degradable plastic bags entering the recycling stream

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42 Dr Kathy Townsend, *Committee Hansard*, 10 March 2016, p. 2.

43 Dr Mark Browne, *Committee Hansard*, 18 February 2016, p. 21.

44 Dr Jennifer Lavers, *Committee Hansard*, 18 February 2016, p. 21.

45 Dr Kathy Townsend, *Committee Hansard*, 10 March 2016, p. 2.

46 Ms Terrie-Ann Johnson, Clean Up Australia, *Committee Hansard*, 18 February 2016, p. 39.

47 Ms Terrie-Ann Johnson, Clean Up Australia, *Committee Hansard*, 18 February 2016, p. 34.

with other products. If this occurs, the process is contaminated and none of the items can be recycled as they would otherwise.[48]

7.41 Dr Lavers cautioned that though fully biodegradable plastics offer an area of research investment where a lot of gain could be made to look for truly biodegradable, truly compostable plastic alternatives, 'as of right now they do not exist, and the ones that do sell themselves as that kind of product almost certainly come with their own set of problems'.[49]

7.42 Under Threat Abatement Plan Action 3.4, the then Department of Environment, Water, Heritage and the Arts was to:

> …identify measures to promote the uptake and application of biodegradable and oxodegradable plastic in marine-based industries and environments where it is found to be effective.[50]

Regulatory and legislative changes

7.43 The committee received a large number of submissions, and over 700 form letters, calling for the introduction of national legislation to prohibit the sale and manufacture of personal cosmetic products containing microbeads, and the use of lightweight single-use plastic bags. The committee also received evidence on the implementation and consideration of such bans both in Australia and internationally.

7.44 The Total Environment Centre submitted that the introduction of a container deposit scheme, and the banning of lightweight single-use plastic bags and products containing microbeads would result in a reduction of over 70 per cent in marine plastic pollution within a 3–5 year period.[51] Clean Up Australia similarly stated that such bans would have a 'drastic impact on the number of items entering the marine environment'.[52]

7.45 Mr Andrew McNee, Assistant Secretary, Department of the Environment, told the committee that over the past two years, that federal, state and territory Environment Ministers have been examining the issue of banning microbeads and single-use plastic bags. Mr McNee indicated that the Ministerial Roundtable has given its support for the work being undertaken by New South Wales and Commonwealth in relation to the 'voluntary industry arrangement to phase out microbeads'. Mr McNee

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48 Dr Kathy Townsend, *Committee Hansard*, 10 March 2016, p. 2. See also Ms Terrie-Ann Johnson, Clean Up Australia, *Committee Hansard*, 18 February 2016, p. 34.

49 Dr Jennifer Lavers, *Committee Hansard*, 18 February 2016, p. 21.

50 Department of the Environment, *Threat abatement plan for the impacts of marine debris on vertebrate marine life Review 2009–2014*, p 28.

51 Total Environment Centre, *Submission 1*, p. 11.

52 Clean Up Australia, *Submission 9*, p. 2.

also told the committee that the Environment Ministers have also examined the issue of a 'national phase-down' of single-use plastic bags.[53]

Ban on single-use plastic bags

7.46 Australians use 3.92 billion lightweight plastic grocery bags a year, and it is estimated that approximately 80 million bags become litter every year.[54] As previously discussed, single-use plastic bags are often ingested by a range of marine fauna, with turtles being particularly susceptible to mistaking them for jellyfish or other prey species. They also breakdown to form microplastic in the marine environment.

7.47 Single-use plastic bans have been banned or levied in a number of jurisdictions both within Australia, and internationally. In some instances levies have been used as transitional measures to change consumer behaviour.[55] Mr Angel told the committee that 'over 100 states, countries and municipalities' have introduced bans and levies.[56] In Australia, the Northern Territory, South Australia, Tasmania and the Australian Capital Territory have all banned lightweight single-use plastic bags.

7.48 The banning of single-use plastic bags was seen as an effective and easy way of reducing the amount of plastic entering the marine environment as well as targeting a plastic which is often mistaken for food by marine animals. The committee also received evidence that such bans have widespread community support. Clean Up Australia stated in its submission that polling in May 2009 conducted by the non-government organisation Do Something found that 83 per cent of Australians supported a ban on non-biodegradable plastic bags.[57] Clean Up Australia also submitted that it is 'currently supporting bag banning petitions in NSW, Queensland and Victoria' and it noted that in each of these states, the petitions had been 'instigated by members of the community'.[58]

7.49 The Surfrider Foundation Australia provided evidence that consumers are actively seeking alternatives to plastic bags. Ms Rowan Hanley told the committee that:

> Surfrider initiated a program like a borrow and bring back bags scheme. We are hoping to make Avalon…eventually single-use-plastics-free. That all began when a bunch of women got together and sewed bags made of recycled material. By June there will be seven boxes all around Avalon that

53 Mr Andrew McNee, Department of the Environment, *Committee Hansard*, 26 February 2016, p. 17.

54 Clean Up Australia, *Submission 9*, p. 9.

55 Ms Rachel Walmsley, EDOs of Australia, *Committee Hansard*, 18 February 2016, p. 69.

56 Mr Jeff Angel, Total Environment Centre, *Committee Hansard*, 18 February 2016, p. 48.

57 Clean Up Australia, *Submission 9*, p. 10.

58 Clean Up Australia, *Submission 9*, p. 10.

> will be filled with these recycled bags so that, if you forget to bring your own bag, instead of getting a plastic bag from Woolies, you can just borrow one of these and bring it back.[59]

7.50 Following the meeting of Environment Ministers on 29 February 2016, it was reported that New South Wales and Queensland would continue to explore options to ban light-weight single-use plastic bags, and explore a coordinated approach with Victoria.[60] However, it was argued by NELA that a coordinated national approach was required and recommended that the Australian Government should be instrumental in securing nationally applicable measures to promote the uptake and application of biodegradable and oxodegradable plastic wherever it is used including a ban on non-biodegradable, single-use plastic bags.[61]

Ban on products containing microbeads

7.51 The committee received a large number of submissions, and over 700 form letters calling for a national ban on the use of microbeads in cosmetic and personal care products. For example, the National Environmental Law Association recommended that the Australian Government legislate for the substitution and phasing-out of microbeads where manufactured locally, and the restriction on the import of products containing such content.[62] Similarly, the Total Environment Centre described microbeads as 'problematic' and called for a ban on microbeads in 'cosmetics, personal care products, laundry detergents and cleaning products and paint'.[63]

7.52 The Department of the Environment presented evidence of strong community-based support for manufacturers to phase-out microbeads. Mr Stephen Oxley, Department of the Environment, stated that:

> …we are seeing an increasingly well-informed consumer movement bringing pressure to bear on both manufacturers and on the retail sector against the use of microplastics in personal care products. A number of significant manufacturers have indicated their intention to phase-out microplastics, or have already stopped using them, and a number of large retail chains have also indicated that their intention is to stop selling

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59 Ms Rowan Hanley, Surfrider Foundation Australia, *Committee Hansard*, 18 February 2016, p. 62.

60 James Robertson and Lucy Cormack, 'Large states delay action on bag ban at environmental roundtable', *The Sydney Morning Herald*, http://www.smh.com.au/nsw/large-states-delay-action-on-bag-ban-at-environmental-roundtable-20160229-gn6mwk.html, (accessed 4 March 2016).

61 National Environmental Law Association, *Submission 132*, p. 16.

62 National Environmental Law Association, *Submission 132*, p. 20.

63 Total Environment Centre, *Submission 1*, p. 8.

products that use microplastics. There is a significant movement towards that outcome at the moment.[64]

7.53 Banning the use of microbeads in cosmetic and personal care items has been discussed around the world with government and industry initiatives in Europe, the US and Australia. In 2012, Unilever announced that all its products worldwide would be microplastic free by 2015 and subsequently, a number of other multinationals such as Oral B (Procter and Gamble Australia), L'Oreal and Johnson&Johnson made similar announcements.[65] In January 2016, Coles, Aldi and Woolworths announced their intention to phase-out the use of microbeads in store brand products by 2017.[66]

7.54 In March 2015, the Canadian House of Commons voted unanimously for the government to take immediate action to add microbeads used in personal care products to the List of Toxic Substances under the Canadian Environmental Protection Act 1999. In July 2015, Environment and Climate Change Canada conducted a scientific review and analysis of over 130 scientific papers, and consulted with experts on the impact of microbeads on the environment. As a result of this research, proposed regulations were developed, and consultation with stakeholders occurred during 2015 and early 2016.[67]

7.55 Similarly, the US House of Representatives passed the Microbead Free Waters Act of 2015 in early December 2015, which would commence the phase-out of microbeads in cosmetic and personal care items by 1 July 2017. The Bill will now go to the Senate for consideration.[68]

7.56 In Australia, there have also been proposals to ban microbeads, In 2014, the then New South Wales Environment Minister, the Hon Rob Stokes MP, called for a national ban on manufacturing and selling polyethylene microbeads in personal care

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64 Mr Stephen Oxley, Department of the Environment, *Committee Hansard*, 26 February 2016, p. 13.

65 For a list of industry announcements see: http://www.beatthemicrobead.org/en/industry.

66 Rachel Brown, 'Aldi joins Coles and Woolies in microbead ban', *The Sydney Morning Herald*, 14 January 2016, http://www.smh.com.au/business/consumer-affairs/aldi-joins-coles-and-woolies-in-microbead-ban-20160113-gm5hwk.html, (accessed 28 January 2016).

67 Environment and Climate Change Canada, 'Proposed Regulations for Microbeads in Personal Care Products Used to Exfoliate or Cleanse', https://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=3A8EA7D7-1&offset=1 (accessed 30 March 2016)

68 Milman, O, 'US to ban soaps and other products containing microbeads', *The Guardian*, 9 December 2015, http://www.theguardian.com/us-news/2015/dec/08/us-to-ban-soaps-other-products-containing-microbeads (accessed 9 December 2015); and Milman, O, 'Congress to vote on bill to ban microbead hygiene products in US', *The Guardian*, 19 November 2015, http://www.theguardian.com/us-news/2015/nov/18/congress-vote-ban-microbeads-beauty-soap-toiletries-plastic, (accessed 9 December 2015), See also, Ms Ellen Geraghty, National Environmental Law Association, *Committee Hansard*, 18 February 2016, p. 29 and p. 31.

products. He also announced that the NSW Government would convene an industry working group with the aim of phasing out microbeads by 2016.[69]

7.57 More recently, plans to achieve a voluntary phase-out of products containing microbeads by no later than July 2018 was announced by federal, state and territory Environment Ministers in December 2015. On 29 February 2016, the Hon Greg Hunt MP, Minister for the Environment, also announced that the Australian Government will continue to support a voluntary phase out of microbeads, however if this does not achieve what is in effect a ban by 1 July 2017, then the Australian Government will implement a ban legislatively.[70]

7.58 Submitters generally welcomed the phase-out of microbeads with Householders' Options to Protect the Environment Inc. describing it as having a 'significant impact on the amount of plastic that enters the marine environment'.[71] However, not all submitters supported the phase-out approach. Ms Ellen Geraghty, NELA, noted that there is currently sufficient evidence that microbeads are having negative impacts on the environment, and more evidence of this may emerge in the future. This evidence, coupled with the difficulty, or even near impossibility, of mitigating the problem of microbeads, was considered by Ms Geraghty, as warranting a ban of microbeads.[72]

7.59 A further concern with a phase-out period rather than an immediate ban was raised by Ms Crick from the Surfrider Foundation Australia. Ms Crick stated that a phase-out period may allow companies to 'find loopholes through definitional jargon that will allow them to continue to use microbeads in their products under different scientific names'. Ms Crick added:

> We should be leading the ban on microbeads. We should not be waiting for another year or 18 months for the three supermarkets to say that they will take them out of their exfoliating creams. What about laundry detergents and toothpaste?[73]

7.60 Clean Up Australia was more vocal in its criticism of the lack of an immediate ban—it described Australia's inaction on banning microbeads as 'a failure of public

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69 'NSW to push for national ban on micro-plastic pollutants', NSW Liberal Party, 28 August 2014, https://members.nsw.liberal.org.au/news/state-news/nsw-push-national-ban-micro-plastic-pollutants, (accessed 1 December 2015).

70 The Hon. Greg Hunt MP, 'Federal Government strengthens efforts to tackle plastic waste' 29 February 2016, http://www.environment.gov.au/minister/hunt/2016/pubs/mr20160229a.pdf (accessed 4 March 2016).

71 Householders' Options to Protect the Environment, *Submission 3*, p. 2.

72 Ms Ellen Geraghty, National Environmental Law Association, *Committee Hansard*, 18 February 2016, p. 31.

73 Ms Susie Crick, Surfrider Foundation Australia, *Committee Hansard*, 18 February 2016, p. 65.

policy to meet its duties and obligations', and recommended that the Australian Government take immediate action to ban microbeads.[74]

7.61 The committee also received evidence in relation to two other issues of concern. Dr Browne cautioned that any replacement to microbeads currently used should be examined to ensure that it does not cause larger effects than microbeads.[75] Mr Angel, Total Environment Centre, pointed to the issue of imported products containing microbeads.[76]

7.62 The committee notes that banning microbeads in cosmetics could be implemented through an amendment to the Cosmetics Standard. The Standard is a legislative instrument made under the *Industrial Chemicals (Notification and Assessment) Act 1989* (Cth) (ICNA Act). The ICNA Act regulates ingredients in cosmetic products as 'industrial chemicals' and its objects include to provide for 'national standards for cosmetics imported into, or manufactured in, Australia and the enforcement of those standards'.[77] The ICNA Act also provides that the Health Minister, may, by legislative instrument, determine standards for cosmetics imported into, or manufactured in, Australia, having regard to Australia's international obligations.[78]

7.63 Cosmetics are defined broadly in the ICNA Act and include a range of personal products, including those in which microbeads might be found such as facial-cleansers, shampoos, and toothpaste. However, other products containing microbeads, such as cleaning and laundry products, are not covered by the Cosmetics Standard. Many of these products are imported from overseas. Prohibition of their import may be possible through the listing of products containing microbeads under the Customs (Prohibited Imports) Regulations 1956. The importation of many goods into Australia is prohibited under the regulations. However, the listing would not prevent the manufacture of such products in Australia.

7.64 A further avenue for banning products containing microbeads may be through the consumer protection regime. The *Competition and Consumer Act 2010* provides for the Commonwealth Minister to impose bans on certain kinds of consumer goods on the basis that they will or may cause injury to any person.[79]

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74 Clean Up Australia, *Submission 9*, p. 11.

75 Dr Mark Browne, *Committee Hansard*, 18 February 2016, p. 9.

76 Mr Jeff Angel, Total Environment Centre, *Committee Hansard*, 18 February 2016, p. 49.

77 *Industrial Chemicals (Notification and Assessment) Act 1989*, paragraph(3)(b).

78 *Industrial Chemicals (Notification and Assessment) Act 1989*, s. 81

79 *Competition and Consumer Act 2010*, Schedule 2, s. 114.

Listing as a hazardous substance

7.65 During the course of the inquiry, the committee considered whether listing plastic as a hazardous substance would provide increased opportunities for the regulation of waste management, and plastic manufacturers and producers.

7.66 The National Environmental Law Association noted that 'classification of plastic as a hazardous substance is a potential avenue to explore particularly in relation to nurdles and microbeads'.[80] Dr Mark Browne and co-authors submitted that reclassifying plastic as a hazardous material would help mitigate plastic pollution while Tangaroa Blue stated that 'classifying plastic waste as hazardous needs to become part of the discussion in our approach to the issue in Australia'.[81]

7.67 Similarly, Mr Sahukar told the committee that such a measure:

> …should certainly be considered, given the impacts are pretty clear and are growing. Whether that needs to happen at a national level in terms of national legislation, or whether it can happen through state pollution laws, is an open question. Both strategies should be looked at. I would have to refresh my memory on the composition of the hazardous chemical legislation, but I know there is a federal scheme under the NICNAS organisation, and then there is some state legislation in relation to hazardous chemicals and so on. Certainly those avenues should be explored.[82]

7.68 Mr Sahukar suggested that through COAG, environment ministers could require state and territory environment protection agencies to examine 'existing pollution laws and the tools under them'. This review could prove useful as plastics were not a focus at the time of drafting, and there should be a recognition that legislation needs to be adaptable.[83]

Clean Water Act

7.69 In exploring legislative options to mitigate the threat of marine plastic pollution, the committee sought evidence on whether the United States Clean Water Act 1972 (CWA) could provide a model for federal legislation in Australia.

7.70 The CWA established a structure for regulating discharges of pollutants into the waters of the United States, and regulated quality standards for surface waters. The provisions of the Act:

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80 National Environmental Law Association, answers to question on notice, 28 February 2016 (received 29 March 2016), p. 6.

81 Dr Mark Browne and co-authors Professor Tony Underwood, Professor Gee Chapman, Professor Emma Johnston, *Submission 21*, p. 4; Tangaroa Blue, *Submission 60, p. 2.*

82 Mr Nari Sahukar, EDOs of Australia, *Committee Hansard*, 18 February 2016, p. 68.

83 Mr Nari Sahukar, EDOs of Australia, *Committee Hansard*, 18 February 2016, p. 68.

- gave the EPA authority to implement pollution control programs such as setting wastewater standards for industry;
- maintained existing requirements to set water quality standards for all contaminants in surface waters;
- made it unlawful for any person to discharge any pollutant from a point source into navigable waters, unless a permit was obtained under its provisions;
- funded the construction of sewage treatment plants under the construction grants program; and
- recognized the need for planning to address the critical problems posed by nonpoint source pollution.[84]

7.71 Implementation of national environment protection legislation in the US is the joint responsibility of federal organisations such as the US Environment Protection Agency (EPA), and state governments. The EPA is described by the National Environmental Law Association as a 'powerful enforcement body'.[85]

7.72 One of the advantages of the CWA is the regulation of plastic manufacturing, handling, and transportation facilities under the *National Pollutant Discharge Elimination System* which can be used to prevent the movement of nurdles from industrial practices, into the marine environment.[86] It does not however, regulate the consumer use of microbeads.[87]

7.73 The National Environmental Law Association noted that while a national Clean Water Act modelled on US legislation may provide some advantages, it would 'require a complete change to arrangements for environmental regulation'. It further noted that the US legislative arrangement has been described as 'overly complex and weakened by significant regulatory gaps so there is no strong legislative basis at the national level for targeting marine plastic pollution'.[88]

84 National Environmental Law Association, Answer to question on notice, 18 February 2016, (received 29 March 2016), p. 8.

85 National Environmental Law Association, Answer to question on notice, 18 February 2016, (received 29 March 2016), p. 7.

86 National Environmental Law Association, Answer to question on notice, 18 February 2016, (received 29 March 2016), p. 8.

87 National Environmental Law Association, Answer to question on notice, 18 February 2016, (received 29 March 2016), p. 9.

88 National Environmental Law Association, Answer to question on notice, 18 February 2016, (received 29 March 2016), p. 7.

Use of existing regulation

7.74 While some submitters supported the introduction of legislation targeted at marine plastic pollution, other submitters argued that greater use of existing legislative measures would assist in decreasing plastic pollution.

7.75 One area of concern was the lack of enforcement by state and territory governments of their environmental powers. The Total Environment Centre noted that it is already an offence in every Australian jurisdiction to dispose of waste in the stormwater system. However, poor enforcement action has resulted in nurdles and plastic pellets used in the manufacturing sector entering the stormwater system. The Total Environment Centre commented:

> 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.[89]

7.76 Similarly, Ms Taylor from the Tangaroa Blue Foundation commented that there is a lack of compliance with state and territory environmental laws and noted that the Tangaroa Blue Foundation has been tracking plastic resin pellets used by industry since 2007. Pellets are now being found in significant numbers on remote beaches. Unofficial site inspections of public land near factories conducted by the Tangaroa Blue Foundation found:

> Six out of eight factories had leaching of pellets, and for some of them there were phenomenal amounts.[90]

7.77 Ms Taylor reported that funding had been received in 2015 from the Victorian Government to run Operation Clean Sweep, which is a US industry led program that was run by the industry to stop resin pellets at the source. In addition, the Tangaroa Blue Foundation have engaged PACIA, the national body representing the chemicals and plastic industry in Australia, to help review the program to make sure it was appropriate for the Australian industry. A website had been launched about Operation Clean Sweep.[91] Ms Taylor expressed frustration that this work had to be carried out by the Tangaroa Blue Foundation rather than the state environmental protection agencies.[92]

7.78 Another area where greater enforcement action was suggested, was compliance of foreign ships with MARPOL Annex V. Take3 stated that it continues to 'retrieve "fresh" foreign pollutants from our coastline that are clearly from ships moored off coastal ports (eg. Newcastle, Wollongong) and passing along the

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89 Total Environment Centre, *Submission 1*, p. 11; see also National Toxics Network, *Submission 4*, p. 5.

90 Ms Heidi Taylor, Tangaroa Blue Foundation, *Committee Hansard*, 10 March 2016, pp. 32–33.

91 Ms Heidi Taylor, Tangaroa Blue Foundation, *Committee Hansard*, 10 March 2016, pp. 32–33.

92 Ms Heidi Taylor, Tangaroa Blue Foundation, *Committee Hansard*, 10 March 2016, p. 33.

Australian coast'. Take3 concluded that it 'would like to see stronger measures and greater controls to address this clear and present problem'.[93]

7.79 The Australian Maritime Safety Authority (AMSA) told the committee that it has undertaken a number of investigations into the discharge of garbage in Australian waters, which have been successfully prosecuted under the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (the POTS Act).[94] Under Port State Control provisions, AMSA has the power to detain ships on a number of grounds, including safety, and non-compliance with waste management regulations. Mr Matt Johnston, Manager of Marine Environment Standards at AMSA told the committee that in 2014 there were 270 ships detained, with 10.4 per cent detained for failing to comply with waste management standards. As a result of these detentions, two prosecutions were undertaken. Similarly in 2015, three prosecutions occurred.[95]

7.80 AMSA also stated that it is now also considering alternative compliance and enforcement options, such as issuing directions and improvement notices, in order to deter offenders from discharging garbage in Australian waters. [96] Mr Toby Stone, AMSA, also told the committee that in addition to compliance and enforcement measures, extensive education campaigns have been initiated to ensure that ships' crews are aware of waste management requirements. Mr Stone explained:

> …there is a 'Welcome to Australia' DVD which we put out to ships through the agents, and through the surveyors. We also work with other organisations, like AUSMEPA. AUSMEPA is the Australian Marine Environment Protection Association, and they work with us. We have jointly produced this video, which we try and get across to ships' masters and the crew as to what you cannot do in Australia. That is all the foreign ships coming into Australian waters.[97]

7.81 AMSA highlighted the 'zero tolerance' under MARPOL Annex V and concluded that 'overall, we feel that the system is working in Australia and that it is working globally.'[98]

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93 Take3, *Submission 72*, p. 5.

94 Australian Maritime Safety Authority, *Submission 68*, pp. 3–4.

95 Mr Matt Johnston, Australian Maritime Safety Authority, *Committee Hansard*, 26 February 2016, p. 23.

96 Australian Maritime Safety Authority, *Submission 68*, pp. 3–4.

97 Mr Toby Stone, Australian Maritime Safety Authority, *Committee Hansard*, 26 February 2016, p. 23.

98 Mr Toby Stone, Australian Maritime Safety Authority, *Committee Hansard*, 26 February 2016, p. 23.

Committee view

7.82 The committee supports the view that source reduction strategies must also include increased product stewardship, changes to production and manufacturing practices, and regulatory reform.

7.83 Producers and manufacturers are able to effect significant change through design and innovation in packaging, and participation in voluntary schemes such as the Australian Packaging Covenant. The committee believes that increased product stewardship through increased reporting and compliance under the Australian Packaging Covenant is also critical. In addition, the committee considers that product stewardship should be recognised in the revised Threat Abatement Plan.

7.84 The committee is of the view that voluntary product stewardship and producer responsibility should also be supported with regulatory and legislative reform. In particular, the banning of the use of single-use lightweight plastic bags was considered, and the evidence indicates that this is an appropriate measure considering the volume of these items found in the marine environment. The committee believes that states and territories which have not already implemented a ban should be encouraged to do so. The committee also believes that alternatives, such as biodegradable plastic bags, should not be encouraged under such a ban until there is conclusive evidence that such alternatives do not pose a risk to the environment.

7.85 A ban on the importation and production of personal care products which contain microbeads also received widespread support during the inquiry. The committee notes the Australian Government's commitment to introducing a legislative ban if a voluntary, industry initiated phase-out does not result in the removal of all such items by 2017. However, the committee believes that the evidence of significant microplastic pollution resulting from the use of such products requires an immediate ban.

7.86 The committee notes that a range of alternative regulatory and legislative mechanisms are also available, including the use of state and territory environmental protection legislation. The committee supports initiatives that increase the use of such legislation, particularly in relation to preventing the movement of nurdles into the marine environment through the stormwater system.

Chapter 8

Conclusion and recommendations

8.1 In 2011, the United Nations Environmental Programme described marine plastic pollution as a 'toxic time bomb'. Plastic pollution is both persistent and pervasive—it is estimated that 150 million tonnes of plastic are present in the global marine environment, and unless this plastic is identified, collected and removed, it continues to exist, albeit in increasingly smaller pieces. As rates of plastic production and consumption increase, it is expected that the rates of plastic entering the ocean will similarly increase. Marine plastic pollution has been identified as having wide-ranging impacts on marine fauna, ecosystems, human health and business.

8.2 This inquiry examined the sources and effects of marine plastic pollution, and sought to identify mitigation strategies which will deliver a reduction in the rate of marine plastic pollution in Australia and Australian waters. The inquiry also examined the feasibility and effectiveness of programs designed to collect and remove marine plastic pollution.

The plastic problem

8.3 Plastics are now a core element of modern life: they are used in all sectors from construction to medicine and packaging. The demand for plastics is growing steadily with the World Economic Forum forecasting that production of plastics is expected to double in the next 20 years and quadruple by 2050. The demand for consumer goods has contributed to the levels of plastics used in packaging—the World Economic Forum noted that 26 per cent of all plastics are used for packaging.

8.4 As plastics are durable, once their usefulness is at an end, the problem of disposal arises. From the evidence received, disposal is often neither efficient nor undertaken with the short- or long-term consequences to the environment in mind. The low cost of plastics contributes to low levels of recycling and the perception that plastic is 'disposable' means that it generally ends up in landfill or is dumped indiscriminately as litter.

8.5 As a consequence, plastics are entering the world's oceans at an alarming rate. The committee notes that, while there are some concerns about the lack of rigor of some of the estimates of the amount of plastic in the marine environment, they are still sobering: five trillion plastic pieces on the surface of the oceans; eight million tonnes

of plastics leaking into the ocean each year—that is the equivalent of one garbage truck of plastic every minute of every day of the year.[1]

8.6 In Australia, estimates of marine plastic pollution also point to the magnitude of the problem. While limited research has been undertaken to fully understand the extent of plastic debris, it is evident to the committee that there is extensive marine plastic pollution in Australian coastal areas and in our waters. This pollution is not limited to densely populated coastal areas; studies have found plastic debris in remote North West Australia and remote areas of Tasmania. The committee was also provided with graphic evidence of the magnitude of marine plastic pollution from organisations and individuals who undertake clean-up activities: the Tangaroa Blue database contains information on 5.4 million marine debris items (500 tonnes). Evidence from local government also pointed to the high volumes of urban litter, including plastics, which they have recovered.

8.7 Plastics enter the marine environment from both ocean- and land-based sources. In northern Australian waters, one of the most significant types of ocean-based debris is ghost nets with up to three tonnes of ghost nets per kilometre being found in the Gulf of Carpentaria. However, land-based sources account for the vast proportion of marine debris—80 per cent by many estimates. Much of the marine debris collected is packaging including beverage containers and food packaging.

8.8 Of significant concern to submitters and witnesses was the amount of microplastic debris (pieces less than five millimetres in size). Microplastics can be intentionally produced (microbeads used in personal care products); result from processes or use of products (fibres released with the washing of synthetic fabrics); or result from degradation of larger plastic items. Plastics are highly durable, and are now found throughout the marine environment, and of most concern is that microplastics are difficult, if not impossible, to remove.

8.9 The committee found that there were few estimates of costs of marine plastic pollution but the estimates available are staggering. The Asia-Pacific Economic Cooperation estimated that the cost of ocean plastics to the tourism, fishing and shipping industries was $1.3 billion in our region. In 2014, the United Nations Environment Program (UNEP) estimated that the annual damage of plastics to marine ecosystems is at least US$13 billion per year. The UNEP went on to estimate that the after-use externalities for plastic packaging, plus the cost associated with greenhouse

1 Associate Professor Mark Osborn, *Submission 16*, p. 1; World Economic Forum, *The New Plastics Economy*: *Rethinking the future of plastics*, January 2016, http://www3.weforum.org/docs/WEF_The_N Plastics ew__Economy.pdf, (accessed 23 February 2016), p. 14.

gas emissions from its production, was US$40 billion. This estimate was seen as 'conservative' and exceeded the plastic packaging industry's profit pool.[2]

8.10 It is clear to the committee that, while there is limited quantitative evidence of the magnitude of marine plastic pollution in Australia and Australian waters, it is a problem that cannot be ignored and one that is growing year-on-year. The economic costs of marine plastic pollution are immense and are being borne by all levels of government through clean-up and infrastructure costs. Businesses also face costs through damage to fisheries and marine infrastructure and the costs to individuals and organisations in time and resources are also considerable. While environmental damage is difficult to evaluate at present, the committee considers that it is wide-ranging and a significant externality of the ubiquitous use of plastics.

The effects of marine plastic pollution

8.11 The committee was provided with a range of evidence on the effects of plastic pollution on marine fauna. Many of the submitters and witnesses pointed to research being undertaken in Australia on the effects of marine plastic ingestion and entanglement on marine fauna species.

8.12 Macroplastics, including lost fishing gear, are the main contributors to entanglements. Individuals and organisations provided the committee with graphic details of the injuries suffered by marine fauna through entanglement—loss of limbs, scoliosis and infection. Many marine animals die from being entangled in marine debris particularly turtles encountering ghost nets in Australia's northern waters. However, the committee recognises that much remains unknown about the extent of entanglements as most reports are either restricted to opportunistic observations of animals or are from heavily visited coastal regions.

8.13 Ingestion of both macro- and microplastic marine debris by some marine animals now appears to be more usual than not: over 50 per cent of turtles worldwide have ingested marine debris and over 60 per cent of some species of seabirds have been found with plastic in their gut and it is estimated that 99 per cent of seabirds will have ingested plastic by 2050. Ingestion of marine debris can cause significant problems for marine animals, for example, decomposing plastics ingested by turtles produces gas which remains trapped inside the animal and causes it to float. The turtle may then starve to death or be the target of predators.

8.14 The committee was provided with disturbing evidence of the quantities of plastic that can be ingested by seabirds. At both its Sydney and Brisbane hearings, researchers showed the committee samples of material taken from seabirds. Mr Ian Hutton presented a bag of 274 pieces of plastic ingested by a single shearwater from Lord Howe Island—this represented 14 per cent of the bird's body weight. There is

2 World Economic Forum, *The New Plastics Economy*: *Rethinking the future of plastics*, January 2016, http://www3.weforum.org/docs/WEF_The_New_Plastics_Economy.pdf, (accessed 23 February 2016), p. 10.

also evidence that chicks are being fed plastic in the nest. While there has been much research on the effects of plastic ingestion on individual species of seabirds, the committee was informed that a significant gap in relation to population level research exists.

8.15 The committee also received evidence that other marine creatures—cetaceans, corals and zooplankton—have been found to ingest plastic. However, the impact of ingestion on these species is less clear, though it is suspected that negative health effects are occurring.

8.16 The evidence provided to the committee outlined the effects of marine plastic pollution on fisheries and ecosystems. Fisheries are particularly at threat from lost fishing gear while many of Australia's unique ecosystems are fragile, and are already under threat from climate change, exploration and development.

8.17 Two issues of particular concern raised with the committee were the possible effects of chemical bioaccumulation from plastic ingestion particularly microplastics ingestion. Plastics contain many chemicals, some of which are toxic. These can leach out of plastic debris, affecting marine animals which have ingested the plastic and contaminating the marine environment where it has lodged as litter.

8.18 Microplastics are also known to accumulate and carry toxic chemicals present in seawater, and these chemicals are known to have negative effects on the health of marine fauna. There is also concern that microplastics may bioaccumulate, and that trophic transfer may occur.

8.19 Emerging research points to the significant threat of microplastic to the marine environment. The committee was considerably alarmed to hear that the potential effect on human health from the ingestion of microplastics in the food chain is only now emerging as an area of research interest. The committee is concerned that there may be a looming health crisis associated with seafood consumption, and urges the prioritisation of research on this issue, and appropriate investment from both government and industry. The committee also considers that microplastics warrant specific focus in strategies aimed a mitigating the effects of marine plastic pollution.

8.20 The committee acknowledges the range of research provided by witnesses. However, it is clear from evidence received by the committee that there are significant gaps in the understanding of the threat of marine plastic pollution. For example, the extent of marine plastic pollution, particularly microplastics, effects of marine plastic pollution; the impacts at the population level; and the effects on ecosystems. As noted above, it appears that more research is required in relation to microplastic pollution and possible effects on human health.

8.21 The committee considers that until these gaps are addressed, it will be difficult to better understand the effects of marine plastic pollution and to identify and implement mitigation strategies.

The role of the Australian Government

8.22 As outlined in the report, the Australian Government manages the threat of marine plastic pollution through a variety of ways including the protection of threatened and endangered species and ecosystems, the implementation of international conventions, and the development and implementation of waste management policies.

8.23 The Threat Abatement Plan, established under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is designed to establish mitigation strategies and research priorities for the federal and state and territory governments. The 2014 Review of the Threat Abatement Plan identified that the threat to marine fauna from plastic pollution had not been abated. The committee has grave concerns that this finding points to a lack of action on the part of the Australian Government, particularly in light of growing evidence on both the scale, and the effects, of marine plastic pollution.

8.24 The Department of the Environment is currently revising the Threat Abatement Plan and the committee notes the department's evidence that plastic will be a focus of the revised plan. However, the committee is concerned that there appears to have been a lack of consultation with leading Australian researchers who could have provided a valuable contribution to the review. In addition, while welcoming the emphasis on plastic in the revised plan, the committee is concerned that, given the complexity of the task of addressing marine plastic pollution, effective mechanisms must not only be identified but also implemented. The committee considers that without the implementation of measures contained in the revised plan and a commitment to achieve this by all stakeholders, including industry, little abatement will occur. This would not be an acceptable outcome.

8.25 While the EPBC Act and the Threat Abatement Plan are the primary means for the Australian Government to address marine plastic pollution, the committee received evidence that suggested that these were inadequate tools to effectively mitigate the threat from marine plastic. Given the complexity of issues related to marine plastic pollution, particularly microplastic pollution and the lack of abatement under the Threat Abatement Plan, there were calls for the establishment of a national body to directly address marine plastic pollution.

8.26 The committee has considered this suggestion. While acknowledging that there has been little evidence of effective abatement under the Threat Abatement Plan, the committee does not believe that, at the present time, there is a need to establish a new dedicated marine plastic body.

8.27 Rather, the committee considers that the Australian Government should develop policies in relation to marine plastic pollution that are research-based so that the most efficient and effective mitigation strategies can be established, and pursue issues through the Council of Australian Governments and the meeting of environment ministers.

8.28 In relation to research, the committee notes the extremely small number of research projects into marine debris that the Department of the Environment has directly funded—five between 2003 and 2016. While there is research being undertaken by CSIRO and numerous universities and institutes, the committee considers that the support for research provided by the department in relation to marine plastic pollution falls far short of what is required. The committee considers that the problem of marine plastic pollution is too complex and threatening for the Australian Government to rely on research conducted overseas or research undertaken in Australia with cobbled together funds.

Recommendation 1

8.29 The committee recommends that any future Australian Government policies on mitigating the threat from marine plastic be underpinned by sound, peer-reviewed research.

Recommendation 2

8.30 The committee recommends that the Australian Government actively support research into the effects of marine plastic pollution in Australian waters ,including research to more fully evaluate:

- **the extent of marine plastic pollution;**
- **the sources of marine plastic pollution;**
- **the effects at the population level; and**
- **the effects on ecosystems particularly in the Great Barrier Reef.**

Recommendation 3

8.31 The committee recommends that the Australian Government actively support research into the threat posed by microplastic pollution, including research to:

- **identify the extent of microplastic pollution;**
- **evaluate the effects of microplastic pollution on marine fauna;**
- **evaluate the effects of microplastic pollution on ecosytems; and**
- **identify mitigation measures.**

Recommendation 4

8.32 The committee recommends that the Australian Government actively support research into the threat posed by marine plastic pollution, particularly microplastic, on human health.

Recommendation 5

8.33 The committee recommends that the Australian Government undertake work to identify and establish the costs of the externalities associated with marine plastic pollution.

8.34 Substantial funding will be required to undertake the research needs identified during the inquiry and recommended by the committee. The committee acknowledges that government funding is limited.

8.35 The committee notes that funding for projects which contribute towards the Australian Packaging Covenant's goals is provided by industry. In 2015, APC signatories contributed $1.5 million to fund projects focusing on litter reduction and delivering sustainable waste management solutions.[3] This is a considerable contribution to these projects. However, understanding and addressing the threat of marine plastic pollution is complex, and there is an urgent need to address identified knowledge gaps. As such, the committee considers that it is appropriate that industry provides further support for scientific research into the effects of marine plastic pollution, as well as possible mitigation strategies. The committee is of the firm view that support for scientific research is part of industry's product stewardship responsibility and that this support should be in the form of funding.

Recommendation 6

8.36 The committee recommends that industry contributes further funding of scientific research through the Australian Packaging Covenant.

8.37 The committee recommends that this funding be provided for research which particularly addresses the effect of marine plastic pollution on marine fauna, and human health from ingestion as well as research to identify mitigation strategies.

8.38 The need for a national database containing information on the types and sources of marine plastic pollution in Australia was identified as being critical to developing sound mitigation strategies. The committee received evidence on the Tangaroa Blue Foundation's Australian Marine Debris Initiative and CSIRO's marine debris survey. The committee also notes that there are a number of other state- and organisation-based marine debris databases.

8.39 The committee supports the establishment of a national database for marine plastic debris. Such a database would assist in ensuring consistent data collection and recording and thereby provide a powerful tool to underpin ongoing research. The committee notes that the CSIRO and Australian Marine Debris Initiative have different uses. However, the committee considers that there are mechanisms available to ensure that a national dataset would be suitable for various applications. The committee considers that support should be given to the establishment of the

3 http://www.packagingcovenant.org.au/pages/2015-projects.html

Australian Marine Debris Initiative as the national database. In doing so, the committee recognises the extent of the database, and the support provided by government and researchers to the database.

Recommendation 7

8.40 The committee recommends that the Australian Government consult with stakeholders, including the Tangaroa Blue Foundation, CSIRO and relevant scientists, to explore mechanisms to establish a national marine pollution database.

8.41 The committee further considers that there are means to achieving threat mitigation through the utilisation of alternative legislative and already existing regulatory mechanisms such as the National Environment Protection Measures. The committee considers that the Australian Government should pursue the mitigation of marine plastic pollution through these measures.

8.42 The committee also received considerable evidence encouraging the Australian Government to provide national leadership in addressing the threat of marine plastic pollution. The committee recognises the effect of geographic and demographic influences on both the causes of marine plastic pollution, and in mitigating the threat. Reducing marine plastic pollution requires a multi-layered approach utilising whole-of-government initiatives, and cooperation with state, territory and local governments. It also requires partnership with not-for-profit organisations and industry, and community participation. Given these many difficult factors, the committee considers that leadership by the Australian Government is fundamental to finding effective solutions to marine plastic pollution.

8.43 One mechanism available to the Australian Government is to support the inclusion of marine plastic pollution on the Council of Australian Governments (COAG) agenda. The committee notes that in the most recent COAG communique coastal and marine issues were not mentioned in relation to water, climate change and environmental matters. In light of the evidence provided during the committee's inquiry, the committee considers this to be a significant oversight. The committee believes that marine pollution matters should be considered by COAG.

8.44 In addition, the committee considers that meetings of the environment ministers, in the absence of a standing council of COAG for environmental matters, provide an opportunity to coordinate measures to prevent further plastic entering the marine environment. These meetings also offer an opportunity to coordinate strategies to mitigate the effects of existing marine plastic pollution.

Recommendation 8

8.45 The committee recommends that the Australian Government place marine plastic pollution on the Council of Australian Governments' agenda for urgent consideration.

8.46 In recognition of the level of threat associated with plastic pollution in Australia's marine environment, and the need for a comprehensive and coordinated response, the committee recommends that the Australian Government pursue the establishment of a working group, under the auspices of the meeting of environment ministers, to address specific matters related to marine plastic pollution.

8.47 The specific matters which the committee considers should be addressed by the working group established by the meeting of environment ministers include mitigation strategies such as clean-up campaigns. These are discussed in detail in the relevant sections of this chapter.

8.48 The committee considers that marine plastic pollution cannot be addressed by Australia in isolation. Given Australia's proximity to heavily populated areas to our north, the extensive fishing activities adjacent to Australian waters, the large amount of sea traffic in the Pacific and Indian Oceans and the complexity and increasing scale of marine plastic pollution, regional cooperation will be vital.

8.49 The committee notes the work already being undertaken to provide support for education and mitigation measures in Indonesia in relation to ghost nets. However, the committee considers that the Australian Government should explore further avenues to increase regional awareness of the threat of marine plastic pollution and to provide support to our neighbouring countries through both technical aid and financial assistance with mitigation measures. The committee is particularly concerned that the Pacific island states have recognised the threat of marine plastic pollution but may lack the resources to implement effective strategies.

Recommendation 9

8.50 The committee recommends that the Australian Government explore opportunities for increased regional leadership and direct support on the issue of marine plastic pollution, including projects focused on ghost net recovery.

Collecting and removing marine plastic pollution

8.51 Since the 1980s, clean-up campaigns have formed an integral part of marine plastic pollution mitigation strategies. The committee received evidence on the significant, and in some cases startling, volumes, collected and removed from the marine environment across Australia. In Cape York for example, up to one tonne of debris per kilometre is being removed annually.

8.52 The Australian Government supports clean-ups through the Australian Government's Green Army Programme and ghost net retrieval programs. Support is also provided by state and territory governments and local governments. Nonetheless, the vast majority of clean-ups are undertaken by volunteers. The committee acknowledges the enormous contribution made by volunteers and the organisations that support them; without their efforts marine plastic pollution would accumulate in coastal areas unchecked.

8.53 While the committee received evidence questioning the effectiveness of clean-up efforts, it considers that clean-ups still play a vital role in addressing marine plastic pollution. In addition, the committee recognises the valuable role that clean-ups play in raising public awareness and providing education on the sources and impacts of marine pollution. However, the committee considers that there is a need for greater coordination of clean-up efforts as well as a strategic approach.

Recommendation 10

8.54 The committee recommends that the Australian Government pursue mechanisms to improve support and coordination of clean-up activities through the meeting of environment ministers working group to ensure that the most effective outcomes of these activities are achieved.

8.55 An area in which Australian Government agencies play a significant role is the identification, collection and removal of abandoned, lost or otherwise discarded fishing gear. In particular, Australian Government agencies respond to ghost nets originating from fishing operations in neighbouring countries, which commonly drift into northern Australian waters. Evidence indicated that it is a complex issue which requires significant coordination and cooperation, and that there are a number of areas where improvements could be made.

8.56 First, it was noted that the responsibility for ghost nets rests with six Australian Government agencies (for nets in the Australian Fishing Zone) as well state and Northern Territory counterparts (for nets in coastal waters), and regional neighbours. Secondly, there is a lack of funding for retrieval of ghost nets. The committee notes that the GhostNets Australia program, originally funded from the National Heritage Trust, no longer receives direct funding from the Department of the Environment. GhostNets Australia plays an important role in ghost net retrieval as an alliance of Indigenous communities from coastal northern Australia who work with researchers.

8.57 The lack of funding and coordination were identified as contributing to delays in the identification and removal of ghost nets, and the subsequent entanglement of significant numbers of marine fauna. It was also identified that increased cooperation and regional leadership may result in a reduction in ghost nets in Australian waters.

8.58 The difficulties associated with the collection and disposal of ghost nets in remote areas were also raised with the committee. It was noted that opportunities exist for innovative strategies to be developed and implemented which would reduce the

impact of burning large ghost nets in situ — including the implementation of waste-to-energy systems in remote communities. The CSIRO also told the committee that research into innovative strategies to tag fishing gear may allow for the identification of net origin, and allow for greater user responsibility.

8.59 The committee acknowledges that the coordination of retrieval of ghost nets is an action under the Threat Abatement Plan. However, the committee considers that ghost nets continue to pose a serious threat to marine fauna in Australian waters, and Australian fisheries. The evidence points to a need to improve coordination of agencies that identify and remove ghost nets. While this matter will be addressed in the revised Threat Abatement Plan, the committee considers that there is an urgent need to address coordination problems. As such, it believes that the Department of the Environment should undertake a review of current arrangements for the detection and removal of ghost nets. The committee recommends that a nationally consistent strategy be developed to ensure that ghost nets are detected and removed from both the Australian Fishing Zone and coastal waters.

8.60 Further, the committee considers that continued engagement with the governments and coastal communities of our near neighbours is critical to addressing concerns with abandoned fishing gear.

Recommendation 11

8.61 The committee recommends that the Australian Government:

- **support CSIRO research to identify the extent of ghost nets in Australian waters, and to identify means to prevent the loss of fishing gear;**
- **support the development of innovative technologies for the tagging of fishing gear and support the introduction of these technologies by the Australian-based fishing industry, and by fishing industries in regional countries;**
- **undertake a review of current Commonwealth arrangements to detect and remove ghost nets; and**
- **develop a nationally consistent strategy through the meeting of environment ministers working group to ensure that ghost nets are collected in a timely manner in the Australian Fishing Zone, and coastal waters.**

Recommendation 12

8.62 The committee recommends that the Australian Government reinstate funding for GhostNets Australia to allow it to continue its work to identify and retrieve ghost nets.

Source reduction – consumer behaviour and infrastructure

8.63 The importance of changing consumer behaviour, particularly in relation to waste disposal was highlighted throughout the inquiry. The committee received evidence that education campaigns, particularly those targeted at specific user groups such as fishers and boat owners, can result in significant reductions of marine debris. The committee recognises the value of community education in preventing marine plastic pollution, and commends organisations and government bodies undertaking this work.

8.64 The committee also notes that there is some community confusion regarding the differences between biodegradable, degradable plastic, compostable and traditional plastic. Of particular concern is the lack of understanding about the ways in which these items should be disposed of, and the end product. While consumers might feel they are 'doing the right thing' by choosing biodegradable or degradable plastic, these products simply disintegrate into smaller and smaller pieces to become microplastic. The committee strongly considers that education campaigns are required to ensure consumers make informed choices about the alternatives to traditional plastics being offered.

Recommendation 13

8.65 The committee recommends that the Australian Government, through the meeting of environment ministers working group, encourage all jurisdictions to support the implementation of targeted education campaigns which aim to change consumer behaviour in relation to the use of plastics, and to provide consumers with information regarding alternatives to traditional plastic.

8.66 The implementation and maintenance of infrastructure such as public rubbish bins has also been identified as being critical in promoting the responsible disposal of plastic items by the public.

8.67 The committee received evidence about the amount of debris being transported in the marine environment through the stormwater system. Local governments install gross pollutant traps to lessen the amount of debris entering stormwater systems but the committee heard that these were expensive to install and maintain. The committee also received evidence that new technologies are also available but similarly, the costs of retrofitting existing systems with new technology is expensive and therefore less common than it should be.

8.68 The committee's 2015 report on the management of stormwater resources in Australia examined the critical role infrastructure plays in preventing the movement of urban litter into the marine environment. In that report, the committee recommended that the Australian Government work with the state and territory governments to develop and implement a national policy framework for stormwater management (a National Stormwater Initiative) (Recommendation 1) and that new funding models and financial incentives be considered as a way of facilitating improved stormwater management outcomes in an economically efficient way (Recommendation 4).

8.69 The committee considers that implementation of these two recommendations would greatly assist with the prevention of plastic debris entering the marine environment.

Recommendation 14

8.70 The committee recommends that the Australian Government implement the recommendations from the Senate Environment and Communications References Committee inquiry into stormwater management in Australia, in particular:

- **Recommendation 1—the development and implementation of a national policy framework for stormwater management (a National Stormwater Initiative); and**
- **Recommendation 4—the consideration of new funding models and financial incentives that would facilitate improved stormwater management outcomes in an economically efficient way.**

Container deposit schemes

8.71 Container deposit schemes were seen as a simple and cost effective way to change consumer behaviour, and to reduce the number of beverage containers found in the marine environment. There is strong community support for container deposit schemes, evidenced by the number of submissions and form letters received by the committee during the inquiry. The committee also notes the compelling argument that container deposit schemes encourage widespread participation in recycling through the provision of a financial incentive.

8.72 While container deposit schemes have been established in over forty jurisdictions worldwide, only South Australia and the Northern Territory have established container deposit schemes in Australia. The South Australian scheme was established in 1977 and many submitters pointed to the benefits accruing from this scheme. In particular, CSIRO research indicates that there has been a reduction—by a factor of three—of beverage containers in the marine environment. The high level of recycling in South Australia was also put forward by supporters of container deposit schemes.

8.73 The committee supports the introduction of container deposit schemes in all Australian jurisdictions. The committee believes that there are proven benefits of such schemes, for example, the ability to remove an additional 35,000 tonnes from the waste stream. The committee considers that the responsibility for implementation rests with each state and territory. However, if container deposit schemes have not been introduced by 2020, the committee believes that this matter should be revisited.

8.74 The committee recognises that the implementation of container deposit schemes is a polarising issue with beverage industry representatives being concerned about possible associated costs to consumers, industry and government. While acknowledging these concerns, the committee is somewhat sceptical of many of the

arguments put forward by industry. In relation to concerns about the costs that will be borne by the community, the committee notes that there will be benefits to both the community and government in reduced costs of litter collection and disposal, less landfill and the reduction of environmental impacts.

8.75 The industry also pointed to concerns that container deposit schemes will reduce demand for beverages and thereby affect investment and employment in the sector. The committee notes that there are currently other matters affecting the beverage sector including concerns with the amount of sugar in beverages which is leading to consumers reassessing their consumption habits.

8.76 Another concern put forward by the industry is the impact on kerbside recycling. The committee notes that in jurisdictions in which kerbside recycling exists without container deposit schemes, recycling rates remain alarmingly low. In addition, research from PricewaterhouseCoopers presented to the committee does not support the contention that kerbside recycling and container deposit schemes cannot co-exist.

8.77 The committee notes that the industry opposes the introduction of a refund-based container deposit scheme in New South Wales and has proposed an alternative—*Thirst for Good*. This is a suite of initiatives including litter collection, funding of bin infrastructure and reverse vending machines which do not offer financial incentives. This alternative was criticised in evidence as overseas experience demonstrates that non-refund programs fail. In addition, it was argued that it is not effective in increasing recycling rates where consumption takes place away from home.

Recommendation 15

8.78 The committee recommends that the Australian Government, through the meeting of environment ministers working group, actively encourage the states and territories, which have not already done so, to consider the most effective methods to address marine plastic pollution in their jurisdictions. These should include implementation of container deposit schemes and other anti-littering mitigation strategies.

Recommendation 16

8.79 The committee recommends that, if all states and territories have not introduced container deposit scheme legislation by 2020, the Australian Government revisit the issue with the view to developing legislation for those jurisdictions which are yet to implement container deposit schemes.

Source reduction – product stewardship and regulatory frameworks

8.80 Source reduction strategies must also include changes in production and manufacturing practices, and regulatory frameworks. The committee explored the value of increased product stewardship, and the need for increased regulation to prohibit the sale and use of certain products such as single-use lightweight plastic bags and microbeads in personal care products.

8.81 Producers and manufacturers play a crucial role in reducing marine plastic pollution, particularly through packaging design choices. The committee received evidence on voluntary schemes such as the Australian Packaging Covenant (APC), and the ways in which these schemes can be improved.

8.82 Insufficient reporting and the voluntary nature of the APC was particularly criticised, as was the lack of enforcement and compliance activities undertaken by government authorities. The committee notes that the APC is currently under review and renegotiation and is of the view that this review should recognise the magnitude of the environmental threat posed by single-use packaging and consumer items. In addition, the committee considers that the APC would benefit from improved reporting and compliance. Enforcement activities under the APC should also be undertaken by relevant state and territory agencies.

8.83 The committee notes that the role of the plastic packaging industry in reducing marine plastic pollution is not included under the current Threat Abatement Plan. However, the committee is of the view that improved product stewardship is critical to achieving a reduction in the volume of plastic entering the marine environment.

Recommendation 17

8.84 The committee recommends that the revised Australian Packaging Covenant include improved reporting and compliance by industry.

Recommendation 18

8.85 The committee recommends that the Australian Government, through the meeting of environment ministers working group, engage with states and territories to improve enforcement of the Australian Packaging Covenant.

Recommendation 19

8.86 The committee recommends that the Department of the Environment give consideration to recognising the role of product stewardship in the Threat Abatement Plan by including reference to the Australian Packaging Covenant

8.87 Evidence was received which showed the gains to be made in reducing plastic pollution through innovation and design. In this regard, the committee notes the efforts of the beverage industry in redesigning containers to reduce the amount of plastic used. Other examples include the substitution of bamboo utensils for use with takeaway food and starch 'peanuts' in packaging. These are encouraging developments but the committee recognises that there are many more areas where gains could be made through innovation and design.

Recommendation 20

8.88 The committee recommends that the review of the Australian Packaging Covenant include support for the development innovative packing solutions that offer alternatives to plastics.

8.89 During the course of the inquiry, a considerable amount of evidence was received supporting the introduction of legislative bans of lightweight, single-use plastic bags due to the volume of such items found in the marine environment. The committee is aware that such bans have been implemented in a number of jurisdictions in Australia and is of the view that such bans should be considered in remaining states and territories.

8.90 The committee is concerned that existing bans have seen the widespread replacement of single-use lightweight plastic bags with degradable plastic bags. The committee received evidence that such items are in fact just as harmful, and could pose a greater risk to marine fauna due to their increased rate of degradation. The committee is of the view that such a replacement should not be supported by government policy without further research.

Recommendation 21

8.91 The committee recommends that the Australian Government support states and territories in banning the use of single-use lightweight plastic bags. In doing so, the Australia Government should ensure that alternatives do not result in other pollutants entering the environment.

8.92 Evidence was also received supporting a legislative ban on the importation and production of personal care products containing microbeads. At present, a number of manufacturers and retailers have announced a commitment to phasing out such products. The committee notes that on 29 February 2016, Minister for the Environment, the Hon Greg Hunt MP, announced that the Australian Government will continue to support the voluntary phase out of microbeads, however if this does not achieve what is in effect a ban by 1 July 2017, then the Australian Government will implement a ban legislatively.

8.93 The committee is supportive of any moves to remove microbeads from consumer products. However, it considers that the evidence of the level of damage to the environment from microbeads is such that an immediate ban should occur. The committee notes that microbeads have been banned in other jurisdiction, for example, Canada where the House of Commons voted unanimously to pass the relevant legislation.

8.94 The committee understands that there are avenues already available to the Australian Government: banning importation through the listing products containing microbeads as a prohibited import; and banning production of personal care products containing microbeads under the Cosmetics Standard. While such bans do not comprehensively address all sources of microplastics, it is an important first step.

Recommendation 22

8.95 The committee recommends that the Australian Government move to immediately ban the importation and production of personal care products containing microbeads.

8.96 The committee also notes that there are other legislative mechanisms which could be used to decrease the amount of plastics entering the environment. This includes state and territory environmental protection legislation and the MARPOL Annex V convention. Evidence received argued that greater enforcement of these measures is required. The committee supports the use of existing environmental protection legislation particularly in relation to controlling the release into waste management systems of pre-production plastic pellets (nurdles) from factories. The committee considers this would be an easy and effective means of addressing pollution from nurdles.

Recommendation 23

8.97 The committee recommends that the Australian Government, through the meeting of environment ministers working group, identify measures, including regulatory measures, already available to prevent plastics entering the marine environment and ensure that they are being implemented effectively in all jurisdictions. In particular, the committee recommends that more effective enforcement of environmental laws in relation to preventing nurdles entering the waste management system be pursued.

Senator Anne Urquhart

Chair

APPENDIX 1

Submissions, additional information, tabled documents and answers to questions on notice

Submissions

1 Total Environment Centre
2 Tasmanian Government
3 Householders' Options to Protect the Environment Inc.
4 National Toxics Network
5 Wildlife Preservation Society of Queensland
6 Poly Marketing Pty Ltd T/A ENVORINEX
7 CSIRO
8 Sydney Coastal Councils Group
9 Clean Up Australia
10 TopInfo Consulting
11 Australian Institute of Marine Science
12 Waste Management Association Australia Tasmania Branch
13 Eco Barge Clean Seas Inc.
14 Surfrider Foundation Australia
15 Clean Ocean Foundation
16 Associate Professor Mark Osborn
17 Georges River Combined Councils' Committee Inc.
18 Department of the Environment
19 Boonah Organisation for a Sustainable Shire
20 Adelaide and Mount Lofty Ranges Natural Resource Management Board
21 Dr Mark Browne, and co-authors Professor Tony Underwood, Professor Gee Chapman, and Professor Emma Johnston
22 Humane Society International
23 Councillor Irene Doutney
24 Logan and Albert Conservation Association
25 Two Hands Project Inc.
26 Emerald for Sustainability Inc.
27 Professor Stephen D.A. Smith
28 Queensland Conservation Council
29 Great Barrier Reef Marine Park Authority
30 Association of Container Deposit System Operators
31 Capricorn Coast Local Marine Advisory Committee
32 Capricorn Conservation Council
33 Australian Fisheries Management Authority
34 Wide Bay Burnett Environment Council Inc.
35 Werribee River Association
36 Name Withheld
37 Mr Derek Saunders
38 Name Withheld
39 Ms Rohani Mitchell
40 Ms Joanne Barkworth
41 Ms Leonie Stubbs
42 Ms Dinny Laurence
43 Miss Emma Williams
44 Ms Jennie Phillips
45 Name Withheld

46	Mr Carmelo Miragliotta
47	Name Withheld
48	Ms Danielle Ryan
49	Ms Rebecca Prince-Ruiz
50	Mrs Marion Cook
51	Ms Leah Page
52	Mr Dale Martin
53	Ms Meredyth Woodward
54	Ms Su Garfinkle
55	Newtecpoly Pty Ltd
56	Coolum and North Shore Coast Care
57	Scab Duty
58	Capricorn Coast Landcare Group Inc.
59	The Dugong Collective
60	Tangaroa Blue Foundation
61	Liverpool City Council
62	Dr Fiona Whitelaw
63	Northern Territory Seafood Council
64	Cairns and Far North Environment Centre
65	PACIA
66	Australasian Bioplastics Association Incorporated
67	Stormwater Australia
68	Australian Maritime Safety Authority
69	Mr Ian Hutton
70	Mr James Cordwell
71	Mr Steven Mitchell
72	Take 3
73	I Like Turtles
74	EDOs of Australia
75	Oceanwatch
76	Birdlife Australia
77	Boomerang Alliance
77.1	Boomerang Alliance, Supplementary submission
78	Law Council of Australia
79	Parks Victoria
80	Australian Seabird Rescue Inc
81	Port Phillip EcoCentre Inc
82	Ms Cheryl Cooper
83	Ms Andrea Woods
84	Mr Scott Bell-Ellercamp
85	Ms Anne Wharton
86	Ms Lyndi Chapman
87	Ms Gillian Fahey
88	Ms Joanna McRae
89	Ms Sue Ellerman
90	Ms Jenanne Kornfeld
91	Mr Glen Shaw
92	Mr Norm Morwood
93	Ms Siobhan Paget
94	Mr Donald Ross and Ms Felicite Ross
95	Mr Michael Asbridge
96	Mr Peter Lamb
97	Ms Jacqueline Puz
98	Ms Marilyn Goninon
99	Mr Harry Johnson
100	Ms Frances Hayward
101	Ms Lynden Jacobi

102	Ms Dörte Planert
103	Mr Robert Pauling
104	Wildcoast Publications
105	Ms Shannon Constance
106	Name Withheld
107	Mr Anthony Hill
108	Ms Meg Rani Carvosso
109	Ms Carole Perry
110	Mr Rowley Goonan
111	Dr Tom Grant
112	Mr Duncan Bourne
113	Ms Lyndal Breen
114	Ms Jennifer Kent
115	Ms Taylor Springett
116	Ms Lesley Haine
117	Ms Karen Joynes
118	Mr Greg Hutchinson
119	Mr Ranjith Evas
120	Mr Alan Bell
121	Mr Marc Matthews
122	Mr Robert McAlpine
123	Ms Julianne Stuart
124	Dr Marilyn Olliff
125	Ms Wendy Dugmore
126	Dr Flavia Santamaria
127	Mr Michael Beasley
128	Ms Pat Carden
129	Ms Judy Blyth
130	Ms Janice Wegner
131	Mr Adam Fletcher
132	National Environmental Law Association
133	Ms Janette Allison
134	Mr Charles Gream
135	Mr Stephen Cottee
136	Ms Ramona Headifen
137	Mr Adam Hall
138	SPEL Environmental Integrated Water Solutions
139	Ms Rachel Craig
140	Ms Jan Anderson
141	Dr Kathy Townsend and Dr Qamar Schuyler
142	Ms Lesley Killen
143	Ms Jennifer Powers
144	Name Withheld
145	Mr Robert Woodley
146	Mr Ben Worthington
147	Ms Sara Eisner
148	Mr John Catalano
149	Mr Lou Hollis
150	Mr Evan Christen
151	Ms Gillian Wilde
152	Ms Julie Bennett
153	Ms Silke van der Linden
154	Mr Apostolis Hadoulis
155	Name Withheld
156	Ms Elvyne Hogan
157	Ms Gabrielle King
158	Ms Leah Gaskell
159	Ms Lucy Bonham

160 Mr Mike Timms and Ms Sadie Cuming
161 Mr Guy Boston
162 Ms Erin Rhoads
163 Mr Tom Burrowes
164 Mr Mick Morley
165 Ms Pamela Irving
166 Mr John Blyth
167 Ms Deirdre Loveless
168 BeachPatrol Australia
169 Mr Daniel Panek
170 Ms Miranda Kichenside-Quinn
171 Ms Nicole Lew
172 Mr Robert Westerman
173 Mr Mike Aldridge
174 Victorian Marine Animal Defence Conservation Society
175 Ms Carolyn Lee
176 Ms Madeleine Charles
177 Southern Coastcare Association of Tasmania
178 Ms Betty Spilsted
179 Ms Renee Schweicker
180 Ms Maddie Glynn
181 Mr Robert Strachan
182 Ms Marita Macrae OAM
183 Friends of Cabarita Park and Wharf
184 Bournda Environmental Education Centre
185 Ms Sally George
186 Talk Plastic
187 Ms Elizabeth Beaumont
188 Ms Eve Lamb
189 Confidential
190 Dr Heidi Auman
191 Australian Nuclear Science and Technology Organisation
192 Coca-Cola Amatil
193 Australian Food and Grocery Council

Additional Information

Form letters received:

Form letter 1 – received from 527 individuals

Form letter 2 – received from 174 individuals

Correspondence:

Australian Packaging Covenant: correspondence dated 12 April 2016

Tabled documents

Clean Up Australia: Statement (public hearing, Sydney, 18 February 2016)

Clean Up Australia: 2015 Rubbish Report—National (public hearing, Sydney, 18 February 2016)

Professor Stephen Smith: Graphic, Plastic bottles on beaches, Northern NSW (public hearing, Sydney, 18 February 2016)

Boomerang Alliance: Graphic, Microbead pollution, nano plastic pollution, microplastic nurdles, secondary microplastic and improper waste management (public hearing, Sydney, 18 February 2016)

Boomerang Alliance: Australian Packaging Covenant, *Media Release*, 16 December 2015 and extract from National Recycling and Recovery Survey 2014–15 (public hearing, Sydney, 18 February 2016)

National Toxics Network: Contaminants in marine plastic pollution: 'the new toxic time-bomb' (public hearing, Brisbane, 10 March 2016)

Answers to questions on notice

National Toxics Network: Answers to questions taken on notice (public hearing, Brisbane, 10 March 2016)

Dr Kathy Townsend: Answers to questions taken on notice (public hearing, Brisbane, 10 March 2016)

CSIRO: Answers to questions taken on notice (public hearing, Canberra 26 February 2016)

Liverpool City Council: Answers to questions taken on notice (public hearing, Sydney, 18 February 2016)

BirdLife Australia: Answers to questions taken on notice (public hearing, Canberra, 26 February 2016)

Great Barrier Reef Marine Park Authority: Answers to questions taken on notice (public hearing, Brisbane, 10 March 2016)

National Environmental Law Association: Answers to questions taken on notice (public hearing, Sydney, 18 February 2016)

Australian Institute of Marine Science: Answers to questions taken on notice (public hearing, Brisbane, 10 March 2016)

Department of the Environment: Answers to questions taken on notice (public hearing, Canberra, 26 February 2016)

Australian Food and Grocery Council: Answers to question taken on notice (public hearing, Canberra, 31 March 2016)

APPENDIX 2

Public hearings

Thursday, 18 February 2016 - Sydney

Dr Mark Browne – Private Capacity

Professor Tony Underwood – Private Capacity

Professor Stephen Smith – Private Capacity

Dr Jennifer Lavers – Private Capacity

Mr Ian Hutton – Private Capacity

National Environmental Law Association
Dr Sarah Waddell
Ms Ellen Geraghty

Clean Up Australia
Mr Ian Kiernan AO, Executive Chairman
Ms Terrie-Ann Johnson, Chief Executive
Mr Dave West, Environmental Economist advising Clean Up Australia

Liverpool City Council
Dr Madhu Pudasaini

Boomerang Alliance
Mr Dave West, National Policy Director and Founder

Total Environment Centre
Mr Jeff Angel, Executive Director

OceanWatch Australia
Mr Brad Warren, Executive Chair
Mr Simon Rowe, Program Manager – Environment

Surfrider Foundation Australia
Mr Brendan Donohoe, President of Northern Beaches Branch
Ms Susie Crick, Board Member
Ms Rowan Hanley, Northern Beaches Committee Member

EDOs of Australia
Ms Rachel Walmsley, Policy and Law Reform Director
Mr Nari Sahukar, Senior Policy and Reform Solicitor

Association of Container Deposit System Operators
Mr Robert Kelman, Executive Officer

Friday, 26 February 2016 – Canberra

CSIRO

Dr David Smith, Research Director, Oceans and Atmosphere
Dr Britta Denise Hardesty, Senior Research Scientist, Oceans and Atmosphere

Department of the Environment

Mr Stephen Oxley, First Assistant Secretary, Wildlife, Heritage & Marine Division
Mr Paul Murphy, Assistant Secretary, Wildlife Trade & Biosecurity Branch, Wildlife Heritage and Marine Division
Mr Andrew McNee, Assistant Secretary, Chemicals & Waste Branch, Environment Standards Division
Ms Rachel Parry, Assistant Secretary, Reef Branch, Biodiversity Conservation Division

Australian Maritime Safety Authority

Mr Toby Stone, General Manager, Marine Environment
Mr Matt Johnson, Manager, Environment Standards

Australian Fisheries Management Authority

Ms Kerry Smith, Senior Manager, Foreign Compliance Policy

Birdlife Australia

Dr Eric Woehler, Convenor, Birdlife Tasmania

Thursday, 10 March 2016 – Brisbane

National Toxics Network

Ms Joanna Immig, Coordinator
Dr Mariann Lloyd-Smith, Senior Advisor

Australian Institute of Marine Science

Dr Frederieke Kroon, Principal Research Scientist
Dr Britta Schaffelke, Research Program Leader

Australian Seabird Rescue

Ms Kathrina Southwell, General Manager

Tangaroa Blue Foundation

Ms Heidi Taylor, Managing Director

Dr Kathy Townsend – Private Capacity

Thursday, 31 March 2016 – Canberra

Coca-Cola Amatil

Ms Elizabeth Therese McNamara, Group Head of Public Affairs and Communications

Australian Food and Grocery Council

Mr Gary Dawson, Chief Executive Officer

Ms Tanya Barden, Director, Economics and Sustainability

Statewide Recycling Pty Ltd

Mr Jeffrey Robert Maguire

Australian Beverages Council

Mr Geoff Parker, Chief Executive Officer