



Regulating Plastic Shopping Bags in the Australian Capital Territory

Plastic Shopping Bag Ban Act 2010 Options Analysis

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Table of Contents

1. Introduction	5
2. Types of plastic shopping bags.....	7
3. Plastic bag consumption and use in Australia and the ACT	9
3.1 National plastic bag consumption and use.....	9
3.2 Plastic bag consumption and use in the ACT.....	14
4. Environmental impacts of plastic bags	17
4.1 Production-related impacts	18
4.2 Use-related impacts	19
4.3 Disposal, recycling and reuse	21
4.3.1 How is most plastic waste disposed of?	21
4.3.2 What are the environmental impacts of disposal to landfill and littering?.....	25
4.4 Comparing the environmental impacts of plastic bags and plastic bag substitutes.....	33
5. Plastic bag regulation in Australia.....	38
6. Effectiveness of legislated Australian bans	40
6.1 Previous reviews of Australian plastic bag bans	41
6.1.1 ACT reviews.....	41
6.1.2 South Australia reviews.....	43
6.1.3 Northern Territory review.....	45
6.2 How environmentally effective has the ACT plastic bag ban been?..	46
6.2.1 Changes in plastic bag consumption	46
6.2.2 Changes in plastic bag litter	49
7. Challenges associated with the implementation of the ACT plastic bag ban 55	
7.1 Retailer compliance costs	55
7.2 Increases in household shopping costs.....	56
7.3 Government enforcement costs.....	57
7.4 Sustainability of community support	57

8.	Options for reform of the ACT <i>Plastic Shopping Bag Ban Act 2010</i>	62
8.1	Contextual information	62
8.1.2	Support for change to improve environmental outcomes.....	62
8.1.2	Jurisdictional inconsistencies	65
8.1.3	Information availability and uncertainties.....	66
8.2	Analysis of reform options.....	66
8.2.1	Keep the ban as it is (do nothing)	66
8.2.2	Increase the minimum thickness of plastic shopping bags	68
8.3	Require all plastic bags to be biodegradable and compostable	71
8.4	Ban plastic shopping bags	77
8.5	Use prices to reduce consumption of plastic shopping bags.....	80
8.6	Introduce a mandatory disclosure regime for the sale and distribution of plastic bags by retailers	85
9.	Conclusions and recommendations.....	87
	Appendix A: Australian Customs Service harmonised tariff item statistical classification codes and descriptions for plastic bags	91
	Appendix B. Household and retailer HDPE surveys.....	92
B1.	Household survey	92
B2.	Retailer HDPE survey	94
	Appendix C. Legislative design in Australian jurisdictions.....	96
C1.	South Australia	96
C2.	Northern Territory	97
C3.	Australian Capital Territory.....	98
C4.	Tasmania	99
C5.	Queensland	100

1. Introduction

Plastics are synthetic materials made from a range of organic polymers that are capable of being moulded when soft. Most plastics are currently made from fossil fuels, typically the by-products from the processing of oil or natural gas. However, there are now a range of bio-based polymers that are used to make plastics, including bioethylene, polylactic acid (PLA) and polyhydroxyalkanoate (PHA).

Generally, plastics are split into two broad families: thermoplastics and thermosets. Thermoplastics are a family of plastics that melt when heated and solidify when cooled, and can be repeatedly reheated, reshaped and re-cooled. They include polyethylene (PE) and polypropylene (PP), two polymers commonly used to make plastic bags. Thermosets are a family of plastics that undergo a chemical change when heated, forming an irreversible, cross-linked chemical bond. In contrast to thermoplastics, once cured, thermosets cannot be re-melted and reformed.

The history of plastics is generally dated to the 1860s, when Alexander Parkes invented Parkesine and John Wesley Hyatt invented celluloid, or to 1907-09, when Leo Baekeland made the first fully synthetic plastic, Bakelite.¹ While used for various purposes from the late 1800s, it was not until the 1950s that the commercial production of plastics began in earnest. In 1950, global production was approximately 1.5 million tonnes (Mt). By 1964, it had reached 15 Mt. It hit 50 Mt in 1977, passed 100 Mt in 1989 and, in 2016, was 335 Mt.²

The growth in global plastic production is a testament to the utility and economy of plastics.³ They are versatile, cheap, lightweight and, in many forms, durable. These characteristics have resulted in plastics becoming a central and inescapable part of modern life. Plastics now come in hundreds of different forms and are used to make thousands of different products, including phones, computers, motor vehicles, planes, cooking utensils, cutlery, stationary, food wrapping and bags.

While extremely useful, plastics can have adverse environmental impacts. These stem from how plastics are made through to how they are disposed. Amongst other things, plastics are a major source of litter, cause damage to marine animals and birds through ingestion and entanglement, and can

¹ S Freinkel, *Plastic: A Toxic Love Story* (Houghton Mifflin Harcourt, 2011); J Meikle, *American Plastic: A Cultural History* (Rutgers University Press, 1995); W Bijker, 'The Social Construction of Bakelite: Toward a Theory of Invention', in W Bijker, T Hughes and T Pinch, *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (MIT Press, 1987).

² Plastics Europe, *Plastics – The Facts 2017* (PlasticsEurope, 2017).

³ A Andrady and M Neal (2009) 'Applications and societal benefits of plastics', *Philosophical Transactions of the Royal Society B* 364, 1977–1984.

absorb and redistribute other pollutants in the environment. Concerns about these and other related forms of pollution has led to calls for restrictions on the production and use of different types of plastics.⁴ One of the primary targets for reform has been plastic shopping bags.

Policy measures to reduce the use of plastic shopping bags have been introduced in approximately 90 countries at national, provincial and/or municipal levels.⁵ These measures typically target lightweight single-use plastic bags made of high or low density polyethylene (HDPE and LDPE bags). The Australian Capital Territory (ACT) introduced a ban on single-use plastic bags through the *Plastic Shopping Bag Ban Act 2010* in November 2011, becoming the third Australian jurisdiction to do so.

Questions have been raised about the efficacy of the *Plastic Shopping Bag Ban Act 2010* and whether additional measures might be necessary to ensure it achieves its environmental objectives. In response to these concerns, in December 2017, the Minister for Climate Change and Sustainability, Shane Rattenbury MLA, asked the ACT Commissioner for Sustainability and the Environment to evaluate the operation of the *Plastic Shopping Bag Ban Act 2010* and assess whether any changes were warranted.

This technical report was commissioned by the ACT Commissioner for Sustainability and the Environment to address the issues raised by the Minister. The report is set out as follows. Section 2 describes the types of plastic bags within the scope of the review. Section 3 analyses the levels of plastic bag consumption and use in Australia and the ACT. Section 4 provides an overview of the environmental impacts associated with the production, consumption and disposal of plastic bags. Section 5 reviews the regulations concerning the sale and distribution of plastic bags in Australian jurisdictions. Section 6 reviews the literature on the environmental effectiveness of the plastic bag bans in Australian jurisdictions, and provides an analysis of the effectiveness of the ACT plastic bag ban. Section 7 analyses the challenges and costs associated with the ACT ban, focusing on retailer compliance costs, increases in household expenditure, government compliance and enforcement costs, and community support. Section 8 analyses options for

⁴ C Rochman et al. (2013) 'Classify plastic waste as hazardous', *Nature* 494, 169-171; United Nations Environment Programme (UNEP), *UNEP Yearbook 2014: Emerging Issues in Our Global Environment* (United Nations, 2014); World Economic Forum (WEF), *The New Plastics Economy: Rethinking the Future of Plastics* (WEF, 2016); R Thompson et al. (2009) 'Plastics, the environment and human health: current consensus and future trends', *Philosophical Transactions of the Royal Society B* 364, 2153–2166.

⁵ D Xanthos and T Walker (2017) 'International policies to reduce plastic marine pollution from single-use plastics (plastic bags and microbeads): A review', *Marine Pollution Bulletin* 118(1-2), 17-26; I Steensgaard et al. (2017) 'From macro- to microplastics: Analysis of EU regulation along the life cycle of plastic bags', *Environmental Pollution* 224, 289-299.

reform of the plastic bag ban and section 9 concludes and provides recommendations.

2. Types of plastic shopping bags

Within Australia and the ACT, there are many different types of shopping bags in use and these are described and classified in a number of different ways.

The main types of plastic shopping bags are made of high density polyethylene (HDPE), low density polyethylene (LDPE), polypropylene (PP) and, to a lesser extent, polyethylene terephthalate (PET). These bags can be made of 'virgin' or recycled resins, and can be designed for single use or to be reused. Apart from plastic bags, there are several types of shopping bags that are made of natural fibres, including paper, jute (hessian) and calico (cotton). The main types of bags discussed in this report are described in Table 1. They include household garbage bags (also known as kitchen tidy bags) because plastic shopping bags are sometimes used as substitutes for standard household garbage bags.

In response to concerns about the environmental impacts of plastic bags, a number of different types of 'degradable' plastic bags have been developed. The term 'degradable' when used in the context of plastics is unhelpful as all plastics degrade through physical, chemical or organic processes. The critical issues are the speed at which they degrade and what they degrade into. The five main types of 'degradable' plastic bags are described in Table 2.

Table 1. Main types of bags discussed in this report

Bag type	Description
Single-use HDPE bags	Typically grey or white singlet type plastic bags made of HDPE that are less than 35 microns (μm) in width and weigh between 5-8 grams. Grey fossil fuel-based single-use HDPE bags are commonly distributed at supermarkets in jurisdictions without plastic bag bans (e.g. NSW).
Reusable HDPE bags	Typically white singlet type plastic bags made of HDPE that are $\geq 35 \mu\text{m}$ in width. In the ACT, 35 μm HDPE bags weighing around 14 g are distributed at many smaller supermarkets, grocery stores, food markets and restaurants. These bags are often labelled as reusable but are frequently treated as single-use bags.
Single-use produce bags	Also known as barrier bags, produce bags are made of either HDPE or LDPE, are typically sold in rolls and are commonly used to package and carry fresh produce, including fruit, vegetables and various types of meats. Produce bags typically weigh around 2.5 g. In the ACT, produce bags are provided to shoppers without charge at most supermarkets, grocery stores and food markets.
Reusable boutique LDPE bags	Thicker bags ($\sim 40\text{-}60 \mu\text{m}$) made of LDPE that typically weigh between 25-50 g that are sold or distributed at supermarkets, department stores and other retailers. Branded reusable boutique LDPE bags are sold at major supermarkets in the ACT for around 15 cents. Boutique LDPE bags are also provided without charge at many department stores.
Reusable polypropylene (PP) bags	Technically known as non-woven polypropylene bags, reusable polypropylene bags generally weigh around 70 g (~ 100 g with the plastic base) and are sold at supermarkets and other retail outlets for around \$1. They are known colloquially as 'green bags', even though they are now sold in a range of colours.
Reusable polyethylene terephthalate (PET) bags	Polyethylene terephthalate (PET) is a type of polyester. PET bags are generally made of recycled plastics and weigh around 40-50 grams. They are less common in the ACT than other types of reusable plastic bags.
Household garbage bags	Household garbage bags are made of either HDPE or LDPE and come in various sizes, from smaller 12-15L kitchen tidy bags, larger 35-50L bin liners through to 75-80L rubbish bags.
Paper bags	Paper bags used for carrying grocery and other shopping items. They are often made (at least partly) of recycled pulp. Paper carry bags (15-20L, 40-50 grams) are rarely offered by supermarkets in the ACT. Most paper bags available at grocery stores are smaller bags for specific items (e.g. alcohol, bread and mushrooms). Paper bags are more commonly offered in department, clothing and liquor stores.
Calico bags	Calico bags are made of cotton and are generally heavier than plastic bags (at around 80-90 g). They are sold at various stores in the ACT.
Jute (or hessian) bags	Jute bags are made of jute fibre and are sold at various stores to carry shopping items. Jute bags are typically sold for \$3-\$4 at supermarkets.

Source: K O'Farrell, *LCA of Shopping Bag Alternatives: Report to Zero Waste South Australia* (Hyder Consulting Pty Ltd, 2009) and author data.

Table 2. Degradable plastic bags – main classifications

Bag type	Description
Biodegradable	Plastics typically made of a combination of organic materials (e.g. starch and cellulose) and chemical additives that degrade into carbon dioxide, methane, biomass, water and mineral salts in a specified time as a consequence of the action of microorganisms.
Compostable	A type of biodegradable plastic that degrades under prescribed composting conditions at rates comparable with other compostable materials. Composting involves accelerated decomposition of materials through the action of microorganisms under aerobic (in the presence of oxygen) conditions.
Oxo-biodegradable	Plastics that include additives that cause accelerated oxidative degradation triggered by ultraviolet light and/or heat. The resistance of conventional plastics to biodegradation is partly due to their high molecular weight. Oxo-biodegradable plastics typically use pro-oxidative transition metal ion complexes to catalyse the oxidation of the plastic polymers, which reduces their molecular weight and thereby enables biodegradation.
Photodegradable	Plastics that degrade when exposed to ultraviolet light. This process can be accelerated by the inclusion of additives in the plastic.
Water-soluble	Plastics that dissolve in water within a specific temperature range and then biodegrade.

Source: H Sawada (1998) 'ISO standard activities in standardisation of biodegradability of plastics – development of test methods and definitions', *Polymer Degradation and Stability* 59, 365-370; J Song et al. (2009) 'Biodegradable and compostable alternatives to conventional plastics', *Philosophical Transactions of the Royal Society B* 364, 2127–2139; K O'Farrell, *LCA of Shopping Bag Alternatives: Report to Zero Waste South Australia* (Hyder Consulting Pty Ltd, 2009); N Thomas et al., *Assessing the Environmental Impacts of Oxo-degradable Plastics Across their Life Cycle: Report for the UK Department for Environment, Food and Rural Affairs* (Loughborough University, 2010).

3. Plastic bag consumption and use in Australia and the ACT

3.1 National plastic bag consumption and use

Despite the degree of public interest in plastic bags and the regulatory measures put in place to reduce their use, there is little publicly available data on the trends in plastic bag production and use in Australia. Only two detailed analyses of plastic shopping bag consumption in Australia have been undertaken in the past 11 years: one in 2008 by Hyder Consulting for the former Environment Protection and Heritage Council;⁶ and another in 2018 by Envisage Works for a consortium of federal and state environment agencies.⁷

The Hyder Consulting report was the last in a series of reports that tracked trends in the consumption of single-use HDPE plastic shopping bags over the period 2002 to 2007. The initiation of the research was linked to the Australian

⁶ Hyder Consulting Pty Ltd, *Plastic Retail Carry Bag Use* (Environment Protection and Heritage Council, 2008).

⁷ K O'Farrell, *2016–17 Australian Plastics Recycling Survey* (Envisage Works, 2018).

Retailers Association’s voluntary code of practice for major supermarkets, which commenced in 2003 and ended in 2005.⁸ Under the code, major supermarkets aimed to reduce single-use plastic bag consumption by 50% between 2002 and 2005. Hyder Consulting’s final report in this series, which was compiled using data from domestic plastic bag manufacturers and the Australian Customs Service, estimated 3.93 billion single-use HDPE plastic shopping bags weighing 21,232 tonnes were used in Australia in 2007, down from 5.95 billion in 2002 (Table 3). It also estimated 391 million kitchen tidy bags were sold in Australia in 2006, up from 296 million in 2002.

Table 3. Australia HDPE single-use plastic shopping bag consumption, 2002 to 2007 (calendar years)

Description	Units	2002	2003	2004	2005	2006	2007
Imported HDPE bags	Tonnes	21,813	19,210	17,358	16,205	14,285	17,432
Imported HDPE bags	Bags (billions)	3.97	3.49	3.16	2.95	2.60	3.17
Locally produced HDPE bags	Tonnes	10,907	9,605	8,679	5,335	3,800	3,800
Locally produced HDPE bags	Bags (billions)	1.98	1.75	1.58	0.97	0.76	0.76
Total	Tonnes	32,720	28,815	26,038	21,540	18,085	21,232
Total	Bags (billions)	5.95	5.24	4.73	3.92	3.36	3.93

Source: Hyder Consulting Pty Ltd, *Plastic Retail Carry Bag Use* (Environment Protection and Heritage Council, 2008).

Since 2000, an annual plastics recycling survey has been conducted in Australia to track trends in the production, importation and recycling of plastics. The survey was previously known as the National Plastics Recycling Survey and is now called the Australian Plastics Recycling Survey.⁹ Traditionally, the survey has not included itemised data on plastic bag consumption. Plastic bags have fallen within the scope of this survey as a form of flexible packaging but data on their production, consumption and recycling have not been collected or published separately. For the 2016-2017 survey, in response to interest from federal and state governments, the task of

⁸ Australian Retailers Association, *National Code of Practice for the Management of Plastic Bags* (Australian Retailers Association, 2003).

⁹ The survey was previously commissioned by the Plastics and Chemicals Industries Association (PACIA) (now known as Chemicals Australia), often with financial support provided by government agencies and other organisations. The 2015-16 survey was commissioned by the Australian Packaging Covenant Organisation. The 2016-17 survey was commissioned by the Australian Department of the Environment and Energy, WA Department of Environment Regulation, Sustainability Victoria, Queensland Department of Environment and Heritage Protection and the New South Wales Environment Protection Authority.

gathering and presenting data on plastic shopping bags was added on a one-off basis.

Using a method that combined data from domestic manufacturers, retailers and the Australian Customs Service, in the 2016-17 survey report, Envisage Works estimates 5.66 billion single-use HDPE plastic shopping bags weighing 30,700 tonnes were used in Australia in 2016-17, along with 105 million single-use LDPE boutique bags, 1.89 billion barrier or produce bags and 20 million reusable polypropylene bags (Table 4).

Table 4. Australia consumption of single-use and reusable plastic carry bags, 2016-17

Bag type	Total weight (tonnes)	Weight per bag (grams)	Bag numbers
Single use HDPE bags	30,700	5.4	5,656,000,000
Single use LDPE bags (boutique type)	3,100	29.1	105,000,000
Single use produce bags	4,700	2.5	1,886,000,000
Reusable LDPE bags (supermarket type)	5,100	29.1	175,000,000
Reusable polypropylene bags	1,800	90	20,000,000
Reusable other plastic bags	500	126.8	4,000,000
Total	45,900	283	7,846,000,000

Source: K O'Farrell, 2016–17 Australian Plastics Recycling Survey (Envisage Works, 2018).

While Envisage Works' estimates are useful, they do not provide information on the trends in consumption and use. Combining the data from the Hyder Consulting and Envisage Works reports provides some trend information—albeit with a nine year gap—but this is limited to single-use HDPE bags. For policy purposes, trend data is required to help track consumption of the bag types of interest and to facilitate analysis of the impacts of policy interventions.

At present, there are a number of obstacles to accurately tracking trends in the consumption and use of plastic bags, including that most of the plastic carry bags used in Australia are now imported, particularly from China, Thailand and Malaysia.¹⁰ In the early 2000s, domestic manufacturers accounted for over 30% of the local HDPE shopping bag market.¹¹ Almost all retail shopping bags, with the exception of a small proportion of reusable LDPE bags, are now imported.¹²

¹⁰ Australian Bureau of Statistics (ABS), *International Merchandise Trade: Imports of Specified Plastic Bags, by Country of Origin, By State of Final Destination* (ABS, 2018).

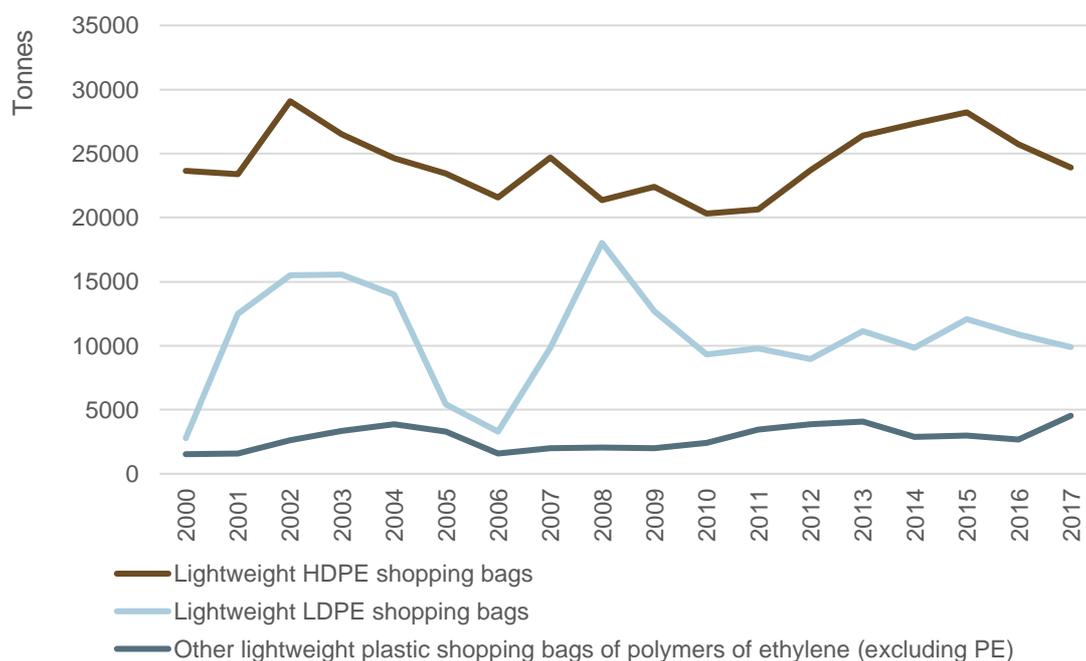
¹¹ Hyder Consulting Pty Ltd, above n 6.

¹² In interviews conducted over March and May 2018, anonymous industry sources indicated local manufacturers account for a maximum of between 2% and 5% of the reusable LDPE shopping bag market. See also O'Farrell, above n 7.

The heavy reliance on imported bags means data on consumption must be obtained from the Australian Customs Service (via the Australian Bureau of Statistics (ABS)), retailers and/or importers. In the case of the Australian Customs Service, data on plastic bag imports are collected under seven harmonised tariff item statistical classification codes (Appendix A, Table A1). There are two issues associated with these data. First, the data are recorded in mass (kilograms) rather than bag numbers. Secondly, a mix of different bag and sack types are recorded in each of the classification codes and the practices adopted in their classification are not necessarily consistent. For example, most single-use HDPE plastic shopping bags are classified as 'Shopping bags not designed for prolonged use, of polyethylene (excl. those of low density polyethylene)' (classification code 3923210025). However, this category also contains produce (or barrier) bags, which are used to wrap fruit and vegetables and are generally available on rolls at grocery stores and markets. The mixture of bag types included in the classification codes creates difficulties when seeking to identify trends in the consumption of particular bag types, like single-use HDPE plastic shopping bags and glossy LDPE supermarket bags. The challenges in tracking trends are compounded by the fact local manufacturers produce some types of bags, and their presence in different market types has fluctuated over time.

Noting these issues, Figure 1 shows the trends in imports of lightweight plastic shopping bags over the period 2000 to 2017. The relatively stagnant trend in imports of lightweight bags (combined, they averaged 37,730 tonnes per year over the period) possibly reflects the efforts expended to curtail their use and shifts in retailer and consumer behaviour.

Figure 1. Australian imports of lightweight plastic shopping bags, 2000 to 2017

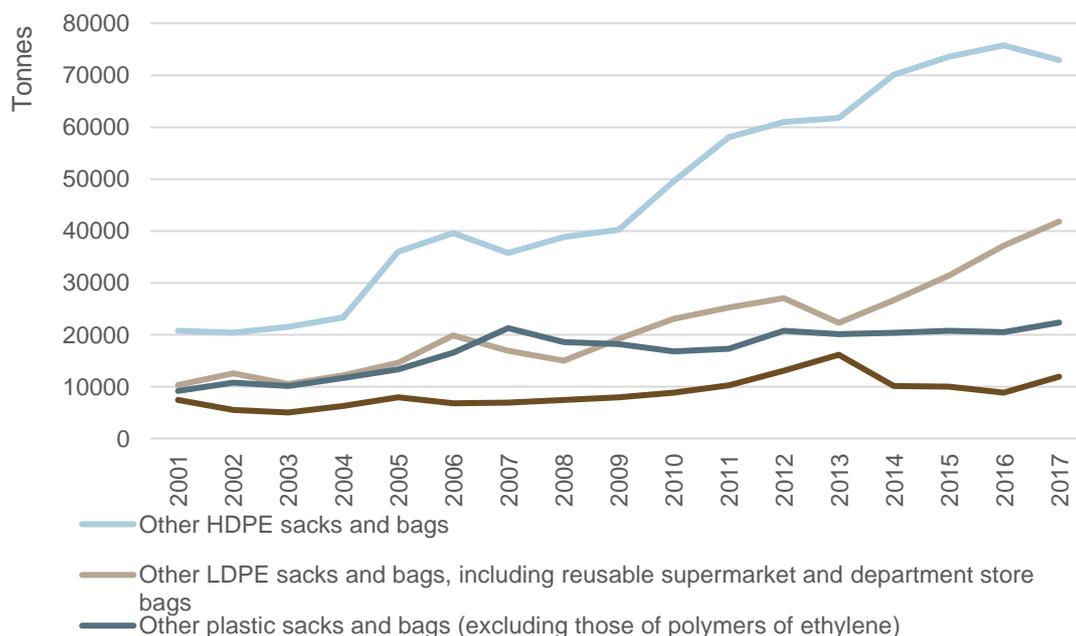


Source: ABS, *International Merchandise Trade: Imports of Specified Plastic Bags, by Country of Origin, By State of Final Destination* (ABS, 2018).

In contrast to the trends in lightweight plastic shopping bag imports, there has been strong growth in imports of most other plastic bag and sack categories, particularly ‘Other HDPE sacks and bags’ and ‘Other LDPE sacks and bags’ (classification codes 3923210027 and 3923210028) (Figure 2). Imports of ‘Other LDPE sacks and bags’, which includes the heavier duty, glossy LDPE bags now sold in most major supermarkets as a substitute for single-use HDPE bags, have increased from 10,446 tonnes in 2000 to 41,797 tonnes in 2017. If it is assumed for visualisation purposes that all relevant sacks and bags in the category are boutique LDPE bags, the 41,797 tonnes imported in 2017 is the equivalent of 1.5 billion boutique bags.¹³ The increase in imports of these ‘other’ plastic bag and sack categories is probably attributable to a combination of increased demand and a decline in domestic manufacturing.

¹³ This estimate was derived using an average bag weight of 28 grams, which was derived from a sample of LDPE bags from major retailers, including Woolworths, Coles, Aldi and Big W. The sampled bags weighed between 23-33 grams, with a mean of 28 grams.

Figure 2. Australian imports of other plastic bags and sacks, including heavier plastic sacks and bags, 2000 to 2017



Source: ABS, *International Merchandise Trade: Imports of Specified Plastic Bags, by Country of Origin, By State of Final Destination* (ABS, 2018).

The most obvious way to get around the difficulties associated with the use of the Australian Customs Service import data is to obtain data directly from retailers who sell or distribute plastic shopping bags, or the importers who supply the retailers. However, there are two obstacles associated with this approach. First, plastic shopping bags are sold and distributed by a diverse range of retailers across the country, including supermarkets and grocery stores, fresh food markets, restaurants and other food retailers, and convenience, clothing and department stores. Secondly, many distributors and retailers are unwilling to voluntarily release data due to concerns about confidentiality. In the preparation of this report, a number of plastic bag importers and major retailers declined to provide data on plastic bags for this reason.

3.2 Plastic bag consumption and use in the ACT

Similar to the situation at the national level, there is limited publicly available data on plastic bag consumption and use in the ACT. In the ACT Government’s 2014 review of its plastic bag ban it was estimated that, over the period May-October 2011, 26 million single-use HDPE bags were distributed in the ACT. For the period May-October 2013, the review estimated just over 4 million reusable boutique LDPE bags were sold. These estimates, which were based on data provided by some of the major retailers,

are the most recent publicly available estimates of plastic shopping bag consumption and use in the ACT.

The major supermarkets and a sample of smaller supermarkets and grocery stores were asked to provide data on plastic bag distribution and sales in the ACT. Data were provided by some smaller supermarkets and grocers but no data were provided by the larger supermarkets. Due to the incomplete nature of the data provided, two surveys were undertaken to provide an estimate of plastic bag consumption in 2017-18.

The first survey (household survey) sought information on household consumption and use of four plastic bag types: produce (barrier) bags; reusable boutique LDPE bags; reusable polypropylene bags (including cooler tote bags); and household plastic garbage bags. The survey was undertaken using a cluster sampling method. For these purposes, the Territory was stratified into its five electorate divisions: Kurrajong, Ginninderra, Yerrabi, Murrumbidgee and Brindabella. There are 18 Woolworths, 12 Coles and 9 Aldi stores in the ACT, spread across the five electorates. In each electorate, two Woolworth stores, one Coles store and one Aldi store were randomly selected using a random number generator. Surveys were then undertaken of shoppers at each selected store, with individuals selected using an unbiased systematic selection method. To ensure the shoppers were representative of households in their electorates, surveys were undertaken at each store on a weekday and a Saturday or Sunday. The survey asked shoppers questions about their consumption or use of the four plastic bag types. In analysing the results, we assumed all households in the ACT either shop at Woolworths, Coles or Aldi, or their relevant plastic bag consumption and use behaviours are the same as those that do.¹⁴

The second survey (retailer HDPE survey) sought to estimate sales and distribution of HDPE carry bags ($\leq 35 \mu\text{m}$ conventional and biodegradable bags) by smaller supermarkets, grocers and other retailers. In undertaking the survey, the ACT retailer population was stratified into six shop types: supermarkets (excluding the major supermarkets, Woolworths, Coles and Aldi); Asian grocery stores; fruit and vegetable stores; butchers and poultry stores; fishmongers; and other retailers. Retailers within each strata (i.e. store types) except 'other retailers' were then randomly selected and asked about their average weekly HDPE bag sales and distribution. Responses were provided by 43 retailers.¹⁵

The results of the household and retailer HDPE surveys suggest 9.5 million HDPE ($\leq 35 \mu\text{m}$ conventional and biodegradable) bags, 9.6 million reusable

¹⁴ Further details of the household survey are provided in Appendix B.

¹⁵ See Appendix B for further details.

boutique LDPE bags, 36.2 million produce bags, 897,000 reusable polypropylene bags and 30.1 million household garbage bags were used in the ACT in 2017-18 (Tables 5 and 6).

Table 5. Estimated annual consumption of selected plastic bag types in the Australian Capital Territory, 2017-18

	35 µm and below HDPE bags	Reusable boutique LDPE bags	Single-use produce bags	Reusable polyprop. bags	Household garbage bags
Average household consumption (bags)	56	57	214	5	178
Total consumption (million bags)	9.5	9.6	36.2	0.9	30.1
Total consumption (tonnes)	126.9	269.9	90.5	88.9	376.8

Source: Australian Bureau of Statistics (ABS), *Census of Population and Housing* (ABS, 2018); ABS, *Australian Demographic Statistics, 3101.0* (Australian Government, 2018); author estimates and data.

Table 6. Estimated annual consumption of selected plastic bag types in the Australian Capital Territory, 2017-18

Division	Reusable boutique LDPE bags	Single-use produce bags	Reusable polypropylene bag	Household garbage bags
Average annual household consumption (bags)				
Kurrajong	55	239	5	163
Ginninderra	50	182	5	163
Yerrabi	59	219	6	207
Murrumbidgee	61	225	5	184
Brindabella	61	199	5	176
ACT average	57	214	5	178
Total consumption (bags)				
Kurrajong	2,137,129	9,327,608	186,449	6,355,981
Ginninderra	1,663,387	6,008,664	179,130	5,381,673
Yerrabi	2,040,709	7,556,381	221,762	7,137,594
Murrumbidgee	2,061,147	7,663,899	169,642	6,245,988
Brindabella	1,740,986	5,636,372	139,893	4,978,546
ACT total	9,642,262	36,180,114	896,973	30,104,772
Total consumption (tonnes)				
Kurrajong	60	23	18	80
Ginninderra	47	15	18	67
Yerrabi	57	19	22	89
Murrumbidgee	58	19	17	78
Brindabella	49	14	14	62
ACT total	270	90	89	377

Source: Australian Bureau of Statistics (ABS), *Census of Population and Housing* (ABS, 2018); ABS, *Australian Demographic Statistics, 3101.0* (Australian Government, 2018); author estimates and data.

These plastic bag consumption estimates align well with the national data contained in the 2016-2017 Australian Plastics Recycling Survey. As shown in Table 7, the Australian Plastics Recycling Survey results suggest, Australia-wide, average household consumption of single-use HDPE (<35 µm), reusable LDPE bags, produce bags and reusable polypropylene bags in 2016-17 was 571, 28, 190 and two respectively. In the ACT, projections based on the results of the two surveys suggest average household consumption of HDPE (35 µm conventional and <35 µm biodegradable), reusable LDPE bags, produce bags and reusable polypropylene bags in the same year was approximately 56, 56, 212 and five respectively.¹⁶ The higher rates of consumption of reusable boutique bags and polypropylene bags in the ACT is expected because of the absence of lightweight conventional HDPE bags and higher rates of income and wealth in the Territory. The lower consumption rate of HDPE bags is expected because of the ban on conventional single-use (<35 µm) HDPE bags.

Table 7. Estimated annual household consumption of selected plastic bag types, Australia vs Australian Capital Territory, 2016-17

	35 µm and below HDPE bags ¹	Reusable boutique LDPE bags	Single-use produce bags	Reusable polyprop. bags ²
Australia	571	28	190	2
ACT ³	56	56	212	5

¹ Australia estimate confined to single-use (<35 µm) HDPE bags. ACT estimate covers 35 µm conventional 'reusable' HDPE bags and <35 µm single-use biodegradable bags.

² Includes cooler tote bags and polyester bags.

³ Estimate based on assumptions outlined in section 6.2 (Table 10) below.

4. Environmental impacts of plastic bags

For several decades, it was thought the most significant adverse environmental impact associated with plastic bags was litter. Today, plastics are recognised as a significant environmental pollutant. Reflecting this, the United Nations Environment Programme has identified plastic pollution as a global environmental threat, there have been calls for plastics to be classified as hazardous and, in December 2017, the United Nations Environment Assembly passed a non-binding resolution that encourages all member states to 'prioritize policies and measures at the appropriate scale to avoid marine litter and microplastics from entering the marine environment'.¹⁷

¹⁶ The 2016-17 estimate was based on the assumptions outlined in section 6.2 (Table 10) below.

¹⁷ United Nations Environment Assembly of the United Nations Environment Programme, *Resolution 3/7. Marine litter and microplastics. UNEP/EA.3/Res.7* (UNEP, 2018) 2. UNEP, above n 4; *United Nations Environment Programme (UNEP), UNEP Yearbook 2011: Emerging Issues in Our Global Environment* (United Nations, 2011); Rochman et al., above n 4, 169-171. See also United Nations Environment Assembly of the United Nations

The adverse environmental impacts associated with plastic bags can be broken down into three broad categories based on their association with points in the life cycle of the product: production; use; and disposal, recycling and reuse.

4.1 Production-related impacts

The production of plastic resin, pellets and products can result in the release of air and water pollutants, including microplastics through spills, volatile organic compounds and other known carcinogens and endocrine disruptors.¹⁸ In uncontrolled and poorly regulated sites, these pollutants can pose a material threat to human health and the environment. However, technological and regulatory measures are available to limit the risks associated with these pollutants.¹⁹

Where plastics are produced using fossil feedstocks, or energy derived from the burning of fossil fuels, it results in the release of direct greenhouse gases, particularly carbon dioxide (CO₂) and nitrous oxide (N₂O).²⁰ These pollutants have long atmospheric lifetimes and contribute to global warming. Over 90% of plastics are currently produced using 'virgin' (non-recycled) fossil fuel feedstocks.²¹

There are a number of plastic bag manufacturers in Australia, the largest of which is probably Andrew Kohn Pty Ltd, whose factory is located at Dingley in the southeastern suburbs of Melbourne. Its emissions of pollutants are regulated under the *Environmental Protection Act 1970* (Vic) and reported under the National Pollutant Inventory. As noted above, local plastic manufacturers hold only a small proportion of the domestic shopping bag market; most plastic shopping bags are now imported. The reliance on

Environment Programme, Resolution 1/6. Marine plastic debris and microplastics. UNEP/EA.1/Res.6 (UNEP, 2014); United Nations Environment Assembly of the United Nations Environment Programme, *Resolution 2/11. Marine plastic litter and microplastics*. UNEP/EA.2/Res.11 (UNEP, 2016).

¹⁸ T Karlsson et al. (2018) 'The unaccountability case of plastic pellet pollution', *Marine Pollution Bulletin* 129(1), 52-60; S Piccot et al. (1992) 'A Global Inventory of Volatile Organic Compound Emissions from Anthropogenic Sources', *Journal of Geophysical Research* 97(D9), 9897-9912; H Niu et al. (2016) 'Screening the emission sources of volatile organic compounds (VOCs) in China by multi-effects evaluation', *Frontiers of Environmental Science and Engineering* 10(5), doi 10.1007/s11783-016-0828-z; C Yang et al. (2011) 'Most Plastic Products Release Estrogenic Chemicals: A Potential Health Problem That Can Be Solved', *Environmental Health Perspectives* 119(7): 989-996; H Koch and A Calafat (2009) 'Human body burdens of chemicals used in plastic manufacture', *Philosophical Transactions of the Royal Society B* 364, 2063-2078; J Brophy et al. (2012) 'Breast cancer risk in relation to occupations with exposure to carcinogens and endocrine disruptors: a Canadian case-control study', *Environmental Health* 11, 87-103; J Siemiatycki et al. (2004) 'Listing occupational carcinogens', *Environmental Health Perspectives* 112, 1447-145.

¹⁹ J Unwin et al. (2013) 'Airborne Emissions of Carcinogens and Respiratory Sensitizers during Thermal Processing of Plastics', *Annals of Occupational Hygiene* 57(3), 399-406; UK Health and Safety Executive, *Controlling Fume During Plastics Processing* (UK Government, 2013).

²⁰ ID Posen et al. (2017) 'Greenhouse gas mitigation for U.S. plastics production: energy first, feedstocks later', *Environmental Research Letters* 12, 034024.

²¹ WEF, above n 4; R Geyer, J Jambeck, K Law, 'Production, use, and fate of all plastics ever made', *Science Advances* 3(7), e1700782 (2017).

imported bags means the adverse environmental effects associated with production-related pollution occur in other jurisdictions, with the exception of greenhouse gases. The climatic effects of greenhouse gases extend across the Earth and persist for centuries.

In addition to releasing pollutants, the production of plastics depletes stocks of fossil fuels and adds to the pressures on non-renewable resources like water.²² The depletion of fossil fuel stocks is regarded by some as a threat to the sustainability of modern living standards.²³ However, there are now numerous substitutes for fossil fuels, both as a source of energy and an input to the production of plastics and plastic substitutes.²⁴ Further, in order to address the threats posed by climate change, a significant proportion of known fossil fuel reserves will have to be left undeveloped.²⁵ Similarly, the environmental implications of using water in the production of plastic bags will generally depend on how the water resources in the relevant catchment or catchments are managed as a whole. The assessment of the environmental impacts associated with the production and use of plastic bags is discussed further below.

4.2 Use-related impacts

Plastic polymers are generally considered to be biochemically inert, meaning final plastic products should pose minimal toxic threat to human health and the environment.²⁶ However, unreacted residual monomers are often found in plastics because of incomplete reactions in the polymerisation process. These residual monomers can be toxic and, under certain conditions, can leach into the surrounding environment.²⁷ Further, in the production of plastics various

²² K O'Farrell, *LCA of Shopping Bag Alternatives: Report to Zero Waste South Australia* (Hyder Consulting Pty Ltd, 2009); K Verghese, *Environmental Impacts of Shopping Bags: Report for Woolworths Ltd* (Sustainable Packaging Alliance Ltd, 2009); Posen et al., above n 20; V Bisinella et al., *Life Cycle Assessment of grocery carrier bags* (Ministry of Environment and Food of Denmark, 2018).

²³ Clean Up Australia, *Plastics Fact Sheet* (Clean Up Australia Ltd, undated); Thompson et al., above n 4, 2153–2166.

²⁴ J Song et al. (2009) 'Biodegradable and compostable alternatives to conventional plastics', *Philosophical Transactions of the Royal Society B* 364, 2127–2139; Posen et al., above n 20.

²⁵ A Macintosh (2010) 'Keeping warming within the 2C limit after Copenhagen', *Energy Policy* 38, 2964–2975; International Energy Agency (IEA), *World Energy Outlook 2012* (OECD/IEA, 2012); M Jakob and J Hilaire (2015) 'Climate science: unburnable fossil fuel reserves', *Nature* 517, 150–152.

²⁶ D Lithner, A Larsson and G Dave (2011) 'Environmental and health hazard ranking and assessment of plastic polymers based on chemical composition', *Science of the Total Environment* 409, 3309–3324; E Teuten et al. (2009) 'Transport and release of chemicals from plastics to the environment and to wildlife', *Philosophical Transactions of the Royal Society B* 364, 2027–2045; V McLain et al. (2007) 'Final Report on the Safety Assessment of Polyethylene', *International Journal of Toxicology* 26, 115–127.

²⁷ Lithner, Larsson and Dave, *ibid*; D Lithner, I Nordensvan and G Dave (2012) 'Comparative acute toxicity of leachates from plastic products made of polypropylene, polyethylene, PVC, acrylonitrile–butadiene–styrene, and epoxy to *Daphnia magna*', *Environmental Science and Pollution Research* 19(5), 1763–1772; K Lund and J Peterson (2006) 'Migration of formaldehyde and melamine monomers from kitchen- and tableware made of melamine plastic', *Food Additives and Contaminants* 23(9), 948–955; Yang et al., above n 18.

types of chemical additives are used to provide desired product qualities. These additives can contain toxins that also leach from end products.²⁸

The nature and extent of the risks posed by the leaching of toxins from plastic products depends on the characteristics of the plastics and the conditions under which they are used and stored. Polyethylene, polypropylene and polyethylene terephthalate (PET)—the three plastic polymers most commonly used to make plastic bags—are considered to have amongst the lowest levels of toxicity associated with chemical leaching.²⁹ Despite this, it is unclear whether they can be considered chemically benign. There is evidence that polyethylene, polypropylene and PET leach chemicals that could have adverse toxicological effects, including through estrogenic pathways.³⁰ Notwithstanding this, given the nature of plastic bags and their uses, chemical leaching from polyethylene, polypropylene and PET shopping bags is likely to pose minimal risk to bag users.

Possibly of greatest risk to users are the threats associated with suffocation and choking from plastic bags. Plastic bags are a suffocation and choking hazard, particularly to babies and young children. While a risk, the number of accidental deaths attributable to plastic bag suffocation or choking is likely to be very small. Annually, around 110 people die in Australia from accidental suffocation and choking, few of which are likely to involve plastic bags.³¹ Where suffocation and choking incidents occur, they are more likely to be a product of suicide attempts or assault. Consistent with this, an Italian study based on data from Milan for the period 1993 to 2013 found 101 cases of plastic bag suffocation, none of which were accidental.³² Almost all of the deaths (100) were due to suicide, with one homicide.

²⁸ J Gray et al. (2017) 'State of the evidence 2017: an update on the connection between breast cancer and the environment', *Environmental Health* 16, 94-154; Teuten et al., above n 26; R Halden (2010) 'Plastics and Health Risks', *Annual Review of Public Health* 31, 179-194; Thompson et al., above n 4; J Meeker, S Sathyanarayana and S Swan (2009) 'Phthalates and other additives in plastics: human exposure and associated health outcomes', *Philosophical Transactions of the Royal Society B* 364, 2097-2113.

²⁹ McLain et al., above n 26; Halden, *ibid*; S Dopico-Garcia et al. (2007) 'Antioxidant content of and migration from commercial polyethylene, polypropylene, and polyvinyl chloride packages', *Journal of Agricultural and Food Chemistry* 55(8), 3225-3231.

³⁰ M Wagner and J Oehlmann (2011) 'Endocrine disruptors in bottled mineral water: Estrogenic activity in the E-Screen', *Journal of Steroid Biochemistry and Molecular Biology* 127(1-2), 128-135; Yang et al., above n 18; Lithner, Nordensvan and Dave, above n 27; M Mutsuga et al. (2006) 'Migration of formaldehyde and acetaldehyde into mineral water in polyethylene terephthalate (PET) bottles', *Food Additives and Contaminants* 23(2), 212-218; S Keresztes et al. (2013) 'Study on the leaching of phthalates from polyethylene terephthalate bottles into mineral water', *Science of the Total Environment* 458-460, 451-458.

³¹ ABS, *Causes of Death, Australia, 2016* (ABS, 2017).

³² G Crudele et al. (2016) 'One Hundred and One Cases of Plastic Bag Suffocation in the Milan Area Between 1993 and 2013—Correlations, Circumstances, Pathological and Forensic Evidences and Literature Review', *Journal of Forensic Sciences* 61(2), 361-366.

4.3 Disposal, recycling and reuse

Arguably, the most significant environmental issues associated with plastic shopping bags relate to their management during the end-of-life phase of the product. There are five main options for the management of plastic bags at the end of their useful life: disposal into the general environment; burial in landfill; recycling (mechanical or chemical); thermal destruction (incineration) without energy recovery; thermal destruction with energy recovery (through controlled combustion or conversion to liquid fuel and subsequent combustion); and composting (where bags are compostable).³³ The nature and magnitude of the environmental impacts associated with the end-of-life phase of plastic bags depends on which of these options is used and how it is undertaken.

4.3.1 How is most plastic waste disposed of?

Globally, most plastic waste is currently either disposed of as litter to the environment or buried in landfill. Recently published research has estimated that, prior to the 2000s, 80% or more of global non-fibre plastics were discarded as litter or buried in landfills.³⁴ This has changed significantly over the past 15 years, with increasing rates of plastics recycling and thermal destruction, including with energy recovery. In 2014, the proportion of global non-fibre plastics discarded as litter or buried in landfills had fallen to 58%, while the recycling and thermal destruction rates had increased to 18% and 24% respectively.³⁵

There is significant variability in the rates of recycling and thermal destruction across nations. The highest rates of recycling and thermal destruction are in Europe. In 2017, 31% of plastics in Europe were recycled, 42% were used for energy recovery and 27% were sent to landfill.³⁶ The European recycling and energy recovery rates are even higher for plastic packaging: in 2017, 41% of plastic packaging was recycled, 39% was used for energy recovery and 20% was sent to landfill. While the average European recycling and energy recovery rates are high, there are a number of southern and former Eastern Bloc nations where the proportion of plastics going to landfill still exceeds 50%, including Greece, Bulgaria, Croatia, and Hungary.

In Australia most plastics are recycled or sent to landfills, with a residual proportion disposed of in the general environment as litter.³⁷ The Australian

³³ J Greene, *Sustainable Plastics: Environmental Assessments of Biobased, Biodegradable, and Recycled Plastic* (John Wiley & Sons, 2014) 129-144; Geyer, Jambeck, Law, above n 21.

³⁴ Geyer, Jambeck, Law, above n 21.

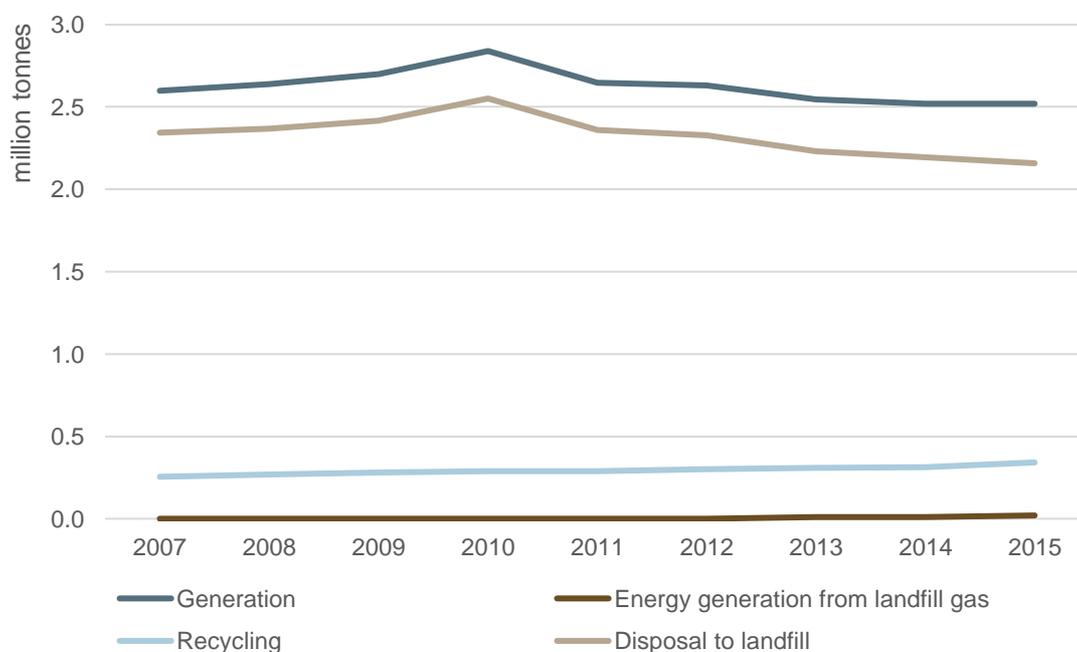
³⁵ Geyer, Jambeck, Law, above n 21.

³⁶ Plastics Europe, above n 2.

³⁷ In contrast with Europe, virtually no plastics in Australia are thermally destroyed. Three incinerators in New South Wales and Queensland previously received municipal solid waste but these ceased operations in the mid-1990s. In 2011-2012, four facilities in Queensland, New South Wales, South Australia and Western Australia

Plastics Recycling Survey estimates that, in 2016-17, total plastic consumption in Australia was 3,142,100 tonnes (3,513,100 tonnes if tyre polymers are included), of which 293,900 (415,200 tonnes with tyres) was recycled, providing a 'consumption-based' recycling rate (excluding tyres) of 9.35%, down from 11.3% in 2015-16.³⁸ Data from the Australian National Waste Report 2016 suggests the 'true' national plastic recycling rate (excluding tyres) (i.e. the amount recycled relative to the amount of plastic waste generated) in 2014-15 was slightly higher at around 14% and that it had steadily increased since 2009-10 because of a decline in the mass of plastic waste generated and an increase in the amounts recycled (Figure 3).³⁹ The report attributes the fall in the mass of plastic waste mainly to the trend toward lighter plastic packaging materials.

Figure 3. National trends in plastic waste generation and fate, 2006-07 to 2014-15



Source: J Pickin and P Randell, *Australia National Waste Report 2016: Report prepared for the Department of the Environment and Energy* (Blue Environment Pty Ltd and Randell Environmental Consulting, 2017).

Roughly half (49.8%) of the recycling (excluding tyres) of plastic disposed of in Australia in 2016-17 occurred overseas, with the remaining reprocessing

incinerated clinical waste, one of which (a cement kiln in South Australia) was known to destroy plastics. The amount of plastic waste destroyed at this facility in 2011-2012 was only 2,000 tonnes; 0.14% of estimated national consumption in the same year. See Department of the Environment and Energy, *National Inventory Report 2015*, Vol. 2 (Australian Government, 2017); D A'Vard and K O'Farrell, *2011-12 National Plastics Recycling Survey* (Plastics and Chemicals Industry Association, 2013); J Pickin and P Randell, *Australia National Waste Report 2016: Report prepared for the Department of the Environment and Energy* (Blue Environment Pty Ltd and Randell Environmental Consulting, 2017).

³⁸ O'Farrell, above n 7.

³⁹ Pickin and Randell, above n 37.

occurring domestically.⁴⁰ When tyres are included, the proportion recycled overseas increased to 56.5% (73% of tyre recycling occurred overseas).

The extent to which plastic bags are recycled is unclear. In 2016-17, national consumption of 'municipal packaging' was 666,100 tonnes, of which 145,800 tonnes (22%) was recycled. For these purposes, municipal packaging includes flexible, rigid and other forms of package. Plastic shopping bags are a form of flexible municipal packaging but the 2016-17 report did not disaggregate recycling rates for flexible packaging. Previous National Plastics Recycling Surveys estimated 48,100 tonnes of flexible packaging was recycled in 2015-16, 49,700 tonnes in 2014-15, and 50,400 tonnes in 2013-14.⁴¹ However, the relevant reports did not separate out plastic bags.

While accurate data on the fate of plastics bags is not available, the recycling rates for plastic shopping bags are likely to be low because most kerbside recycling collection systems exclude flexible plastics. Consistent with this, most of the flexible plastic packaging that has been recycled to date has been low and linear low density polyethylene (L/LLDPE) film from commercial and industrial sources.⁴²

In recent times, the treatment of flexible plastic waste in Australia has been significantly affected by China's decision to impose new restrictions on the import of recyclables under its Blue Sky Program. The new requirements limit the contamination levels in plastic and paper recyclables to 0.5%, a level that is largely unachievable in Australian waste management systems. Prior to the introduction of the new requirements in early 2018, around 60% of Australia's flexible plastic recyclables were exported,⁴³ and China was receiving almost 70% of Australia's plastic recyclable exports.

Prompted by the introduction of China's new restrictions, in late April 2018 Australian environment ministers endorsed a target of completely phasing out the disposal of packaging, including plastic packaging, to landfill by 2025. The joint statement released by the environment ministers stated:

Ministers endorsed a target of 100 percent of Australian packaging being recyclable, compostable or reusable by 2025 or earlier. Governments will work with the Australian Packaging Covenant

⁴⁰ O'Farrell, above n 7.

⁴¹ K O'Farrell, *National Recycling and Recovery Survey 2015-16 for Plastics Packaging* (Envisage Works, 2016); K O'Farrell and P Allen, *National Recycling and Recovery Survey 2014-15 for Plastics Packaging* (Sustainable Resource Use, 2015).

⁴² O'Farrell, *ibid.*

⁴³ *Ibid.*

Organisation (APCO), representing over 900 leading companies, to deliver this target.⁴⁴

In the ACT, it is likely most plastic shopping bags are disposed of in the Mugga Lane Landfill, which is the Territory's only operational landfill facility. The prevalence of plastic bags in the waste deposited at the Mugga Lane Landfill, Mugga Lane Transfer Station and Mitchell Transfer Station attests to this. In a 2015 audit of the waste deposited at these facilities, involving five days of inspections at the landfill and eight days at each transfer station, 13 tonnes of plastic bags and film were deposited, with a volume of 685 m³.⁴⁵ One of the main reasons why plastic bags are mainly disposed of in landfill is the relative lack of recycling opportunities. The ACT's kerbside recycle services do not collect flexible plastics, and neither of the Territory's two resource management centres (at Mitchell and Mugga Lane) accepts them.

Some retailers in the ACT now operate facilities for the collection and recycling of flexible plastics. The most well-known of these is the REDcycle Program run by REDcycle Pty Ltd in partnership with major retailers, including Coles and Woolworths. The retailers involved maintain collection bins at supermarkets where shoppers can deposit unwanted plastic bags and other soft plastics for recycling. There are currently 23 REDcycle collection sites in the ACT and a further two in Queanbeyan. At present, only a small proportion of plastic bags are recycled through this program. Since it commenced in 2011, it has recycled, in total, around 1,600 tonnes of soft plastics nationwide.⁴⁶ Even if it is assumed all of the soft plastics were plastic shopping bags, this still only represents approximately 0.7% of plastic shopping bag consumption over this period.

A material issue often associated with plastic bags is their improper inclusion in kerbside recycling collection bins. The inclusion of plastic bags and other contaminants in recycling materials increases recycling costs and can result in damage to recycling equipment and the forced disposal of otherwise recyclable materials to landfill. In the ACT, the available data suggest plastic bags constitute a relatively small proportion of contaminants. For example, a 2014 audit of the Hume Materials Recovery Facility found 0.2% of its residual material by mass was plastic bags, mainly produce bags and single-use plastic bags.⁴⁷ While not amongst the main contaminants, the number

⁴⁴ *Seventh Meeting of Environment Ministers, Agreed Statement – 27 April 2018, Melbourne* (Australian Government, 2018) 1.

⁴⁵ B Johnston and M Cumming, *ACT NOWaste 2015: Landfill and Transfer Station Waste Audits* (A Prince Consulting Pty Ltd, 2015).

⁴⁶ <http://www.redcycle.net.au/resources/>. Coles claims to have diverted 300 million pieces of flexible plastic from landfill through the REDcycle program since 2011. This equates to approximately 1,620 tonnes of plastic (if it is assumed all the plastic was single-use HDPE bags). See: www.coles.com.au/corporate-responsibility/sustainability/environment (13 May 2018).

⁴⁷ M Cumming, *ACT NOWaste MRF Audit Report* (A Prince Consulting Pty Ltd, 2014).

identified, when extrapolated, equated to around 7,500 plastic bags per year that were inappropriately placed in recycling collection bins.

4.3.2 What are the environmental impacts of disposal to landfill and littering?

The environmental impacts associated with the disposal of plastic bags in landfills depend on the nature of the plastic bags and the design and management of the landfill. Biodegradable plastic bags that decompose in landfills under anaerobic conditions will result in the release of methane, a relatively short-lived but potent greenhouse gas.⁴⁸ In contrast, conventional fossil fuel-based LDPE and HDPE plastic bags do not contain organic materials, are not biodegradable in their natural form and do not release methane as they breakdown.⁴⁹ Importantly, though, the extent to which the production of methane from biodegradable plastic bags contributes to climate change will depend on whether the relevant landfill captures and combusts the gas. Where the methane is captured and combusted, a proportion of the potential negative climate impacts will be nullified. Moreover, positives can arise where the methane is destroyed in an electricity generator or boiler, which displaces fossil fuel-based energy production.

In addition to the release of methane, the disposal of plastic bags to landfill can contribute to the release of toxins to the environment. Unreacted residual

⁴⁸ Technically, the anaerobic decomposition of the organic material produces biogas, which is generally made up of predominantly methane (40-60%) and carbon dioxide. When poorly managed, landfill biogas can give rise to odour and, in the worst cases, safety problems. Most major landfills in Australia, including Mugga Lane in the ACT, are subject to regulatory requirements governing the management of odour and safety-related issues associated with landfill biogas: Emissions Reduction Assurance Committee, *Landfill Gas Method Crediting Period Review Report* (Australian Government, 2018).

⁴⁹ Conventional polyethylene plastic bags degrade through exposure to ultraviolet light (photodegradation), mechanical weathering or chemical processes. The resistance of conventional polyethylene to biodegradation is due to its high molecular weight, high hydrophobic levels (water resistance) and presence of anti-oxidants and stabilisers, which inhibit the oxidation necessary to transform hydrocarbons into carboxylic acid that can be metabolised. Some research suggests polyethylene may be biodegradable but only under specific conditions following photodegradation and chemical degradation. Oxo-biodegradable polyethylene plastics undergo accelerated oxidative degradation then biodegradation due to the inclusion of additives (pro-oxidative transition metal ions). The rates at which oxo-degradable materials degrade are generally significantly faster than conventional plastics but slower than compostable materials, including compostable plastic. There is uncertainty about whether all particles from oxo-biodegradable plastics undergo biodegradation: AA Shah et al. (2008) 'Biological degradation of plastics: A comprehensive review', *Biotechnology Advances* 26, 246-265; Y Zheng et al. (2008) 'A Review of Plastic Waste Biodegradation', *Critical Reviews in Biotechnology* 25(4), 243-250; N Thomas et al., *Assessing the Environmental Impacts of Oxo-degradable Plastics Across their Life Cycle: Report for the UK Department for Environment, Food and Rural Affairs* (Loughborough University, 2010); J-M Restrepo-Flórez et al. (2014), 'Microbial degradation and deterioration of polyethylene – A review', *International Biodeterioration & Biodegradation* 88, 83-90; J Eubeler et al. (2010) 'Environmental biodegradation of synthetic polymers II. Biodegradation of different polymer groups', *TrAC Trends in Analytical Chemistry* 29(1), 84-100; A-C Albertsson et al. (1987), 'The mechanisms of biodegradation of polyethylene', *Polymer Degradation and Stability* 18, 73-87; S Bonhomme et al. (2003) 'Environmental biodegradation of polyethylene', *Polymer Degradation and Stability* 81(3), 441-452; A Sivan (2011) 'New perspectives in plastic biodegradation', *Current Opinion in Biotechnology* 22, 422-426; S Sen and S Raut (2015) 'Microbial degradation of low density polyethylene (LDPE): A review', *Journal of Environmental Chemical Engineering* 3, 462-473; M Weiland, A Daro and C David (1995) 'Biodegradation of thermally oxidized polyethylene', *Polymer Degradation and Stability* 48(2), 275-289.

monomers and chemical additives in plastics can leach from landfills into surface water, groundwater and soils. Microplastics formed from the breakdown of plastic bags can also absorb toxins in landfills then transport them to other terrestrial and aquatic environments through leachate.⁵⁰ The extent of the chemical risks associated with the disposal of plastic bags to landfill depends on the characteristics of the bags and the design and management of landfills. At well-designed and -managed landfills, where the base is lined to prevent contamination through leachate, drainage systems are maintained to move water off the landfill, and landfill cells are capped, the risks are limited. The landfill-related risks from plastic bags are also likely to be orders of magnitude lower than those associated with other waste types.

In the case of the ACT, the Mugga Lane Landfill and now closed West Belconnen Landfill are lined and capped, have well-maintained drainage systems that drain leachate into leachate dams, and are subject to regulatory oversight by the ACT Environment Protection Authority.⁵¹ Landfill gas from both sites is also captured and combusted in onsite generators. Some ACT waste is also transported to the Woodlawn Bioreactor in New South Wales. However, like the Mugga Lane and West Belconnen Landfills, Woodlawn is a well-designed and -managed landfill that uses biogas to generate electricity and has facilities to limit leachate risks.

Given the best practice nature of relevant landfill facilities, the most significant environmental hazards associated with the disposal of plastic bags in the ACT stem from littering and other illegal bag disposal into the general environment. There are four main categories of environmental risk associated with the disposal of plastics into the environment as litter or debris:

- ingestion by and entanglement of wildlife;
- the potential for plastics to facilitate the spread of invasive species;
- the potential for plastic particles to absorb and transfer toxins to humans and wildlife; and
- amenity impacts.⁵²

⁵⁰ H Asakura et al (2004) 'Behavior of endocrine-disrupting chemicals in leachate from MSW landfill sites in Japan', *Waste Management* 24(6), 613-622; T Eggen et al. (2010) 'Municipal landfill leachates: A significant source for new and emerging pollutants', *Science of the Total Environment* 408, 5147-5157; Teuten et al., above n 26.

⁵¹ *Environmental Authorisation under the Environment Protection Act 1997: Authorisation No. 0375* (ACT Government, 2017).

⁵² There are a number of other potential impacts. For example, while far less studied and understood than the risks associated with ingestion and entanglement, a number of studies have raised the prospect that, when plastic materials sink and settle on lake and river beds, and the seafloor, it could result in the smothering of aquatic life and modification of benthic ecosystems (S Katsanevakis et al. (2007), 'Effect of marine litter on the benthic megafauna of coastal soft bottoms: a manipulative field experiment', *Marine Pollution Bulletin* 54,771-778; M Gregory (2009) 'Environmental implications of plastic debris in marine settings—entanglement, ingestion, smothering, hangers-on, hitch-hiking and alien invasions', *Philosophical Transactions of the Royal Society B* 364, 2013-2025).

Ingestion by and entanglement of wildlife

Most of the literature on the ingestion of and entanglement in plastics by wildlife relates to marine organisms, particularly vertebrates.⁵³ There is an extensive scientific literature that documents the adverse impacts of plastic marine debris on wildlife. Plastics are divided into two broad categories for these purposes: macroplastics (larger than 5 mm); and microplastics (less than 5 mm).⁵⁴ While there are significant gaps in the knowledge base, the adverse impacts associated with macroplastic ingestion and entanglement are relatively well established.⁵⁵ The impacts associated with the ingestion of microplastics by marine organisms are more uncertain. The available research suggests microplastics are ingested by marine organisms but it is unclear whether, and to what extent, this leads to increased morbidity and mortality.⁵⁶

While noting this uncertainty, interactions through the ingestion and entanglement of marine debris have been documented for 395 marine species worldwide, 17% of which are listed as threatened on the IUCN Red List.⁵⁷ Most of the documented interactions have involved entanglement with macroplastics, with the most commonly affected animals being sea turtles, marine mammals and sea birds. Plastic bags are regarded as one of the highest ingestion and entanglement risk items because of their persistence in the environment, three-dimensional structure and appearance (similarity to marine food sources).⁵⁸ They are also one of the more common items identified in marine debris surveys.⁵⁹

In Australia, the impacts of plastic and other marine debris on at least 20 nationally listed threatened species prompted the listing, in 2003, of 'injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris' as a key threatening process under the federal

Here we focus on the four environmental issues most commonly associated with plastic litter, and for which there is the strongest evidence of adverse impacts.

⁵³ Adverse impacts from ingestion are not confined to vertebrates. See, for example, Cole et al. (2013) 'Microplastic ingestion by zooplankton', *Environmental Science & Technology* 47, 6646-6655.

⁵⁴ C Arthur, J Baker and H Bomford (eds), *Proceedings of the International Research Workshop on the Occurrence, Effects and Fate of Microplastic Marine Debris* (National Oceanic and Atmospheric Administration, 2009).

⁵⁵ Ibid; S Gall and R Thompson (2015) 'The impact of debris on marine life', *Marine Pollution Bulletin* 92, 170-179; Gregory, above n 52.

⁵⁶ Arthur, Baker and Bomford, above n 54; S Wright et al. (2013) 'The physical impacts of microplastics on marine organisms: A review', *Environmental Pollution* 178, 483-492; Gall and Thompson, *ibid*; A Koelmans et al. (2016) 'Microplastic as a Vector for Chemicals in the Aquatic Environment: Critical Review and Model-Supported Reinterpretation of Empirical Studies', *Environmental Science & Technology* 50(7), 3315-3326; S Bruck and A Ford (2018) 'Chronic ingestion of polystyrene microparticles in low doses has no effect on food consumption and growth to the intertidal amphipod *Echinogammarus marinus*?'', *Environmental Pollution* 233, 1125-1130.

⁵⁷ Gall and Thompson, above n 55.

⁵⁸ Wilcox et al. (2016) 'Using expert elicitation to estimate the impacts of plastic pollution on marine wildlife', *Marine Policy* 65, 107-114.

⁵⁹ Ocean Conservancy, *Together for Our Ocean: International Coastal Cleanup 2017 Report* (Ocean Conservancy, 2017).

Environment Protection and Biodiversity Conservation Act 1999 (Cth).⁶⁰ The nationally listed threatened species that are known to be adversely affected by marine debris include at least six species of turtles (flatback, green, hawksbill, leatherback, loggerhead, olive ridley), five whale species (southern right, blue, humpback, sei, and fin), and 11 bird species (albatross and petrel spp.).⁶¹

The adverse impacts of macroplastics on marine life are mainly attributable to their durability (which ensures plastics persist in the environment), low densities and mass (which ensures plastic items float or remain suspended in the water column for extended periods, and are easily dispersed), and abundance (which ensures plastic items frequently come into contact with wildlife). It has been estimated that, in 2010, in the order of 4.4-11.5 million tonnes of plastic entered the ocean.⁶² Due to the large quantities entering the ocean, and the fact that they persist in the environment for extended periods, particularly in salt water, plastics now comprise in the order of 60-80% of all ocean litter.⁶³ An indicator of the extent of marine plastic pollution is the finding, from research published in 2017, that Henderson Island—a remote uninhabited 37 km² island in the South Pacific that is part of the Pitcairn Island group—has the highest recorded density of beach litter in the world (up to 672 items per m²; average 239 items per m²), almost all of which (>99%) is plastic.⁶⁴

In Australia, marine plastics comprise approximately 75% of litter in coastal areas.⁶⁵ A 2013 study found average sea surface plastic concentrations in Australian waters were 8,966 pieces per km² (after correcting for the impacts of wind-driven vertical mixing), similar to the levels found in the Caribbean Sea and Gulf of Maine but significantly less than in more polluted areas like subtropical gyres and the Mediterranean Sea.⁶⁶ Most of the plastics identified in the study were microplastics formed from the breakdown of larger polyethylene and polypropylene objects. Hard plastics made up the majority of

⁶⁰ Australian 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* (Australian Government, 2009).

⁶¹ See also B Hardesty et al., *Understanding the Effects of Marine Debris on Wildlife: Report to Earthwatch Australia* (CSIRO, 2014).

⁶² J Jambeck et al. (2015) 'Plastic waste inputs from land into the ocean', *Science* 347(6223), 768-771.

⁶³ J Derraik, 'The pollution of the marine environment by plastic debris: a review', *Marine Pollution Bulletin* 44, 842-852 (2002); R Thompson, *Future of the Sea: Plastic Pollution* (UK Government Office for Science, 2017).

⁶⁴ J Lavers and A Bond (2017) 'Exceptional and rapid accumulation of anthropogenic debris on one of the world's most remote and pristine island', *Proceedings of the National Academy of Science* 114(23), 6052-6055. See also M Eriksen et al. (2014) 'Plastic pollution in the world's oceans: more than 5 trillion plastic pieces weighing over 250,000 tons afloat at sea', *PLoS One* 9(12), e111913; and I Peeken et al. (2018) 'Arctic sea ice is an important temporal sink and means of transport for microplastic', *Nature Communications*, DOI: 10.1038/s41467-018-03825-5.

⁶⁵ Hardesty et al., above n 61; B Hardesty et al. (2017) 'Estimating quantities and sources of marine debris at continental scale', *Frontiers in Ecology and the Environment* 15(1), 18-25.

⁶⁶ J Reisser et al. (2013) 'Marine Plastic Pollution in Waters around Australia: Characteristics, Concentrations, and Pathways', *PLoS One* 8(11), e80466.

materials identified but soft plastics of the type used to make plastic bags were still prevalent, constituting 17% of the items captured in the samples.

For the ACT, one of the key policy questions concerning plastic shopping bags is the extent to which shopping bags consumed in the Territory contribute to coastal and marine debris. While there is no known empirical research on this issue, four factors suggest only a relatively small number of plastic shopping bags consumed in the ACT are likely to end up as ocean litter. First, plastic bags constitute only a small proportion of the ACT litter stream (less than 0.5%, see below for further details).

Secondly, the Territory (except Jervis Bay) is located approximately 150 kms from the nearest coastal area by road. Thirdly, the ACT's rivers flow via the Murrumbidgee River into the Murray River and then to the sea through South Australia, a trip of around 2,000 km. Both the Murrumbidgee and Murray Rivers are, moreover, highly regulated systems with multiple dams, levies and weirs that obstruct the movement of plastic waste to the coast.

Finally, both international and Australian research on the sources of marine debris and litter suggests most of it comes from direct deposition and sources in reasonably close proximity to the coast. A recent coastal debris survey undertaken by CSIRO in Australia found a strong correlation between coastal litter density and urban areas, which suggests a significant proportion of the identified litter came from domestic (and presumably also reasonably local and coastal) sources.⁶⁷ Related CSIRO research found direct deposition to be the primary determinant of the amount of debris at specific sites, followed by transportation by water and then wind.⁶⁸ Again, these findings suggest local and coastal activities are the main sources of marine debris. Consistent with this, research undertaken using data collected through the Ocean Conservancy's International Coastal Cleanup found marine debris is dominated by litter from three categories of activity: shoreline and (land-based) recreational activities (64% globally and 75% in Oceania); smoking-related activities (25% globally, 20% in Oceania); and ocean and waterway activities (water-based activities like commercial and recreational shipping) (8% globally, 5% in Oceania).⁶⁹

Invasive species

Invasive species are a major threat to biodiversity globally and in Australia. These species range from large vertebrates through to small plants and microorganisms. Although not widely studied, concerns have been raised

⁶⁷ Hardesty et al., above n 65.

⁶⁸ B Hardesty et al., *Understanding Debris Sources and Transport from the Coastal Margin to the Ocean: Report to the Australian Packaging Covenant Organisation Ltd* (CSIRO, 2016).

⁶⁹ Ocean Conservancy, *Trash Travels: International Coastal Cleanup 2010 Report* (Ocean Conservancy, 2010).

about the potential for plastic marine debris to transport invasive species to new habitats. The characteristics of plastics that facilitate their wide dispersal—durability, low density and abundance—make them ideal for the ‘rafting’ of invasive species in the ocean. There is evidence of species rafting on plastic debris but the extent to which this is attributable to plastic bags is unclear.⁷⁰ The magnitude of plastic-related rafting risks, relative to other avenues for invasive species dispersal, are also not well known.

The relevance of marine invasive species risks to the regulation of plastic bags in the ACT depends on the extent to which bags from the ACT contribute to marine debris. As discussed, there is no empirical data on this issue but the available information suggests plastic shopping bags consumed in the ACT are unlikely to end up as ocean litter.

Absorption and transfer of toxins

Over the past 10-15 years, there has been growing concern recorded in the scientific literature about the potential for plastic particles, particularly microplastics, to leach toxins into the environment and, possibly more importantly, to absorb and transfer toxins to organisms and ecosystems.⁷¹ The ability of microplastics to absorb pollutants (during and after manufacturing), which are subsequently ingested by organisms has been raised as a potential pathway by which persistent organic pollutants such as DDT and PCBs could contaminate food webs and potentially affect human health.⁷² The scientific evidence on these types of toxicological impacts is limited and mixed. Some studies suggest the risks are material, while others suggest they are not.⁷³ Further research is required to resolve these uncertainties.

Amenity impacts of litter

The impacts of plastic litter on local amenity have been well-known and documented since plastics became widely available in the 1950s. Whether plastic litter is found in marine or terrestrial environments, it is generally regarded as unsightly and unwanted. As plastic litter persists in the environment, the only way to address the associated amenity impacts is through physical removal.

⁷⁰ Gregory, above n 52; Gall and Thompson, above n 55.

⁷¹ Teuten et al., above n 26; Wright et al., above n 56; Gall and Thompson, above n 55; J Reisser et al., above n 66.

⁷² Teuten et al., above n 26; C Rochman et al. (2012) ‘Long-Term Field Measurement of Sorption of Organic Contaminants to Five Types of Plastic Pellets: Implications for Plastic Marine Debris’, *Environmental Science & Technology* 47, 1646–1654.

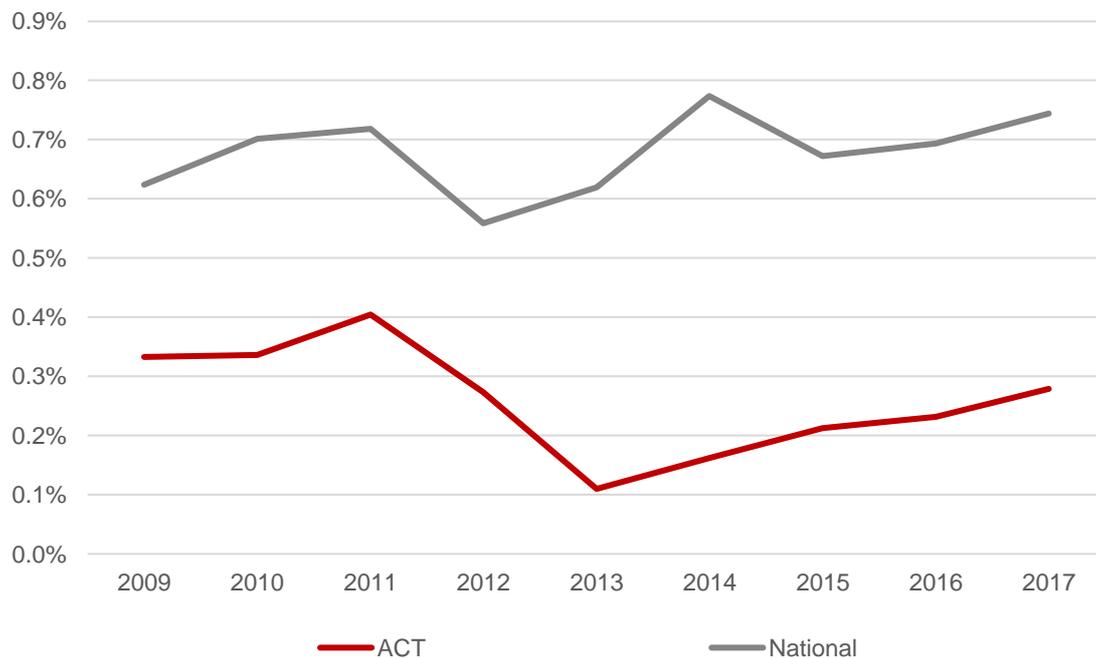
⁷³ Arthur, Baker and Bomford, above n 54; Wright et al., above n 56; Teuten et al., above n 26; Rochman et al., *ibid*; Gall and Thompson, above n 55; Koelmans et al., above n 56; Bruck and Ford, above n 56; D Herzke et al. (2016) ‘Negligible Impact of Ingested Microplastics on Tissue Concentrations of Persistent Organic Pollutants in Northern Fulmars off Coastal Norway’, *Environmental Science & Technology* 50, 1924–1933.

The degree of community concern about plastic and other forms of litter is evidenced by both the government resources devoted to its removal and the large number of volunteers who regularly give their time to litter clean up initiatives. The largest of these in Australia is Clean Up Australia Day, which commenced in 1989 and has run annually since.⁷⁴ Each year for the past decade, more than 500,000 people have voluntarily participated in the day. The 2017 Clean Up Australia Day alone attracted 590,354 volunteers, who collected 15,552 ute loads of rubbish (roughly 23,000-30,000 m³). Plastic bags are not the only type of litter collected on these days but they are generally amongst the top 10 reported items.

The available data on the composition of litter streams suggest plastic shopping bags generally constitute only a small proportion of litter in Australia and the ACT. Arguably, the most comprehensive database on litter in Australia is the Keep Australia Beautiful National Litter Index (KABNLI), which has been maintained since 2005-06. The KABNLI is derived from biannual litter counts at 983 undisclosed sites across the country, 76 of which are in the ACT. While plastics comprise around 20-24% of the litter counted through the national KABNLI surveys, plastic bags (lightweight single use shopping bags and boutique bags) make up only 0.6-0.8% (by average items counted) (Figure 4). If plastic bags are combined with other types of plastic sacks, they generally still constitute less than 1.3% of the nationally counted litter. In the ACT, the proportion of litter counted through the KABNLI surveys made up of plastic bags is even lower: 0.1-0.4% for plastic bags and 0.6-1.4% for all plastic bags and sacks (Figures 4 and 5).

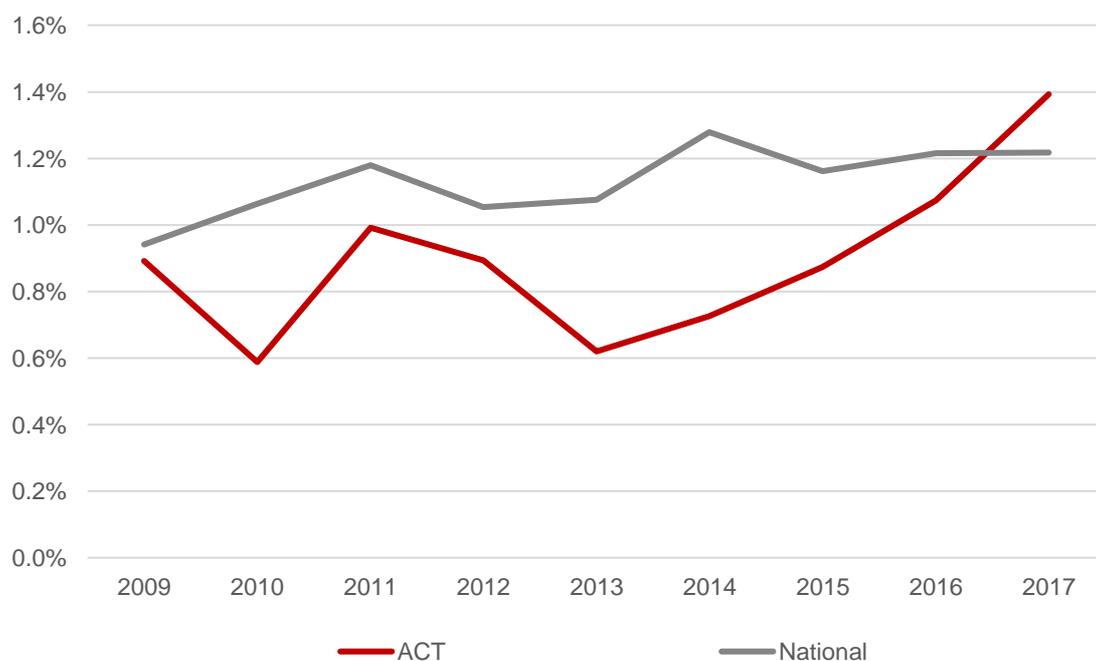
⁷⁴ There are now two offshoot 'clean up days': Business Clean Up Day and School Clean Up Day. There are similar initiatives in many other countries, including New Zealand, Canada and the United Kingdom.

Figure 4. Plastic bags as a proportion of the Keep Australia Beautiful National Litter Index (KABNLI) litter stream, ACT and National, by average items counted, 2008-09 to 2016-17



Source: McGregorTan Research, *Keep Australia Beautiful National Litter Index* (Keep Australia Beautiful, 2018).

Figure 5. All plastic bags and sacks as a proportion of the Keep Australia Beautiful National Litter Index (KABNLI) litter stream, ACT and National, by average items counted, 2008-09 to 2016-17



Source: McGregorTan Research, *Keep Australia Beautiful National Litter Index* (Keep Australia Beautiful, 2018).

The KABNLI litter count data are consistent with the results of the analysis of the rubbish collected as part of Clean Up Australia Days. For example, in 2017, supermarket/retail bags represented 1.7% of the rubbish items collected nationally, down from 2% in 2016. In the ACT, in both 2016 and 2017, plastic shopping bags represented less than 1% of rubbish items counted.

Although plastic bags constitute only a small proportion of the litter counted through KABNLI surveys and Clean Up Australia Days, plastic bag litter remains an issue of community concern. This could point to possible limitations associated with the KABNLI and Clean Up Australia Day data; in particular, they may not be representative of the actual litter streams in the environment. Another underlying reason for concern could be the visibility of plastic bag litter and its persistence in the environment. Compared to other common forms of litter, particularly cigarette butts, plastic bags are highly visible, meaning they more readily detract from people's experiences. The fact that conventional plastics do not biodegrade may also be a source of community concern.

4.4 Comparing the environmental impacts of plastic bags and plastic bag substitutes

Governments and stakeholders in Australia and elsewhere have often used life cycle assessments (LCA) to compare the net environmental impacts of different types of plastic bags and plastic bag substitutes. LCA is an internationally accepted method of evaluating the resources used through, and environmental impacts associated with, the lifecycle of a product or process. There are two general types of LCA: attributional and consequential.⁷⁵ Attributional LCAs provide a historical estimate of the environmental impacts that are directly and indirectly caused by a product or process. In essence, they seek to answer the question: what are the environmental impacts that are caused by, or attributable to, a particular product or process? Consequential LCA has a different orientation and purpose. It is forward looking and seeks to answer the question: how will relevant environmental impacts or outcomes change in response to different decisions or pursuit of different options? Both attributional and consequential LCAs are valid ways of evaluating the environmental impacts associated with products and processes but their outputs relate to different issues and, reflecting this, are often significantly different.⁷⁶

⁷⁵ T Ekvall and B Weidema (2004) 'System boundaries and input data in consequential life cycle inventory analysis', *International Journal of Life Cycle Assessment* 9, 161–171; G Finnveden et al. (2009) 'Recent developments in Life Cycle Assessment', *Journal of Environmental Management* 91, 1–21.

⁷⁶ S Lundie, A Ciroth, and G Huppel, *Inventory methods in LCA: towards consistency and improvement – Final Report. UNEP-SETAC Life Cycle Initiative* (UNEP, 2007); Ekvall and Weidema, *ibid*; A Bento and R Klotz (2014)

Most plastic bag-related LCAs have used attributional LCA methods to evaluate the relative environmental impacts of different shopping bag types.⁷⁷ The results of the attributional LCAs done on plastic bags and their substitutes have tended to show that reusable plastic bags have superior environmental performance to single-use plastic bags and even other more ‘natural’ alternatives, like paper and calico, provided they are repeatedly used. Table 8 provides an illustrative example of the summary outputs from two Australian attributional LCAs on shopping bags.

While useful, the results of all attributional LCAs need to be interpreted with caution because of their sensitivity to assumptions and data inputs. For example, in the studies cited in Table 8, the relative environmental performance of single-use vs reusable bags hinged on the number of times the bags were assumed to be reused. Most reusable bags were assumed to be reused 104 times prior to replacement, with the exception of reusable LDPE bags that were assumed to be used 3 times. Changing the assumed life of reusable bags significantly alters the relative environmental performance of the bags. In the Verghese study, the sensitivity analysis showed that halving the life of polypropylene and PET bags from 104 to 52 trips doubled their attributed greenhouse gas emissions, making them worse on this measure than single use plastic bags.⁷⁸

‘Climate Policy Decisions Require Policy-Based Lifecycle Analysis’, *Environmental Science & Technology* 48, 5379–5387; R Plevin, M Delucchi and F Creutzig (2014) ‘Using attributional life cycle assessment to estimate climate-change mitigation benefits misleads policy makers’. *Journal of Industrial Ecology* 18, 73–83; A Macintosh, H Keith and D Lindenmeyer (2016) ‘Reply to ‘Policy institutions and forest carbon’, *Nature Climate Change* 6, 805–806.

⁷⁷ See, for example, ExcelPlas Australia, *The Impacts of Degradable Plastic Bags in Australia* (Nolan-ITU & RMIT, 2003); C Chaffee and B Yaros, *Life Cycle Assessment for Three Types of Grocery Bags – Recyclable Plastic; Compostable, Biodegradable Plastic; and Recycled, Recyclable Paper* (Boustead Consulting & Associates, 2007); O’Farrell, above n 22; Verghese, above n 22; C Edwards and G Parker, *A Life Cycle Assessment of Oxo-biodegradable, Compostable and Conventional Bags* (Intertek, 2012); Posen et al., above n 20; Bisinella et al., above n 22.

⁷⁸ Verghese, above n 22.

Table 8. Attributional LCA outputs on shopping bags, two studies, in adjusted equivalent units*

	Study	No. of shopping trips	Carbon dioxide equivalents (CO ₂ -e)	Energy use (MJ)**	Water use (L)	Litter marine impacts (g. yrs)***
Single-use HDPE (100% virgin resin feedstock)	1	1	6.2	199.8	4.2	15.6
	2	1	7.5	19.9	13	NA
Single-use HDPE (100% recycled feedstock)	1	1	3.3	14.7	3.4	15.6
	2	NA	NA	NA	NA	NA
Single-use HDPE (15% recycled feedstock)	1	NA	NA	NA	NA	NA
	2	1	7.4	19.1	53	NA
Reusable LDPE	1	3	8.9	269.2	5.1	18.8
	2	NA	NA	NA	NA	NA
Reusable polypropylene	1	104	0.8	23.2	20.7	3.2
	2	104	5.4	6.6	16	NA
Reusable polypropylene (100% recycled feedstock)	1	104	0.4	7.2	23.6	3.2
	2	NA	NA	NA	NA	NA
Reusable PET bags (100% recycled feedstock)	1	104	0.5	8.0	16.3	1.7
	2	104	6.5	6.5	38	NA
Single-use compostable plastic	1	1	9.0	210.4	91.4	5.3
	2	1	9.2	10.0	50	NA
Single-use oxo-biodegradable plastic	1	1	10.2	229.7	75.7	3.8
	2	1	6.7	17.9	12	NA
Single-use kraft paper bag	1	1	61.1	865.1	350	0.3
	2	1	44.7	44.8	423	NA
Single-use kraft paper bag (100% recycled feedstock)	1	1	56.3	648.5	167.5	0.3
	2	1	NA	NA	NA	NA
Reusable calico	1	104	3.2	30.1	7600.4	0.76
	2	NA	NA	NA	NA	NA

* Study 1 modelling based on bags required for 52 shopping trips per year with an equivalent shopping bag requirement of ten HDPE shopping bag loads per trip. Study 2 based on the number of bags per year for 70 grocery items per week per household.

** Study 2 does not include an embodied energy estimate. Instead, it included an estimate of fossil fuels (for energy and non-energy purposes) depleted through the production of the bags.

*** G. yrs = number of years prior to breakdown of material before it is no longer an entanglement risk to larger marine organisms. Estimates only provided in study 1.

Source: Study 1 = O'Farrall, above n 22. Study 2 = Verghese, above n 22.

Another example of the sensitivity of attributional LCAs' outputs to assumptions concerns the assumed sources of greenhouse gas emissions. In most plastic bag LCAs, estimates of climate change impacts are primarily based on assumptions regarding the emissions from four sources: emissions associated with the extraction, refining and transport of feedstocks; energy used in the production process; energy used to transport the bags to market; and methane emissions from the decomposition of organic materials in anaerobic conditions.⁷⁹ The majority of the greenhouse emissions attributable to plastic bags are typically assumed to emanate from the reliance on fossil fuel-based energy in production processes. However, it is not always the case that the energy used in the production of plastic bags will be exclusively derived from fossil fuels. The attributed climate impacts of plastic bags can vary significantly depending on the assumed balance between fossil and renewable energy.⁸⁰

Similarly, most LCAs on shopping bags typically do not account for the capture and combustion of methane at landfill sites. Where LCAs have been undertaken on biodegradable bags, some of the bags are assumed to go to landfill (rather than being recycled, composted, reused or littered) and a proportion of these are assumed to decompose under anaerobic conditions, resulting in the release of methane to the atmosphere. As noted above, the actual net climate impacts associated with the release of landfill gas depend on whether the methane component of the gas is captured and combusted, and how it is combusted (e.g. is it flared or used to produce energy?). Most LCAs on shopping bags do not account for the potential to capture and combust the methane; they simply assume it escapes into the atmosphere.⁸¹ This potentially artificially depresses the relative environmental performance of biodegradable bags.

In addition to the sensitivity of their results to assumptions, the other critical limitation of attributional LCAs is their limited predictive power in relation to the likely impacts of policy or behavioural change. Attributional LCAs only provide information on the environmental impacts caused by different types of bags. They do not provide information on how net environmental impacts will change if there is a change in policy settings that prompt changes in behaviour concerning the production and use of different types of shopping bags.⁸²

⁷⁹ Some LCAs on paper, calico and jute bags also account for nitrous oxide emissions from soils that are associated with the use of synthetic fertilisers.

⁸⁰ One US study estimates switching to renewable energy would cut attributed emissions in the production process by 50-75%: Posen et al., above n 20.

⁸¹ There are also alternative waste treatment facilities that divert waste from landfill.

⁸² Ekvall and Weidema, above n 75; Bento and Klotz, above n 76; Plevin, Delucchi and Creutzig, above n 76; Macintosh, Keith and Lindenmeyer, above n 76.

The net environmental outcomes that arise from changes in policy settings concerning plastic bags depend on market responses (demand- and supply-side behaviour) and the rules governing relevant behaviours. For example, attributional LCAs generally rank calico and paper bags below conventional and other types of plastic bags in terms of water use. However, banning calico and paper bags will not necessarily result in more water being available for the environment. Whether more water is available for the environment will depend on a number of factors, including:

- the extent to which calico and paper bag consumers reduce overall bag consumption;
- the extent to which calico and paper bag consumers use substitutes and the nature of the substitutes;
- whether the calico and paper bag producers reduce production or sell the bags or relevant fibres (cotton or wood) into other markets; and
- whether the extraction of water by the producer and other water uses in the relevant catchment is regulated.

In catchments where water use is regulated, reductions in demand for water from particular users (e.g. because of a decrease in the production of cotton or roundwood) will not necessarily result in less water being extracted from the system and more water being left for the environment. The more likely outcome is the water will be reallocated to another water user.

Similarly, attributional LCAs generally rank conventional plastic bags above paper bags in terms of climate impacts. Does this mean that net greenhouse gas emissions would increase if a jurisdiction mandated that all shopping bags must be paper? The only valid answer that can currently be provided is: not necessarily. Whether net emissions increase will depend on: where the relevant paper bags are sourced from (e.g. whether the wood fibre is derived from a native forest or a plantation); whether the increase in demand for paper bags results in the reforestation of cropping or grazing lands; the extent to which the drop in demand for plastic bags in the jurisdiction is offset by an increase in demand elsewhere; and the policy and institutional settings that govern greenhouse gas emissions in the relevant jurisdictions. If all the bags are sourced from a jurisdiction like Australia that has cumulative limits on greenhouse gas emissions, there should be no change in net emissions. The cumulative emission limit prevents any net increase in emissions. The net climate outcome should be the same – only the sources of the emissions should change.

To answer the question of how net environmental outcomes will change in response to different policy settings (or even different supermarket and consumer behaviour) it is necessary to undertake consequential LCAs. No

detailed consequential LCAs have been prepared on shopping bags in Australia. Until these studies are undertaken, there is no accurate way of predicting the net environmental impacts of alternative policy choices concerning shopping bags.

5. Plastic bag regulation in Australia

Globally, a number of different types of policy instruments have been used to alter behaviour in relation to the use of plastic bags, including taxes, levies and regulatory bans. While taxes and levies have been used in a number of jurisdictions, regulatory bans on single-use plastic bags have been the most popular policy response.

In Australia, four jurisdictions have imposed regulatory bans on the sale or supply of single-use plastic bags: South Australia, the ACT, the Northern Territory and Tasmania. As detailed in Table 9 (and Appendix C), South Australia was the first to impose bans, in May 2009. Its ban applies to plastic bags of less than 35 μm , except biodegradable bags (those that meet the Australian Standard for compostable plastic bags in commercial systems)⁸³ and bags that are an integral part of the packaging in which goods are sealed prior to sale. The Northern Territory introduced a similar ban in September 2011. Shortly after, in November 2011, the ACT introduced its ban, which differs from those in South Australia and the Northern Territory only in the explicit exclusion of 'barrier bags' (bags used to carry unpackaged perishable food). Tasmania introduced a similar regulatory ban to the ACT's in November 2013.

In addition to the bans currently in operation, regulatory bans on lightweight plastic bags will be introduced in Queensland and Western Australia from 1 July 2018 (Table 9). In October 2017, the Victorian Government announced it will also ban lightweight plastic bags and, at the time of writing, was undertaking public consultation on the design of the measure. New South Wales is the only major jurisdiction in Australia that is not currently committed to phasing out single-use lightweight plastic bags.⁸⁴

⁸³ Australian Standard AS 4736-2006: *Biodegradable plastics-Biodegradable plastics suitable for composting and other microbial treatment*. This standard covers biodegradable plastics suitable for composting in commercial systems. Biodegradable plastics suitable for home composting are covered by *Australian Standard AS 5810-2010: Biodegradable plastics suitable for home composting*, which is not currently prescribed under the *Plastic Shopping Bags Ban Regulation 2011* (ACT).

⁸⁴ The Norfolk Island Regional Council introduced a policy in October 2017 that aims to phase out the use of plastic shopping bags on the island through a voluntary scheme. The Council does not have legislative powers and, as a consequence, is unable to impose a regulatory ban.

Table 9. Existing state and territory policies on lightweight plastic bags, as at May 2018*

	Legislation	Ban start date	Scope of regulatory ban
South Australia	<i>Plastic Shopping Bag (Waste Avoidance) Act 2008</i>	4 May 2009	s 3: ‘plastic shopping bag’ defined as any carry bag, with handles, ‘the body of which comprises (in whole or in part) polyethylene with a thickness of less than 35 microns’ or as prescribed in regulations. Specifically excludes biodegradable bags and any ‘plastic bag that constitutes, or forms an integral part of, the packaging in which goods are sealed prior to sale’.
Northern Territory	<i>Environment Protection (Beverage Containers and Plastic Bags) Act 2011</i>	1 September 2011	s 51: defines a ‘prohibited plastic bag’ as any carry bag, with handles, ‘the body of which comprises (in whole or in part) polyethylene with a thickness of less than 35 microns’ or as prescribed in regulations. Specifically excludes biodegradable bags and any ‘plastic bag that is, or forms an integral part of, the packaging in which goods are sealed prior to sale’.
ACT	<i>Plastic Shopping Bag Ban Act 2010</i>	1 November 2011	s 6: ‘plastic shopping bag’ defined as ‘a bag that is made (in whole or in part) of polyethylene with a thickness of less than 35 microns’, or as prescribed in regulations. Specifically excludes biodegradable bags, integrated packaging and barrier (produce) bags.
Tasmania	<i>Plastic Shopping Bags Ban Act 2013</i>	1 November 2013	s 3: ‘plastic shopping bag’ defined as a bag ‘made, in whole or in part, of polyethylene with a thickness of less than 35 microns’, or as prescribed in regulations. Specifically excludes biodegradable bags, integrated packaging and barrier bags.
Queensland	<i>Waste Reduction and Recycling Act 2011</i>	1 July 2018	s 99B: defines ‘banned plastic shopping bag’ as ‘a carry bag with handles ... made, in whole or in part, of plastic (whether or not the plastic is degradable) that has a thickness of less than ... 35 microns’, or as otherwise defined in regulations. Specifically excludes barrier bags and integrated packaging.
Western Australia	<i>Environment Protection Act 1986</i>	1 July 2018	The ban will be implemented through regulations made under the <i>Environment Protection Act</i> . At the time of writing, the regulations had not been released. However, information published by the Department of Water and Environmental Regulation indicates it will apply to all plastic bags with handles that are $\leq 35 \mu\text{m}$, including degradable, biodegradable and compostable plastic bags.

Source: Cited statutes and WA Department of Water and Environmental Regulation, *Frequently Asked Questions: Western Australia’s Ban on Lightweight Plastic Bags* (Western Australian Government, 2018).

* See Appendix C for further details on relevant state and territory legislation.

The bans in Queensland and Western Australia will be introduced via regulations made under existing environmental legislation.⁸⁵ At the time of writing, neither jurisdiction had published the final regulations. However, the publicly available information indicates that, in contrast to the other Australian jurisdictions, both Queensland and Western Australia are poised to include biodegradable bags within the scope of their bans.⁸⁶ Two main reasons have been provided for the prohibition on lightweight biodegradable bags: they can

⁸⁵ *Waste Reduction and Recycling Act 2011* (Qld) and *Environment Protection Act 1986* (WA).

⁸⁶ *Waste Reduction and Recycling Act 2011* (Qld), s 99B (defining ‘banned plastic shopping bag’ to include biodegradable bags); Western Australian Government, *Implementing a lightweight single-use plastic bag ban in Western Australia: Discussion paper* (Western Australian Government, December 2017), 14.

cause confusion amongst retailers, consumers and other stakeholders because they are difficult to distinguish from polyethylene bags; and the environmental impacts of biodegradable bags are not materially different from polyethylene bags, generally because they require commercial-grade compositing conditions to break down.⁸⁷

Recent government initiatives to ban single-use plastic bags have coincided with moves by several major retailers to voluntarily phase them out. Aldi and Bunnings already do not offer single-use plastic bags (Aldi has not done so since entering the Australian market). In July 2017, Coles, Woolworths and IGA announced they will phase-out single-use plastic bags by 1 July 2018, which coincides with the commencement of the bans in Queensland and Western Australia.

6. Effectiveness of legislated Australian bans

The primary purpose of Australian plastic bag bans has been to reduce the use of plastic bags and their impacts on the environment. This is reflected in the Explanatory Statement for the ACT *Plastic Shopping Bags Ban Bill*, which states:

The Bill aims to put in place arrangements to reduce the use of plastic bags made from polyethylene through restricting supply of plastic bags at the point of sale where the bag is provided to carry goods.⁸⁸

Similarly, the Minor Assessment Statement prepared in relation to the Tasmanian *Plastic Shopping Bag Ban Act 2013* (Tas) provides:

The objectives of the proposed Tasmanian Legislation will support community aspirations for reducing unnecessary consumption of natural resources and for lessening the environmental impacts of plastic bag litter.⁸⁹

Given this relatively consistent aim, the effectiveness of the Australian bag bans is best judged on the basis of the extent to which they have reduced plastic bag use and the associated impacts of plastics on the environment.

⁸⁷ Western Australian Government, *ibid*; Queensland Department of Environment and Heritage Protection, *Implementing a lightweight plastic shopping bag ban in Queensland: Discussion paper* (Queensland Government, 2016) 15.

⁸⁸ *Plastic Shopping Bags Ban Bill 2010: Explanatory Statement*, 2.

⁸⁹ Department of Primary Industries, Parks, Water and Environment, *Minor Assessment Statement on Proposed New Tasmanian Legislation, Plastic Shopping Bag Ban Act 2013* (Tasmanian Government, 2012) 2.

Assessing the environmental effectiveness of the bans on this basis requires a counterfactual comparison.⁹⁰ The observed use of plastic bags and their environmental impacts over the period since the imposition of the bans should be compared to the patterns of use and impacts that would have occurred over the same period if the ban had not been introduced. While counterfactual analysis is best practice, it is complex and requires the identification and analysis of the variables that influence plastic bag use and management. The difficulty in devising robust counterfactuals often results in policy assessments comparing usage and impacts before and after the imposition of policy interventions, and using the difference as the measure of effectiveness.

To date, none of the Australian jurisdictions with plastic bag bans have undertaken robust environmental effectiveness analyses using counterfactual comparisons. Significant reviews have only been undertaken in the ACT, South Australia and the Northern Territory, and these assessments were based on before and after comparisons of bag usage and litter.⁹¹ The reviews that have been undertaken have also not covered all relevant environmental impacts, being focused mainly on litter and bags deposited in landfill. One of the reasons for the limitations in the analyses that have been undertaken is a relative absence of data, particularly on plastic bag consumption and reuse. Further details on the assessments undertaken in the ACT, South Australia and the Northern Territory are provided below.

6.1 Previous reviews of Australian plastic bag bans

6.1.1 ACT reviews

The ACT plastic bag ban has been reviewed on two occasions, in 2012 and 2014. The 2012 review was an interim review that looked at the impacts of the ban on three main issues: plastic bag use, plastic bag litter and consumer attitudes.⁹² The analysis of impacts on plastic bag use involved a before and after comparison, which looked at four categories of bags: single-use HDPE bags; boutique bags ($\geq 35 \mu\text{m}$ polyethylene bags); reusable non-woven polypropylene bags; and bin liners. Based on data provided by retailers in relation to bag sales over the period prior to (1 May 2011 to 31 October 2011) and after (1 November 2011 to 30 April 2012) the introduction of the ban, the review found there had been a 41% reduction in shopping bag sales, which

⁹⁰ P Ferrero, 'Counterfactual thinking and Impact Evaluation in Environmental Policy' in M. Birnbaum & P. Mickwitz (Eds.), *Environmental program and policy evaluation: Addressing methodological challenges. New Directions for Evaluation, Issue 122* (Wiley InterScience, 2009) 75–84.

⁹¹ In July 2017, the Tasmanian Environment Minister commissioned the State's Environment Protection Authority to investigate and report on the extent to which the ban was being circumvented by retailers using bags that fall just outside bag ban parameters (e.g. slightly thicker than $35 \mu\text{m}$). The report had not yet been released. Further, it appears to be limited in scope.

⁹² Directorate of Environment and Sustainable Development, *Interim Review of the Plastic Shopping Bags Ban* (ACT Government, 2012).

was partially offset by a 31% increase in bin liner sales. After accounting for the different mass of the relevant bags, the review concluded that the ban had resulted in a 31% reduction in plastic going to landfill. Although useful, the robustness of these results was undermined by the fact that data on plastic bag sales and distribution were not provided by all retailers, and by the relative infancy of the ban (the ban took effect in November 2011). The 2012 review report stresses this, noting:

The long term impact of the Ban on plastic generation and plastic to landfill will be more apparent at the time of the two year review.⁹³

To analyse the impacts of the ban on plastic litter, the review relied on data from Keep Australia Beautiful National Litter Index audits, from the period 2007-08 to 2011-12. However, due to variability in the data, the review was unable to determine the impacts of the ban on plastic litter.

The third core aspect of the 2012 interim review was an analysis of consumer attitudes towards the ban and plastic bag usage. To gauge this, the review commissioned a phone survey, which found:

- 84% of primary shoppers reported taking re-usable bags 'always or most of the time' when they go to the supermarket, compared to 44% prior to the introduction of the ban; and
- 58% of primary shoppers supported the ban, 33% did not and 9% were unsure.

The 2014 review adopted a similar structure to the 2012 interim review, looking at impacts of the ban on a number of issues, the three most important being plastic bag use, plastic bag litter and consumer attitudes.⁹⁴ Again, the analysis of the effectiveness of the ban in reducing plastic bag usage was based on a before and after comparison, for the six month period prior to the commencement of the ban (1 May 2011 to 31 October 2011) and a six month period in 2013 (1 May 2013 to 31 October 2013). Accounting for substitution effects across the four bag types (single-use HDPE plastic bags, boutique plastic bags, reusable polypropylene bags and bin liners), the review found there had been a significant reduction in plastic bag consumption and the amount of plastic deposited in landfill.

The review estimated that, in the six-month period prior to the introduction of the ban, 26 million single-use plastic bags were distributed in the ACT and 182 tonnes of single-use plastic bags were interred in landfill. In contrast, over the period 1 May 2013 to 31 October 2013 the review found just over 4 million

⁹³ Ibid, 8.

⁹⁴ Directorate of Environment and Sustainable Development, *Review of the Plastic Shopping Bags Ban* (ACT Government, 2014).

boutique bags were purchased from retailers (who provided data) and 114 tonnes of boutique bags were sent to landfill. In relation to reusable polypropylene bags and bin liners, the review found that, after an initial increase in sales, consumption of both bag types had settled back to pre-ban levels. Overall, the review found that the amount of plastic going to landfill from bags had fallen by 36%, from 266 tonnes in the six months prior to the commencement of the ban to 171 tonnes in the six-month period in 2013.

In relation to litter, the 2014 review concluded there had been 'a consistent reduction in plastic bag litter since November 2011', when the ban was introduced.⁹⁵ This conclusion was based primarily on KABNLI data, which showed a marked drop in the average number of single-use plastic bags found in the ACT's litter stream and no significant change in the number of boutique bags. Consistent with the KABNLI data, waste removal contractors engaged to clean gross pollutant traps in ACT waterways and stormwater channels reported a reduction in plastic bags since the introduction of the ban.

The 2014 review identified several positive changes in consumer behaviour attributable to the ban.⁹⁶ From a survey of 602 'primary shoppers', the review found strong support for the ban (65%, up from 58% in 2012). Seventy-nine per cent of respondents also reported that they 'always' took reusable bags with them to go shopping (down from 84% in 2012), with only 4% stating that they 'never' did so.

6.1.2 South Australia reviews

South Australia's single-use plastic bag ban was introduced in May 2009 via the *Plastic Shopping Bag (Waste Avoidance) Act 2008* (SA). Under section 8 of the Act, the responsible Minister was required to commission a review of the Act, prior to the second anniversary of its commencement, on the ban's effectiveness in restricting the supply of plastic shopping and the effect of the ban on the community.

The review report, published in November 2012, found the ban had been effective in restricting the supply of single-use plastic shopping bags, with only one non-compliance notice issued since the ban's commencement. Consumer behaviour was also found to have been affected. Based on the results of empirical research undertaken by the Ehrenberg-Bass Institute for Marketing Science at the University of South Australia, the review found that 'twice as many households regularly carry their own bags at any given time than before the ban'.⁹⁷ In grocery settings, the majority of respondents to a survey conducted for the review indicated they took bags from home on at

⁹⁵ Ibid, 10.

⁹⁶ Ibid, 7.

⁹⁷ M Aspin, Review of the *Plastic Shopping Bags (Waste Avoidance) Act 2008* (Zero Waste SA, 2012) 3.

least 8 out of 10 shopping occasions. This was consistent with the findings of an observational study conducted at supermarkets, in which 65% of observed consumers brought enough reusable bags to carry their entire shop, while 24% purchased bags as part of their shop.⁹⁸ In surveys conducted prior to the introduction of the ban, 60% of respondents claimed to take their own bags shopping.⁹⁹

In non-grocery shopping contexts (e.g. in department stores and specialty shops), 40% of respondents in a survey in 2011 indicated they always carried/used bags, compared with 25% prior to the ban. Fifty-one per cent of consumers were also observed to carry their own shopping bags in non-grocery settings. However, 30% reported never carrying bags in non-grocery shopping contexts and 51% of consumers were observed to take bags from retailers (mostly provided free of charge).¹⁰⁰

While there was evidence of 'positive' bag behaviours and behavioural change, the review found there had been a significant increase in the sale of plastic bin liners. Prior to the introduction of the ban, 15% of consumers reported purchasing bin liners. In 2011, this had increased to 80%, suggesting consumers were substituting purchased bin liners for the previously free lightweight plastic shopping bags.¹⁰¹

In order to gain further insights on the effects of the ban, the review interrogated KABNLI data, which showed there had been a 45% decline in the proportion of litter consisting of plastic bags. However, due to the fact plastic bags constitute a small proportion of the litter stream, this result was regarded as inconclusive. Further, the KABNLI data indicated that, as of 2011, the levels of heavy plastic bag litter were higher in South Australia than any other state, which could indicate the positives of reduced single-use plastic bag use were being offset by increased heavy bag use.

The review report found retailers to be positive overall about the ban and the way it had been managed by the government. Likewise the report revealed a high level of retailer compliance. The other notable finding from the review was that the ban was widely supported. Among those surveyed for the review, the mean level of support on a 1-10 scale (1 indicating strong opposition, 10 strong support) was 7.8. More than half of respondents in interviews also supported the extension of the ban to include heavy and thick plastic bags.¹⁰²

⁹⁸ Ibid.

⁹⁹ Ehrenberg-Bass Institute for Marketing Science, *Plastic Bag Ban Research* (University of South Australia, 2009).

¹⁰⁰ Aspin, above n 97.

¹⁰¹ Aspin, above n 97.

¹⁰² Aspin, above n 97.

In addition to the statutory review, the research team from the Ehrenberg-Bass Institute for Marketing Science at the University of South Australia, who undertook research for the government in relation to the ban, also published a peer-reviewed paper on the impact of the ban on consumer behaviour.¹⁰³ The research tracked individuals to enable pre- and post-ban comparisons, and found the ban significantly increased the incidence of respondents taking their own bags shopping. Prior to the introduction of the ban and during the phase out period, approximately 60% of respondents reported taking their own bags, which increased to 95% after its commencement. The same study also reported significant decreases in the reported frequency with which respondents forgot to take bags or took insufficient bags when shopping.

6.1.3 Northern Territory review

The Northern Territory's plastic bag ban commenced on 1 September 2011. In 2014, the Territory Government commissioned a review of the ban, which focused on consumer behaviour and support, perceptions of the effectiveness and impacts of the ban, plastic bag sales and use, and the prevalence of plastic bags in the litter stream.¹⁰⁴ From customer surveys, the review found strong support for the ban, with consumers reporting a mean level of support on a 1-10 scale (1 indicating strong opposition, 10 strong support) of 7.3. There was also evidence of positive changes in consumer behaviour. Prior to the introduction of the ban, on average, shoppers reported taking their own bags to the shops on 1.7 trips out of 10. After the ban was introduced, this increased to 5.5 out of every 10 trips.

The capacity of the review to provide conclusions on the impacts of the ban on plastic bag usage was hindered by a lack of data. Based on a 'high level analysis', the review report concluded:

... total plastic bags (single-use plastic bags, reusable shopping bags, bin liners and kitchen tidy bags) are estimated to have reduced by 10.3 million per annum since the introduction of the ban. Given the diversity of bag types of varying thickness that are available, this high-level analysis may not necessarily indicate a reduction in overall plastic usage.¹⁰⁵

Part of the reason for the inclusive results was an observed increase in the purchase of substitute plastic products, particularly bin liners and kitchen tidy bags. Average sales of bin liners and kitchen tidy bags were estimated to

¹⁰³ Anne Sharp, Stine Høj and Meagan Wheeler (2010) 'Proscription and its impact on anti-consumption behaviour and attitudes: the case of plastic bags', *Journal of Consumer Behaviour* 9, 470-484.

¹⁰⁴ M Wheeler, *Northern Territory Plastic Bags Ban Review* (Rawtec, 2014).

¹⁰⁵ *Ibid*, 6.

have increased from 160,000 units prior to the introduction of the ban to 443,000 units after it commenced (September 2011 to February 2014).

KABNLI data were used to provide insights into the impacts of the ban on plastic litter. The review presented data showing a notable decline in the number of single-use plastic bags detected in the Territory. The reported data showed no change in the average number of detected heavy plastic bags.

6.2 How environmentally effective has the ACT plastic bag ban been?

The environmental effectiveness of the ACT plastic bag ban was assessed for current purposes on the basis of two measures:

- a) changes in plastic bag consumption;
- b) changes in plastic bag litter in the ACT litter stream.

The ability to carry out analysis on these issues was hindered by the relative absence of publicly available data on plastic bag consumption.

6.2.1 Changes in plastic bag consumption

Method

The analysis of the impact of the ban on the consumption of plastic bags covered five plastic bag types: single-use and reusable HDPE (conventional and biodegradable), reusable boutique LDPE, reusable polypropylene, garbage bags and barrier bags. Two scenarios were developed for the analysis:

- Scenario 1 (without the ban), which projected consumption of the five plastic bag types in the ACT over the period 2008-09 to 2016-17 under the assumption the plastic bag ban was never introduced;
- Scenario 2 (with the ban), which sought to estimate actual consumption of the five plastic bag types in the ACT over the period 2008-09 to 2016-17.

Scenario 1 involved a counterfactual assessment using, amongst other things, the results of the ANU retailer HDPE and household surveys described above, and data from the Australian Plastics Recycling Survey 2016-17, ACT 2014 plastic bag ban review and ABS. Scenario 2 required estimating historical consumption using similar data sources. The main assumptions adopted in each scenario are described in Table 10.

Table 10. Changes in plastic bag consumption, main assumptions

Bag type	Mass (grams)	Assumptions	
		Scenario 1 (without the ban)	Scenario 2 (with the ban)
Single-use and reusable HDPE bags	Single-use (~15 µm) = 5.4 Reusable (35 µm) = 14.2	Estimate for 2010-11 (51 million) derived from 2014 ACT review. Assumed growth rate over entire period of approximately 3.8%, derived from national data on single-use HDPE bag consumption.	2010-11 estimate same as scenario 1. For 2011-12, consumption assumed the same as scenario 1 until 1 November, with estimate for remainder of the financial year composed of reusable conventional 35 µm HDPE bags, ¹ single-use biodegradable HDPE bags ¹ and 34,000 illegally distributed conventional single-use HDPE bags. ² 2017-18 estimate derived from ANU retail HDPE survey. Growth in legal consumption over period 2011-12 to 2016-17 of approximately 1.8% in line with weighted final ACT household consumption. ³ Illegal bag consumption over same period grows at 1.7% in line with ACT population growth.
Reusable LDPE	28.0	Estimates for 2008-09 to 2010-11 same as Scenario 2. From 2011-12 onward, consumption grows at 1.7% in line with ACT population growth.	2017-18 estimate derived from ANU household survey. Growth in consumption over period 2011-12 to 2016-17 of approximately 1.8% in line with weighted final ACT household consumption. Growth prior to ban of 2.0% in line with ACT population growth.
Reusable polypropylene	99.1 (including plastic base)	Estimates for 2008-09 to 2010-11 same as Scenario 2. From 2011-12 onward, consumption grows at 1.7% in line with ACT population growth.	2017-18 estimate derived from ANU household survey. Growth of approximately 2.2% from date of introduction of ban (ACT population growth plus 0.5%). Assumed 15% spike in consumption in 2011-12. ⁴
Garbage bags	12.5	Estimates for 2008-09 to 2010-11 same as Scenario 2. From 2011-12 onward, consumption grows at 1.7% in line with ACT population growth.	2017-18 estimate derived from ANU household survey. Growth of approximately 2.2% from date of introduction of ban (ACT population growth plus 0.7%). Assumed 31% spike in consumption in 2011-12. ⁴
Produce bags	2.5	2017-18 estimate derived from ANU survey. Growth of 4.3% over period in line with final ACT household food consumption.	Same as scenario 1.

Source: ABS, *Australian National Accounts: State Accounts, 5220.0* (Australian Government, 2017); ABS, *Australian Demographic Statistics, 3101.0* (Australian Government, 2018); Directorate of Environment and Sustainable Development, above n 93; Directorate of Environment and Sustainable Development, above n 94; O'Farrell, above n 7; Hyder Consulting Pty Ltd, above n 6.

¹ Reusable HDPE bags and single-use biodegradable HDPE bags have been distributed at many smaller supermarket chains, grocery stores, food markets and restaurants in the ACT since the introduction of the ban. Data from retailers suggest, in 2017-18, around 90% of HDPE bags were conventional 35 µm bags and 10% were biodegradable.

² Assumes non-compliance rate of approximately 0.1%.

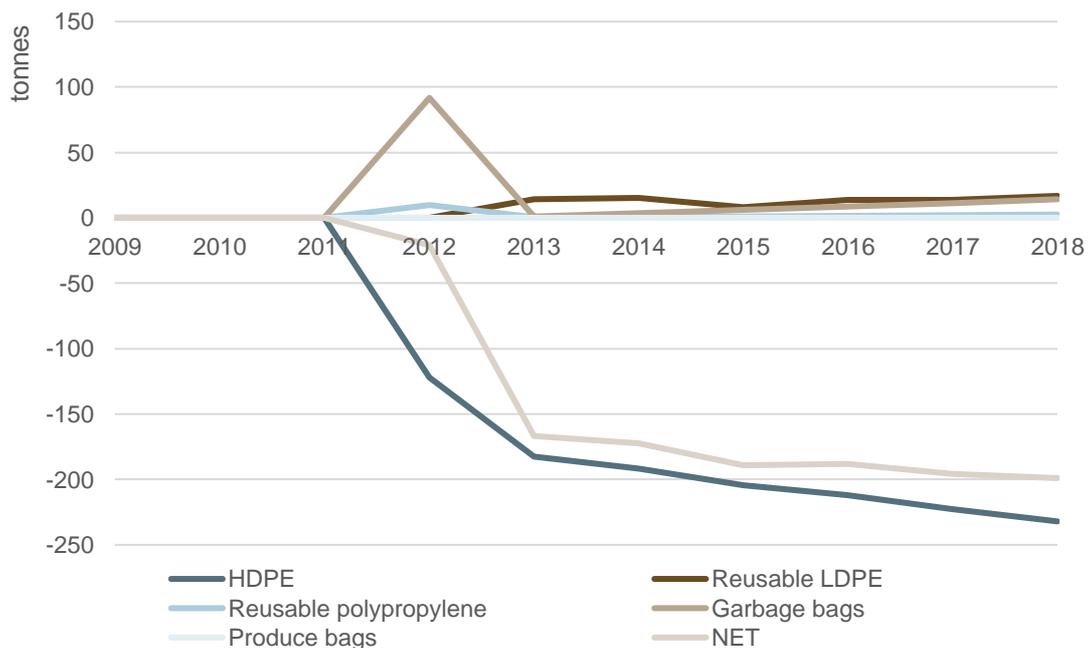
³ Consumption confined to food, clothing and footwear, and alcohol and tobacco (chain volume measures), with weightings of 0.76, 0.21 and 0.03 respectively.

⁴ Based on the 2014 review observation there was a short-term increase in consumption of PP bags following November 2011, which had subsided by 2013.

Results

The results suggest the ACT plastic bag ban has led to significant reduction in net plastic bag consumption across the five modelled bag types. Consumption of reusable LDPE, reusable polypropylene and garbage bags were all estimated to be higher in scenario 2 (with the ban) than scenario 1 (without the ban), by 16.8 tonnes, 2.4 tonnes and 14.0 tonnes respectively in 2017-18 (Figure 6). However, these increases were more than offset by a reduction in the relative consumption of HDPE bags. In 2017-18, consumption of HDPE bags was estimated to be 232 tonnes lower than it would have been if the ban was not introduced. The estimated net reduction in plastic bag consumption across all five bag types (scenario 2 consumption relative to scenario 1) in 2017-18 was 199 tonnes. The estimated cumulative reduction in net plastic bag consumption over the period 2011-12 to 2017-2018 was 1,132 tonnes.

Figure 6. Projected impact of ACT plastic bag ban on consumption of plastic bags (net difference between scenarios 1 and 2), tonnes, 2008-09 to 2017-18

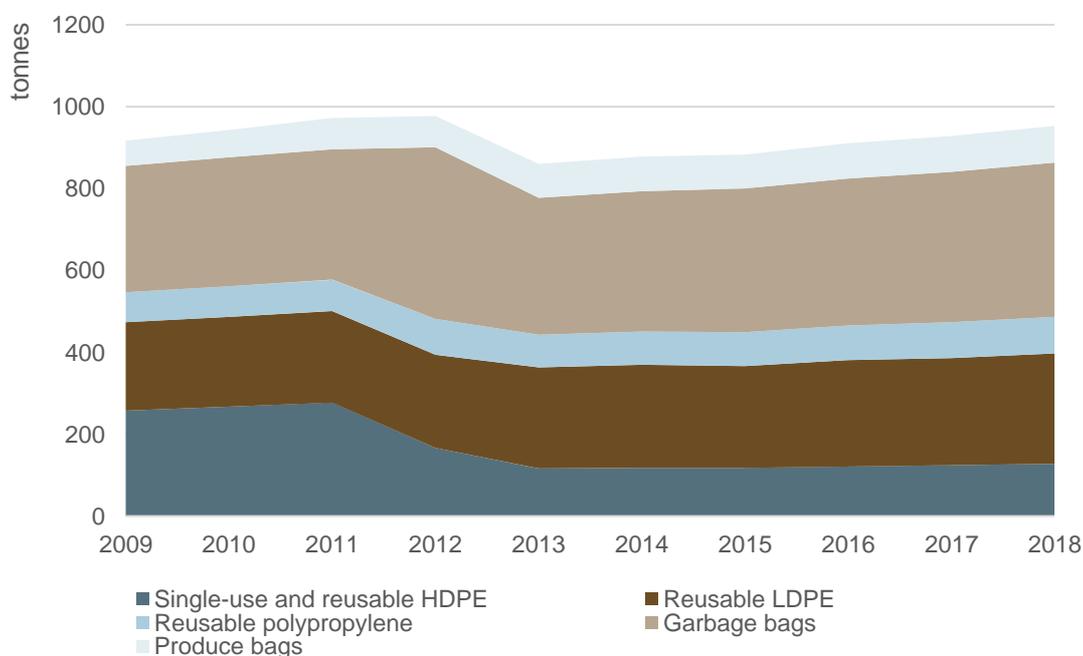


Source: author projections.

Overall, total consumption (tonnes) of HDPE, reusable LDPE, reusable polypropylene, garbage bags and produce bags in the ACT is estimated to be less than the levels prior to the introduction of the ban (Figure 7). Consumption in 2017-18 was approximately 953 tonnes, compared to 973 tonnes in 2010-11. However, as time passes, increasing population levels and household consumption are driving plastic bag consumption back to the levels seen prior to the introduction of the ban. Further policy intervention may be

necessary if the object of the policy is to keep plastic bag consumption below 2011 levels.

Figure 7. ACT plastic bag ban consumption (scenario 2 – with the ban), tonnes, 2008-09 to 2017-18



Source: author projections.

Due to data limitations, the above results should be interpreted with caution. There is a particular need for additional information on household garbage bag and HDPE bag consumption.¹⁰⁶ Improved time series data on consumption patterns are also necessary if there is a desire to analyse the impacts of policy interventions over time.

6.2.2 Changes in plastic bag litter

Ideally, an analysis of the impact of the plastic bag ban on litter would involve a comparison between two scenarios:

- projected plastic shopping bag litter in the ACT under the assumption the plastic bag ban was never introduced;
- estimated actual plastic shopping bag litter in the ACT.

¹⁰⁶ Due to time and resource constraints, limited data were obtained on the consumption patterns of garbage (kitchen tidy) bags. The release of retailer data on garbage bags sales would provide a more comprehensive picture of consumption patterns, particularly in relation to the types and size of bags used in ACT households. In relation to HDPE bags, data were not provided or not able to be obtained from a significant number of retailers. The inability to get more comprehensive data from retailers reduced the reliability of the HDPE estimates. See Appendix B for further details.

To undertake this analysis, there needs to be representative time series data on litter in the ACT. The best available data on the ACT litter stream is from the KABNLI. Keep Australia Beautiful kindly provided KABNLI data to assist with the analysis. However, it is unclear how representative the KABNLI data are of the ACT litter stream.

There are 76 KABNLI survey sites in the ACT, covering a total area of 115,955 m² (0.12 km²). For comparison, Canberra covers approximately 814.2 km², with the ACT covering 2,358 km². The physical locations of the KABNLI sites are not disclosed. The only information reported on the nature of the sites is their type: beach (8 sites); carpark (11 sites); highway (13 sites); industrial (9 sites); recreational park (7 sites); residential (13 sites); retail (8 sites); and shopping centres (7 sites). On the basis of the available information, it is not possible to determine whether the KABNLI data are representative of Canberra or the ACT.

Without representative data on litter composition, it is not possible to construct scenarios to facilitate analysis on the impacts of the plastic bag ban on litter in Canberra or the ACT. The best available alternative is to report trends in the KABNLI data.

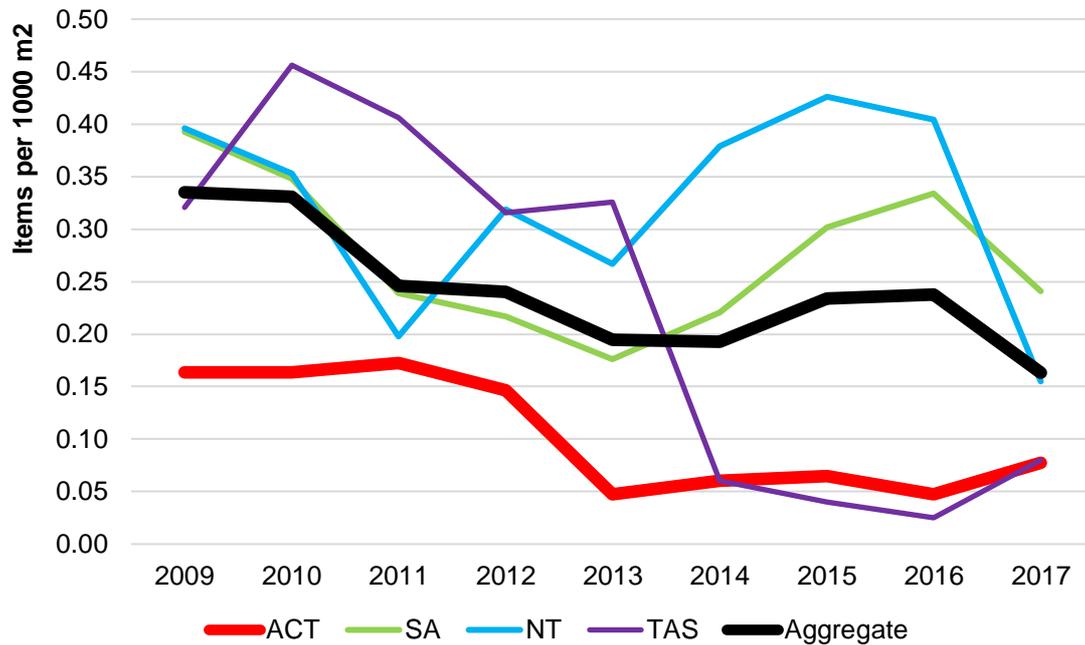
For these purposes, data on the two main KABNLI plastic bag categories ('Bags – supermarket type light weight carry bags' and 'Bags – heavier glossy typically branded carry bags') were extracted and normalised (litter items per 1000 m²). The normalisation of the data enables comparisons to be made between jurisdictions, most notably between Australian jurisdictions with and without bans on single-use plastic bags during the study period (2011 to June 2018).¹⁰⁷ The jurisdictions with bans (ACT, SA, NT and TAS) account for around 12% of Australia's population, with the remaining 88% of the population in jurisdictions without bans (NSW, VIC, WA and QLD).¹⁰⁸

As shown in Figure 8, in the three years leading up to the introduction of the ACT plastic bag ban, the number of lightweight plastic bags counted in KABNLI surveys averaged 0.17 bags per 1,000 m². In the five years since (2013-2017), the average number has fallen by more than 60% to 0.06 bags per 1,000 m². In the most recently reported survey, the number rose slightly to 0.08 bags per 1,000 m² but the ACT remains the jurisdiction with the lowest number of lightweight plastic bags counted in KABNLI surveys, just below Tasmania (0.078 per 1,000 m² vs 0.080 bags per 1,000 m²).

¹⁰⁷ The third major KABNLI plastic bag category, 'Plastic sacks and other bags', was excluded because it includes other types of bags and sacks that are not the target of the plastic bag ban.

¹⁰⁸ ABS, *Australian Demographic Statistics, 3101.0* (Australian Government, 2018).

Figure 8. Lightweight plastic bags in litter stream, items per 1,000 m², jurisdictions with plastic bag bans

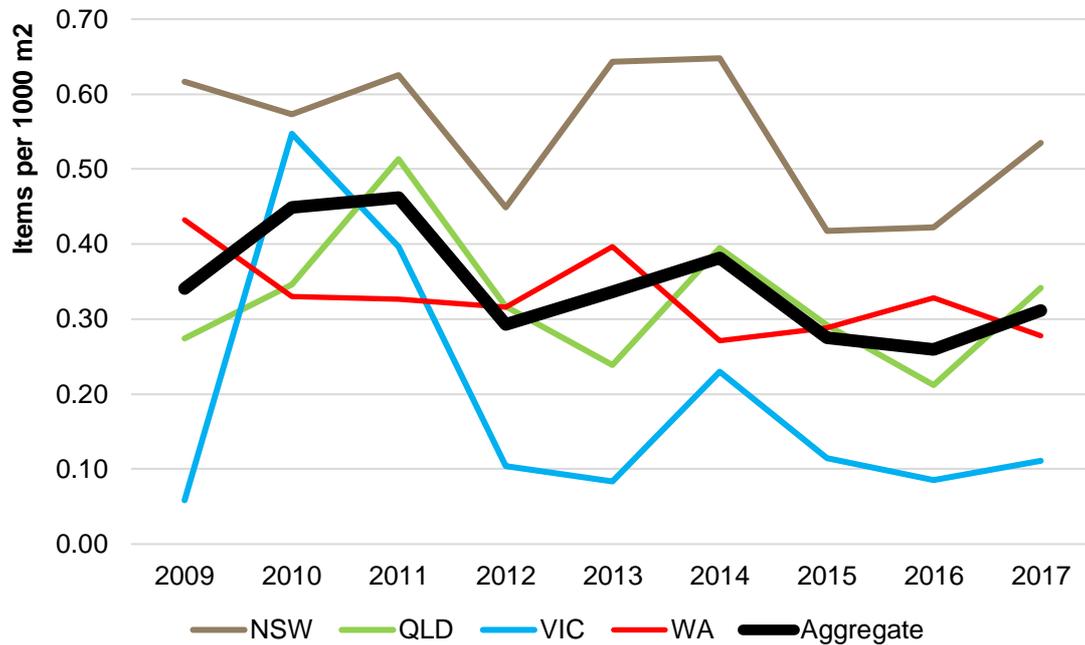


Source: McGregorTan Research, *Keep Australia Beautiful National Litter Index* (Keep Australia Beautiful, 2018).

The trends across the jurisdictions with lightweight plastic bag bans have not been consistent. In both the ACT and Tasmania, the number of lightweight plastic bags counted in KABNLI surveys dropped noticeably following the introduction of their bans (in 2011 and 2013 respectively). The trends in counted lightweight bags in both South Australia and the Northern Territory have been more volatile. On aggregate, the number of lightweight bags counted in KABNLI surveys across the four jurisdictions fell from 0.34 to 0.16 per 1,000 m² between 2009 and 2017.

In jurisdictions without bans, the aggregate number of lightweight bags counted in KABNLI surveys across the period 2009-2017 fell only slightly, from 0.34 to 0.31 bags per 1,000 m² (Figure 9). However, the aggregate number hides significant variability between jurisdictions. New South Wales has consistently had the highest number of lightweight plastic bags counted in KABNLI surveys. In contrast, for most of the period since 2011, the number counted in Victoria has been amongst the lowest in Australia (average 0.12 bags per 1,000 m²).

Figure 9. Lightweight plastic bags in litter stream, items per 1,000 m², jurisdictions without plastic bag bans

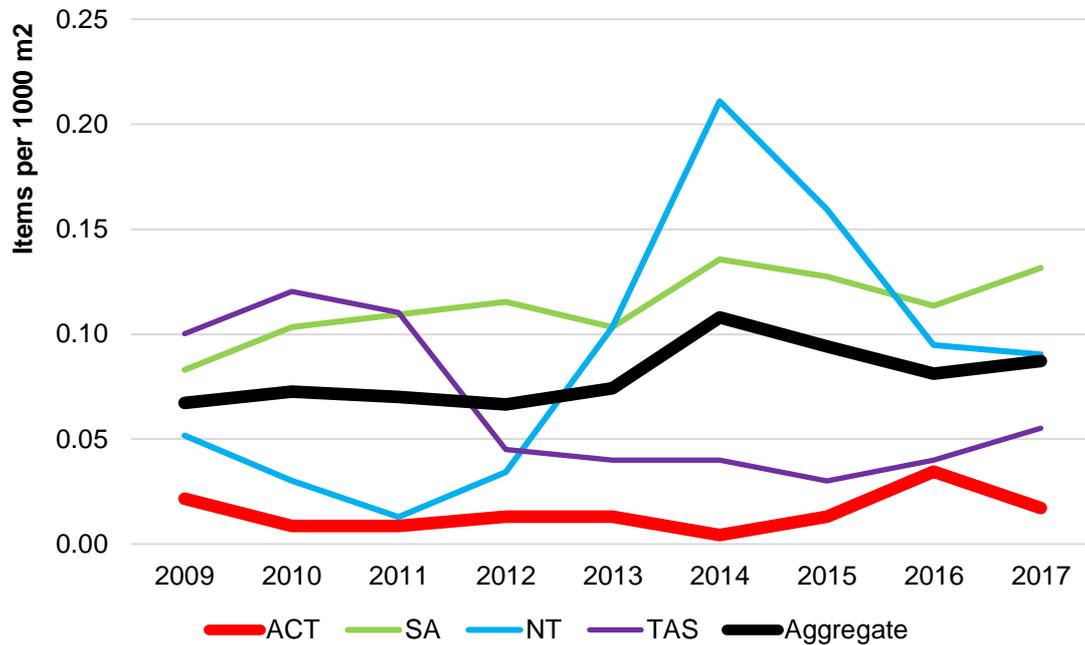


Source: McGregorTan Research, *Keep Australia Beautiful National Litter Index* (Keep Australia Beautiful, 2018).

In relation to boutique ('heavier glossy') plastic bags, the average number of bags counted in KABNLI surveys in the ACT in the five years since the introduction of the ACT ban (2013-2017) is 27% above the average number counted in the three years prior to the ban's introduction (2009-2011). However, the numbers counted are very low (0.0164 per 1,000m² vs 0.0129 bags per 1,000m², which equates to an average of 1.9 vs 1.5 bags counted across the entire 115,955 m² ACT survey area per year). The average number of boutique bags counted in KABNLI surveys in the ACT has effectively remained stable throughout the period 2009-2017.

The trends in the number of boutique bags counted in KABNLI surveys in other jurisdictions with bans on lightweight plastic bag are variable: steady increase in South Australia, notable drop in Tasmania, and sharp rise followed by reduction in the Northern Territory (Figure 10). However, across all relevant jurisdictions, the numbers counted are low (jurisdictional averages are generally <0.13 bags per 1,000m², with an aggregate average of 0.09 bags per 1,000m² over the period 2013-2017).

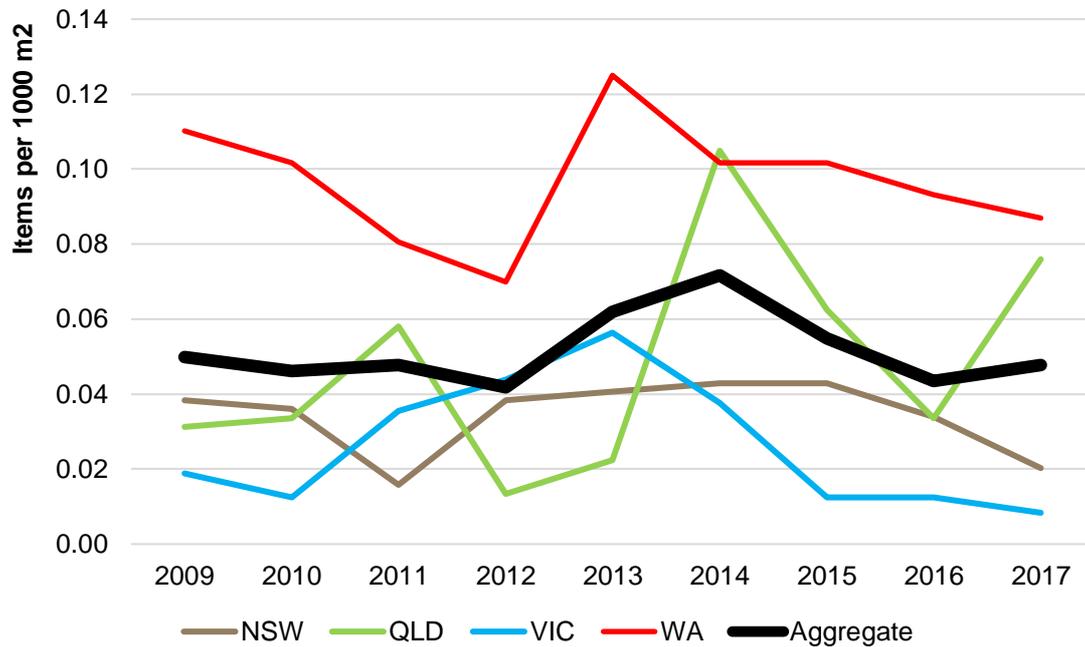
Figure 10. Boutique ('heavier glossy') plastic bags in litter stream, items per 1,000 m², jurisdictions with plastic bag bans



Source: McGregorTan Research, *Keep Australia Beautiful National Litter Index* (Keep Australia Beautiful, 2018).

In jurisdictions without bans on lightweight plastic bags, the number of boutique bags counted in KABNLI surveys has been low and relatively stable (Figure 11). The aggregate average counted across the four jurisdictions over the period 2013-2017 was only 0.056 bags per 1,000m². On average, Western Australia had the highest number counted (0.10 bags per 1,000m²) and Victoria the lowest (0.025 bags per 1,000m²) over this period.

Figure 11. Boutique ('heavier glossy') plastic bags in litter stream, items per 1,000 m², jurisdictions without plastic bag bans



Source: McGregorTan Research, *Keep Australia Beautiful National Litter Index* (Keep Australia Beautiful, 2018).

At a superficial level, the trends in the number of plastic bags counted in KABNLI surveys in the ACT align well with the plastic bag consumption analysis: a marked fall in single-use HDPE consumption accompanied by a comparatively small increase in reusable LDPE consumption. However, it is unclear to what extent the decline in the number of plastic bags counted in KABNLI surveys is attributable to the plastic bag ban.

As noted above, the number of plastic bags counted in KABNLI surveys both before and after the introduction of the ban is small. It is also unclear how representative the results of the KABNLI surveys are of the actual Canberra and ACT litter streams. Further, even if the results are representative, there are a number of factors, other than the plastic bag ban, that may account for the change in the prevalence of plastic bags in the litter stream. For example, observed falls in litter could be a product of greater resources being devoted to reducing littering and increasing its collection and removal. This could take the form of increased government litter collection services, increased voluntary litter collection, public education campaigns and/or the installation of

litter traps in waterways.¹⁰⁹ Changes in social attitudes related to levels of income and education may also have been a causal factor.¹¹⁰

Without further information, it is difficult to reach definitive conclusions on the impact of the ACT plastic bag ban on plastic bag litter. All that can be said at this stage is that the trends in KABNLI survey data are consistent with the hypothesis that the ban has reduce plastic bag litter.

7. Challenges associated with the implementation of the ACT plastic bag ban

The introduction of any regulatory measure is likely to give rise to costs and challenges. In the case of the ACT plastic bag ban, the main costs and challenges fall into four categories:

- retailer compliance costs;
- increased household shopping costs;
- government enforcement costs; and
- sustainability of community support for bans.

7.1 Retailer compliance costs

Retailer compliance costs here refers to any net reduction in the economic surplus derived by retailers in the ACT as a consequence of the plastic bag ban. Limited information was able to be gathered on matters relevant to the assessment of compliance costs, including the wholesale cost of plastic shopping bags. However, the publicly available information and that provided by a relatively small number of retailers and suppliers suggests that, rather than decreasing retailer returns, the bag ban has increased them, if only by a small amount.

Prior to the introduction of the ban, most ACT retailers did not charge for single-use HDPE bags. Those bags cost retailers in the order of 0.75-1 cents per bag immediately prior to the introduction of the ban and were available free of charge to shoppers. This meant that retailers either absorbed the costs of the bags (by reducing profits) or recovered the costs by imposing higher prices on other products. Since the introduction of the ban, a significant proportion of retailers now charge for plastic bags. Reusable HDPE bags are

¹⁰⁹ K Willis et al. (in press) 'How successful are waste abatement campaigns and government policies at reducing plastic waste into the marine environment?', *Marine Policy*, doi.org/10.1016/j.marpol.2017.11.037. The study found that, while litter bans are correlated with lower litter in coastal areas, other policy measures aimed at the prevention of litter and its removal are often more effective and that the best outcomes arise from a combination of approaches.

¹¹⁰ Hardesty et al., above n 68. The study established a correlation between socio-economic status and litter densities. This may be a factor in the ACT due to the relatively high socio-economic status of the population.

typically either sold for 10 cents or provided free of charge, single-use biodegradable HDPE bags are generally sold for 5 cents or provided free of charge, reusable LDPE bags typically retail for 15 cents, and reusable polypropylene bags retail for around \$1.¹¹¹ The data available suggest the wholesale prices paid by retailers are approximately 4 cents for reusable (35 µm) HDPE bags, 2 cents for single-use biodegradable HDPE bags, 6-12 cents for reusable LDPE bags, and 70-80 cents for polypropylene bags.¹¹²

Given these wholesale and retail prices, the increases in retailer profits that are attributable to the plastic bag ban are likely to be small. For example, for single-use HDPE plastic bags, if the plastic bag ban was not introduced, retailers would have spent approximately \$875,000 on plastic bags in 2017-18, yet received no direct revenue from their distribution. With the ban, the aggregate net profit (before tax) to retailers from the sale and distribution of HDPE bags was probably in the order of \$100,000, meaning there has been a net gain to retailers of around \$975,000 relative to the situation if the ban had not been introduced. For reusable LDPE bags, the aggregate net gain to retailers between these two scenarios is likely to be in the order of \$35,000 across the ACT. While small, the evidence suggests retailers are likely to have benefitted financially from the introduction of the ban rather than incurring costs.¹¹³

7.2 Increases in household shopping costs

The plastic bag ban has increased household shopping costs, mainly by prompting the substitution from free single-use HDPE bags to costed reusable bags. However, increases in household shopping costs have been relatively small, both because of the price of the substitutes and the capacity for shoppers to minimise financial impacts by reducing bag consumption. On the basis of the scenarios described in section 6.2, the aggregate net increase in household shopping costs in 2017-18 (relative to what they would have been if the ban was not introduced) was approximately \$696,000, or around \$4.20 per household per annum. The scenario analysis suggests most of this increase (84%) is attributable to the relative increase in expenditure on HDPE bags and garbage bags rather than reusable LDPE and polypropylene bags.

¹¹¹ All prices are GST inclusive.

¹¹² All prices are GST inclusive. The amounts paid by individual retailers will depend on the quantities order and market power.

¹¹³ Banning single-use plastic bags is also likely to have reduced the economic surplus derived from the manufacture and supply of plastic bags to ACT retailers. However, as there are no plastic bag manufacturers in the ACT, and most of the transport of plastic bags is undertaken by entities located outside of the ACT, these costs were disregarded.

7.3 Government enforcement costs

Compliance and enforcement services associated with the ACT plastic bag ban were originally provided by the ACT Government Office of Regulatory Services. In the four months prior to the introduction of the ban, the Office undertook 1,734 inspections to gauge readiness for the commencement of the ban. From 1 November 2011, when the ban commenced, through to 31 October 2013, the Office undertook 714 inspections and detected four breaches. The infringements were managed through the issuance of warnings (two verbal and two written). The 2014 review noted that the Office had, on an unspecified number of occasions, acted on complaints from customers about plastic bags, including in relation to the sale of non-compliant degradable bags. The report states that the Office's approach in instances where non-compliance has been detected has been to provide 'assistance through education as opposed to issuing infringement notices'.¹¹⁴

Since the completion of the 2014 review, issues have arisen in relation to the governance arrangements concerning the implementation of the ban. Responsibilities for waste and litter related issues in the ACT Government are currently divided between Transport Canberra and City Services, the Environment, Planning and Sustainable Development Directorate, and Access Canberra. Transport Canberra and City Services is responsible for waste management and the administration and enforcement of the *Litter Act 2004*. The Environment, Planning and Sustainable Development Directorate is responsible for the oversight of the *Plastic Shopping Bag Ban Act 2010*, while responsibility for the enforcement of the ban rests with Access Canberra.

Despite this formal governance structure, amongst relevant government agency staff, there is a degree of uncertainty about the division of responsibilities related to the administration of the plastic bag ban. Due to this, it was not possible to evaluate the fiscal impacts associated with the implementation of the ban. It appears few resources have been assigned to regular monitoring and compliance.¹¹⁵ However, without additional information, no conclusions can be drawn about the magnitude of the budgetary impacts.

7.4 Sustainability of community support

The ACT plastic bag ban has enjoyed high levels of public support since it was introduced in 2011. Three surveys have been undertaken on the levels of public support, in 2012, 2014 and now in 2018. For the purposes of this review, ReachTel were commissioned to undertake a phone survey of ACT

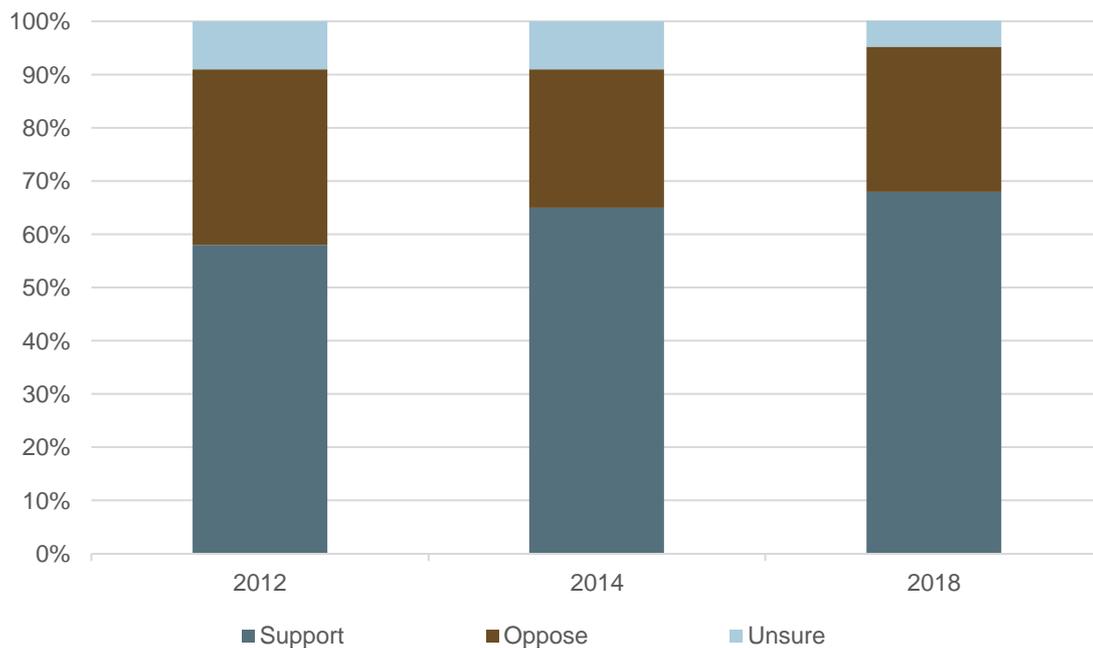
¹¹⁴ Directorate of Environment and Sustainable Development, above n 94, 12.

¹¹⁵ In theory, the ban could also affect ACT revenues from indirect taxes, including the GST. However, the impact of the ban on these revenue sources is immaterial.

residents. The survey was conducted in March 2018 and had 1,058 respondents.

Sixty-eight per cent (68%) of respondents said they either supported (20%) or strongly supported (48%) the ban. Twenty-seven per cent (27%) either opposed (14%) or strongly opposed (13%) the ban, with 5% unsure. These results suggest the level of public support for the ban has increased over time, from 58% in 2012, to 65% in 2014, and now 68% in 2018 (Figure 12).

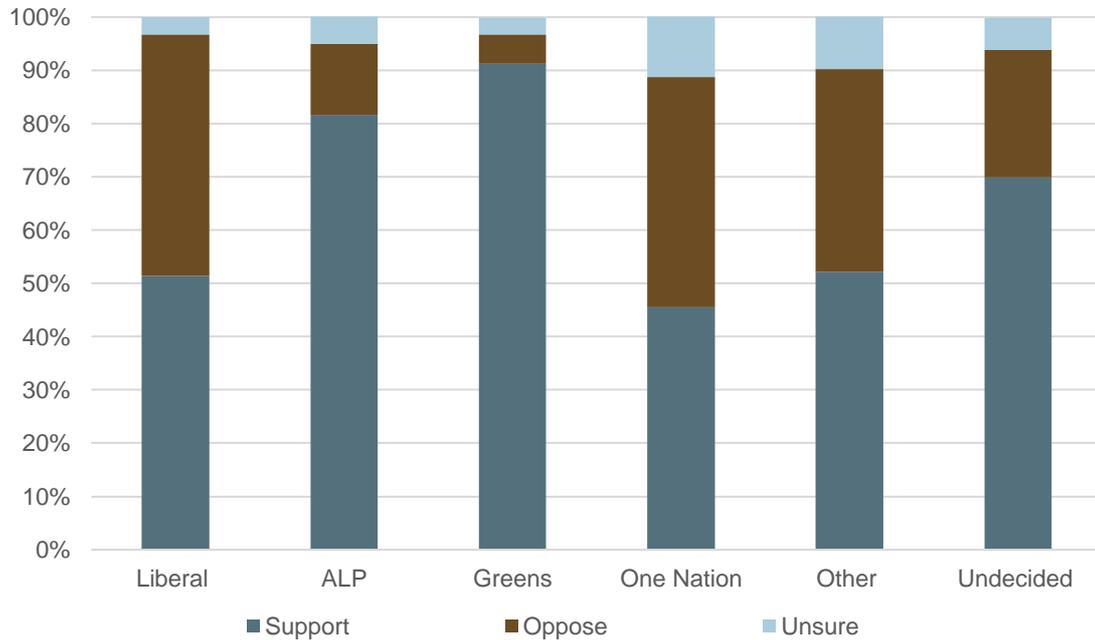
Figure 12. Attitudes to the ACT plastic ban bag, 2012, 2014 and 2018



Source: ReachTel, *ACT Plastic Bag Survey* (March, 2018); Directorate of Environment and Sustainable Development, above n 93 and n 94.

Support for the plastic bag ban was highest amongst those who expressed a preference for voting for the Australian Greens (91%) and the Australian Labor Party (82%) if an election was held in the ACT at the time of the survey (Figure 13). It was lowest amongst those who expressed a preference for voting for One Nation (46%) and the Australian Liberal Party (51%). Support amongst undecided voters was 70%.

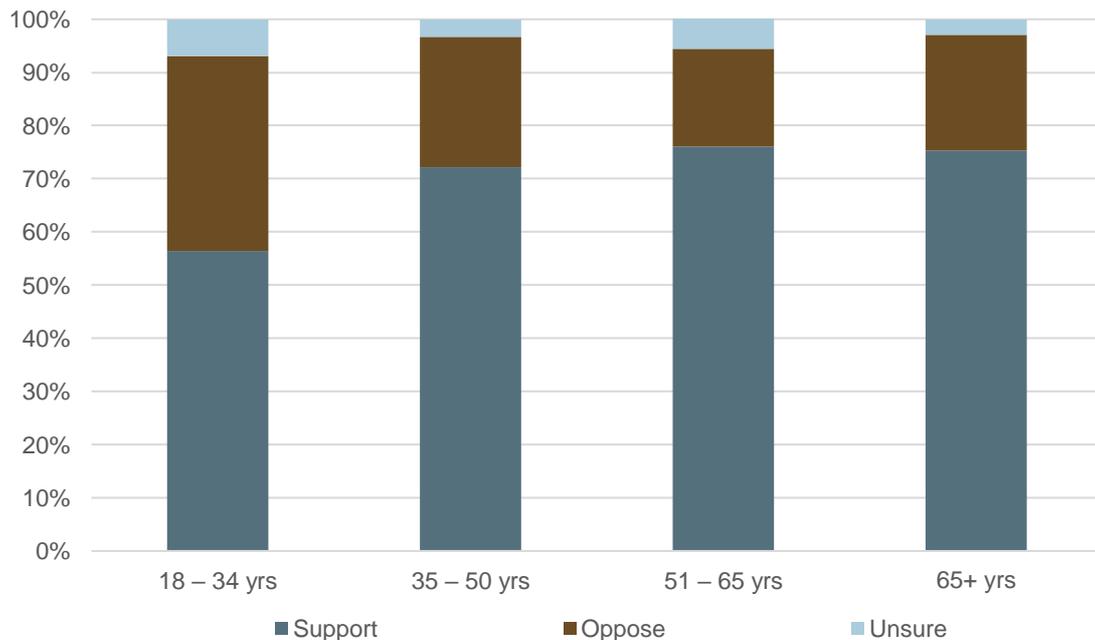
Figure 13. Attitudes to the ACT plastic ban bag, by ACT voting preference, 2018



Source: ReachTel, *ACT Plastic Bag Survey* (March, 2018).

Interestingly, support for the ACT plastic bag ban was highest amongst older voters and lowest amongst those aged 18-34 years (Figure 14).

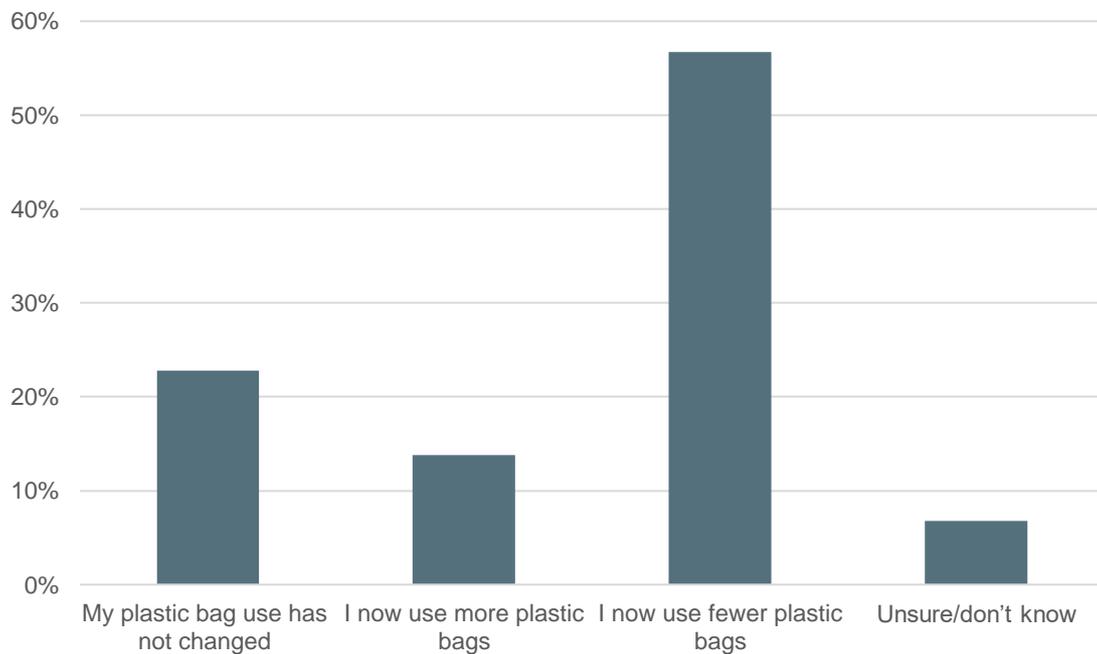
Figure 14. Attitudes to the ACT plastic ban bag, by age, 2018



Source: ReachTel, *ACT Plastic Bag Survey* (March, 2018).

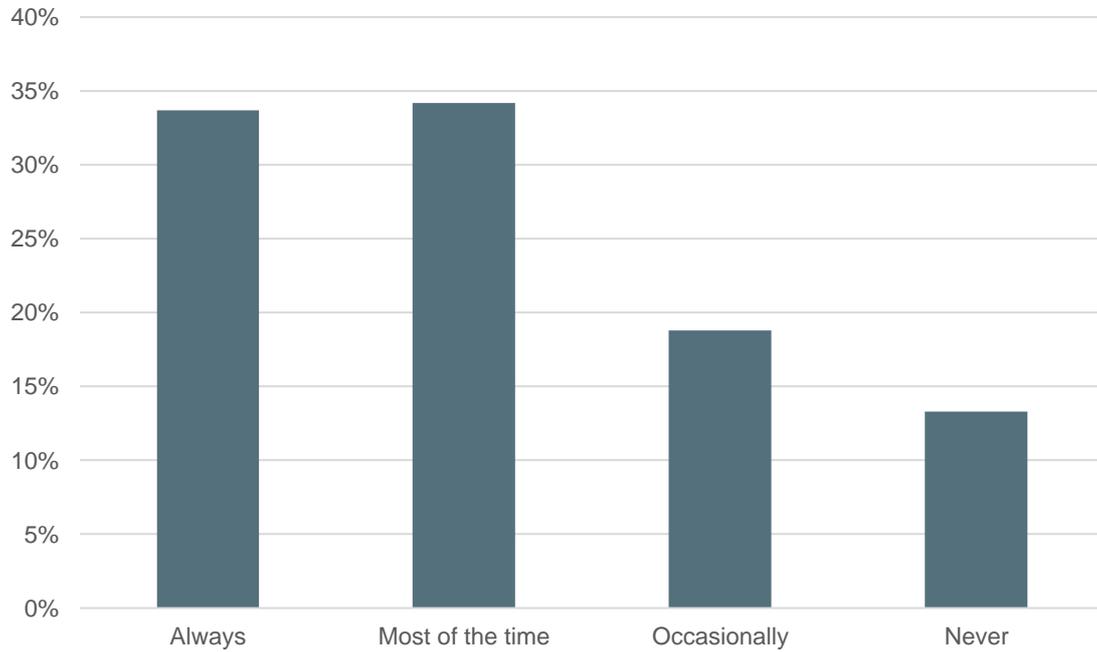
The reasons for the high level of community support for the plastic bag ban are likely to relate to how shoppers have responded to the ban, and their perceptions of its positive environmental impacts. As part of the ReachTel survey, respondents were asked how they have responded to the ban, how often they take reusable bags when they go shopping, and whether they thought the ban has had a positive impact on the environment. Most respondents indicated they had reduced their plastic bag use as a consequence of the ban (57%), take reusable bags always or most of the time when they shop (68%), and believe the ban has had a positive impact on the environment (69%) (Figures 15, 16 and 17).

Figure 15. Of the following, which best describes how you have responded to the “Bag Ban”?



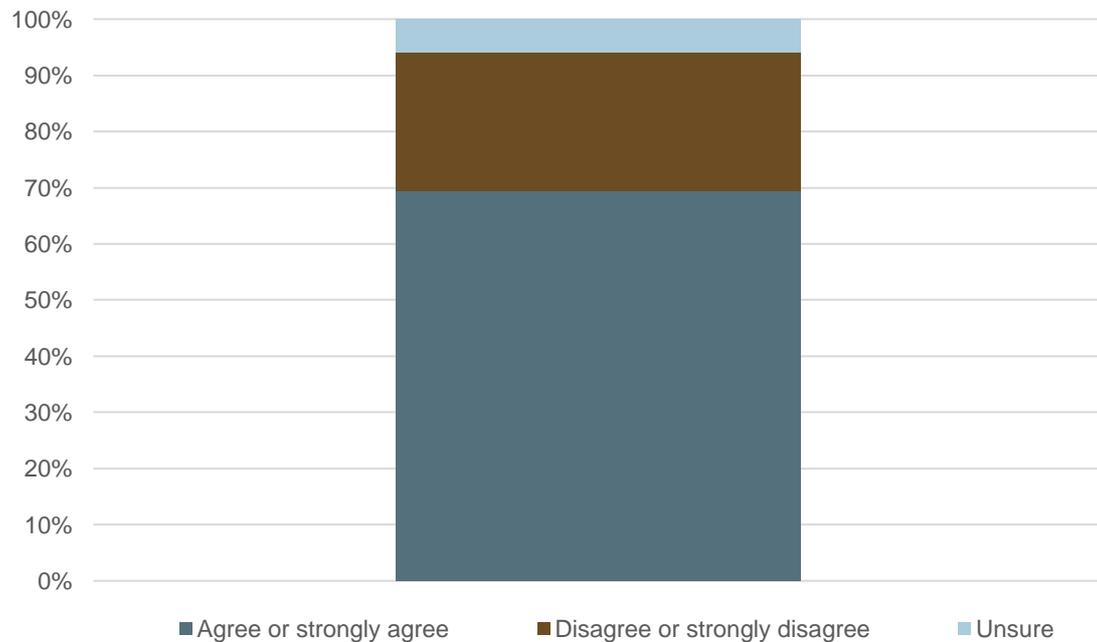
Source: ReachTel, *ACT Plastic Bag Survey* (March, 2018).

Figure 16. How often would you say you take reusable bags when you go shopping?



Source: ReachTel, *ACT Plastic Bag Survey* (March, 2018).

Figure 17. Do you agree or disagree with the following statement – The plastic bag ban has had a positive impact on the environment



Source: ReachTel, *ACT Plastic Bag Survey* (March, 2018).

8. Options for reform of the ACT *Plastic Shopping Bag Ban Act 2010*

In the preparation of this report, six options were considered for what to do with the ACT plastic bag ban:

- keep the ban as it is (do nothing);
- increase the minimum allowable thickness of plastic shopping bags;
- require all plastic bags to be biodegradable and compostable;
- ban all plastic shopping bags;
- use prices to reduce consumption of plastic shopping bags; and
- introduce a mandatory disclosure regime for the sale and distribution of plastic bags by retailers.

It was assumed for these purposes that the primary objective of the plastic bag ban and any substitute policy is to reduce plastic bag consumption and/or the associated detrimental environmental impacts.

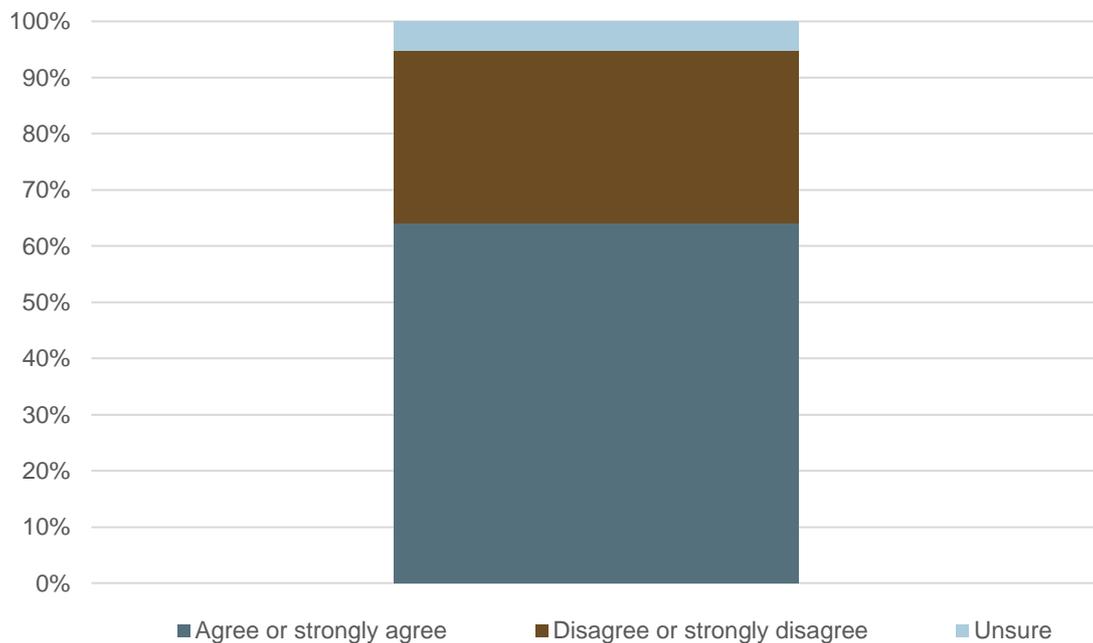
8.1 Contextual information

There are three main contextual factors that are relevant to the analysis of the policy options available to the ACT Government: the level of community support for changes to the ban to improve environmental outcomes; the potential for policy changes to exacerbate jurisdictional inconsistencies in the regulation of plastic bags; and information availability and uncertainties.

8.1.2 Support for change to improve environmental outcomes

To inform the analysis of options, respondents to the ReachTel survey were asked whether they would support or oppose changes to the ACT plastic bag ban to further reduce plastic bag use and the impacts of plastic bags on the environment. Sixty-four per cent (64%) of respondents said they would support further policy change, 30% opposed further changes and five per cent were unsure (Figure 18).

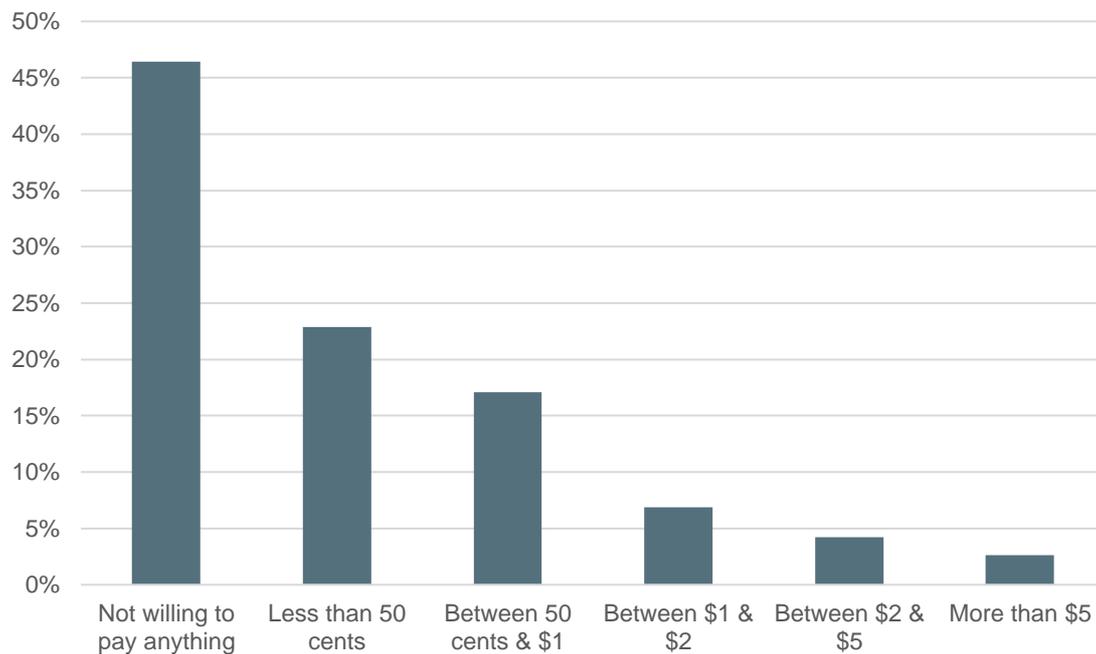
Figure 18. Would you support or oppose changes to the Plastic Bag Ban to further reduce plastic bag use and the impacts of plastic bags on the environment?



Source: ReachTel, *ACT Plastic Bag Survey* (March, 2018).

While there was broad support amongst respondents for further policy changes to improve environmental outcomes, the stated willingness to pay for these improvements was relatively low. In response to questioning about how much they would be willing to pay per week to help further reduce plastic bag use and the associated environmental impacts, 86% of respondents said less than \$1 (Figure 19): almost half (46%) said they were not willing to pay anything, 23% said they were willing to pay less than 50c and 17% said they were willing to pay between 50c and \$1.

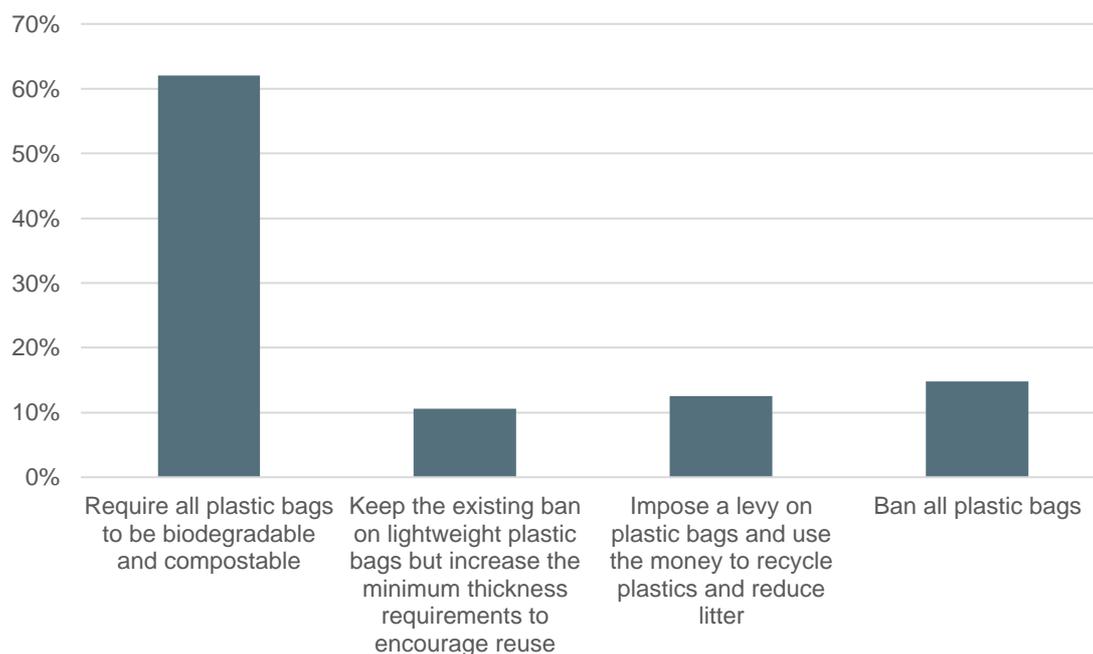
Figure 19. How much would you be willing to pay per week to help further reduce plastic bag use and the impacts of plastic bags on the environment?



Source: ReachTel, *ACT Plastic Bag Survey* (March, 2018).

To further investigate community opinions on potential changes to the ban, respondents were asked which of four broad reform options they would prefer: require all plastic bags to be biodegradable and compostable; increase the minimum thickness requirement for plastic shopping bags; impose a levy on plastic bags and use the money to recycle plastics; or ban all plastic bags. Of these options, requiring all plastic bags to be biodegradable and compostable was by far the most popular (62%), followed by banning all plastic bags (15%) (Figure 20). Imposing a levy and increasing the minimum thickness requirements were the least popular (13% and 11% respectively).

Figure 20. Which of the following changes do you support the most?



Source: ReachTel, *ACT Plastic Bag Survey* (March, 2018).

8.1.2 Jurisdictional inconsistencies

An issue associated with any change to the ACT plastic bag ban is that it will result in disparate regulatory regimes for plastic shopping bags across Australian jurisdictions. As noted above, since 2009 there has been variability in the regulatory treatment of plastic bags in Australia: the larger jurisdictions have not imposed regulatory bans on single-use plastic bags, while the smaller jurisdictions have. This has potentially caused complications for, and confusion amongst, retailers. Consistent with this, the 2014 ACT plastic bag ban review noted a number of instances of non-compliance arising in relation to retailers newly established in the ACT. These occurrences may be at least partially due to expectations arising from the treatment of plastic bags in other jurisdictions.

After 1 July 2018, New South Wales will be the only Australian jurisdiction without a ban on single-use conventional HDPE plastic bags. With most major retailers signalling their intention to voluntarily phase out the distribution of these bags from 1 July, the New South Wales Government may follow suit and impose a ban.

If the ACT Government chose to make changes to its regulation of plastic bags, it could potentially create further confusion for retailers. This could give rise to unintentional non-compliance incidents and increase business costs; for example, by creating a need for businesses to establish ACT-specific

compliance protocols. This is not a reason in itself for not making changes to the plastic bag ban. However, the ACT Government should consider it when contemplating any future changes.

8.1.3 Information availability and uncertainties

The ability to make informed decisions on the regulation of plastic bags is currently impeded by the relative absence of information on key issues and uncertainties surrounding environmental impacts. These gaps and uncertainties include the following.

- There are gaps in the available information on current plastic bag consumption and almost no time series data on consumption trends.
- There are uncertainties about the fate of plastic bags during their end-of-life phase, including in relation to their representation in the ACT litter stream and the extent to which bags littered in the ACT pose a threat to marine (and potentially also terrestrial) organisms.
- There are scientific uncertainties about the threats posed by plastic bags in the environment, particularly when reduced to microplastic size.
- There is an absence of robust information on the nature and extent of community concern about the environmental impacts associated with plastic bags. The data collected through the ReachTel survey provide insights on the nature of community concerns about plastic bags. However, further qualitative and quantitative data are necessary to fully understand why community members are concerned and the depth of these concerns relative to other priorities.

The information gaps and scientific uncertainties have limited the analysis that was able to be undertaken on the options identified above. The extent of the information gaps also suggests consideration should be given to the acquisition of additional information to help inform future policymaking.

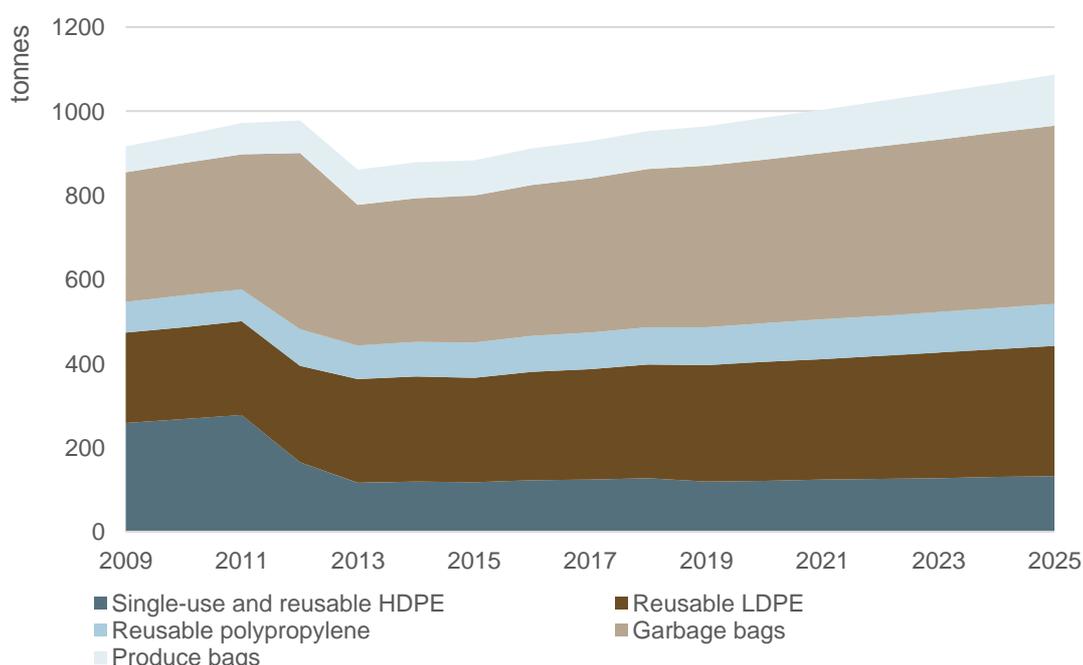
8.2 Analysis of reform options

8.2.1 Keep the ban as it is (do nothing)

Keeping the plastic bag ban as it is will provide ongoing environmental benefits relative to the counterfactual situation in which the bag ban was never introduced. It will also minimise costs to government and any potential adverse impacts on ACT retailers and consumers. However, as discussed, in the absence of additional policy measures the consumption of plastic bags in the ACT is likely to grow to exceed the rates seen prior to the introduction of the ban. Conservative projections suggest that, due to increasing population levels and household consumption, this is likely to occur in the early to mid-

2020s, despite proposed new voluntary changes in the bags offered in some IGAs (Figure 21).¹¹⁶ Reducing plastic bag consumption, or at least keeping consumption below the levels seen prior to the introduction of the ban, is likely to require additional policy measures. Ideally, such measures would address consumption of all types of flexible plastics or all types of plastic bags and sacks, particularly garbage bags. More flexible plastic is consumed in the ACT in the form of garbage bags than in any other form (i.e. any of the main plastic shopping bag types).

Figure 21. ACT plastic bag ban consumption, tonnes, estimates 2008-09 to 2017-18, then projections to 2024-25



Source: author estimates.

Environmental effectiveness

The environmental impacts will remain unchanged. There will be ongoing environmental benefits relative to the situation where the bag ban was never introduced, yet plastic bag consumption in the ACT is likely to continue to rise as a consequence of consumption and population growth.

Impact on retailers

The costs to retailers will remain unchanged.

¹¹⁶ With the announced phase out of single-use HDPE bags on 30 June 2018, a number of local IGA stores are proposing to eliminate or reduce the sale or distribution of 35 µm HDPE bags. To account for this, in the scenario, it was assumed there was a 8% reduction in 35 µm HDPE bag consumption in 2018-19, which prompts an increase in reusable LDPE consumption of 99,000 (1/8th of the HDPE decline).

Impact on households

The costs to consumers will remain unchanged.

Costs to government

The costs to government of the plastic bag ban will remain unchanged.

8.2.2 Increase the minimum thickness of plastic shopping bags

Retailer responses to the specifics of the ACT plastic bag ban have differed. The major supermarket chains have elected to phase out HDPE bags and now offer a combination of reusable LDPE and polypropylene bags, and to a lesser extent jute bags. The reusable LDPE bags offered by the major supermarkets are significantly thicker than the regulated minimum of 35 μm , with most falling in the range 47-55 μm and with a mass of between 23-33 grams.

Many smaller supermarkets, grocery stores and other retailers in the ACT offer HDPE bags (sometimes in combination with polypropylene, jute and other bag types). Some of the HDPE bags offered by these retailers are single-use biodegradable bags but most are reusable, 35 μm HDPE bags. The reusable HDPE bags are not as large or durable as the reusable LDPE or polypropylene bags sold by the major supermarkets, and there is the potential they may not be reused as many times as these other bag types prior to replacement.

Increasing the mandated minimum thickness requirement for conventional (fossil fuel-based) plastic bags (to say between 45-55 μm) could potentially increase the average life of the plastic shopping bags offered by smaller supermarkets and other retailers and thereby reduce plastic consumption.¹¹⁷ Only recently, one of the local supermarket chains (Supabarn) voluntarily took this step, phasing out 35 μm HDPE bags in preference for 55 μm LDPE bags.

Environmental effectiveness

On the basis of the available information, it is difficult to evaluate how effective increasing the mandated minimum thickness requirement might be in reducing plastic consumption. There is uncertainty about the extent to which behaviours regarding the use of 35 μm HDPE bags differ from those involving ≥ 45 μm plastic bags. Increasing the mandated minimum thickness requirement might simply result in the substitution of thicker bags for thinner ones, without changing the number of bags consumed or littered.

¹¹⁷ For these purposes, it is assumed the minimum thickness requirements applies only to conventional (fossil fuel-based) plastic bags, meaning biodegradable bags of less than 35 μm could still be offered.

One of the reasons for the uncertainty is the different nature of the products offered by some smaller retailers and other bag distributors. For example, where plastic bags are used to carry products that befoul the bags (e.g. fish, takeaway meals in containers that leak, poisonous materials or plants), increasing the thickness of the bag is unlikely to prolong its useful life. Consumers will typically discard the bag rather than clean and reuse it. On the other hand, if the minimum thickness is increased, most retailers will charge for bags, providing an incentive for consumers to alter their behaviour.

Industry sources suggest there is an approximately 6:1 'substitution rate' between single-use HDPE and reusable HDPE and LDPE bags when single-use HDPE bags are banned or otherwise removed from distribution. The substitution rate in this context refers to the ratio between the number of conventional single-use HDPE bags distributed prior to the introduction of the ban and the increase in the number of reusable (HDPE and LDPE) and single-use biodegradable bags sold or distributed after the ban's commencement. In the ACT, the available data suggest the 'substitution rate' was similar to the industry estimate, at 5:1.

Given the nature of the HDPE bags currently offered in the ACT, the fact the ACT has already banned lightweight HDPE bags, and the extent of behavioural change that has already occurred around the use of plastic bags, the rate of substitution between 35 μm HDPE bags and thicker plastic bags in the ACT would likely be higher if the minimum thickness requirement was increased. However, if it is conservatively assumed that increasing the minimum thickness requirement results in a 5:1 rate of substitution, and the average substituted bag has a mass of 28 grams, raising the thickness requirement would reduce plastic consumption by 69 tonnes per year in 2018-19, rising to 77 tonnes in 2024-25.¹¹⁸ This equates to a 7% reduction in the consumption of plastic from shopping bags, garbage bags and produce bags over this period.

While these estimates are subject to a high degree of uncertainty, it is likely that increasing the minimum thickness requirement would result in a net reduction in flexible plastic consumption. The substitution rate would have to be $\leq 2:1$ in order for there to be no net reduction. The effectiveness (and acceptability) of the measure could also be enhanced by having exemptions for particular product types or retailers; for example, butchers, fishmongers, poisons and takeaway restaurants.

The impact of the projected decrease in plastic bag consumption on litter and other environmental impacts is not known. However, given the small number

¹¹⁸ This assumes substituted bag consumption increases by 1.8% in line with weighted average household consumption growth after 2018-2019. For simplicity, we have also assumed there is no substitution to non-plastic bag types (e.g. calico, jute or paper) or to $<35 \mu\text{m}$ biodegradable bags.

of plastic bags in the known ACT litter stream, the scope for further reductions in plastic litter appear to be small. Moreover, the extent of any reduction will depend on other variables, including societal litter behaviours and government and non-government efforts to control litter.

Impact on retailers

Increasing the minimum thickness requirement is likely to have minimal impacts on retailers. Thicker plastic bags will cost retailers more to purchase, with the difference being in the order of 5-6 cents per bag depending on the bag type and purchasing power of the retailers. However, in most cases, retailers will be able to pass these costs on to consumers in the form of higher retail plastic bag prices.

For some retailers, the policy change could result in small increases in profit. For example, retailers that do not currently charge for plastic bags are likely to profit from the change, provided they are able to charge for bags. Other retailers may suffer small losses, primarily because of the decline in bag sales. Overall, these losses are likely to outweigh gains, but only marginally.

On the basis of the above projections of the impact of the measure on plastic bag consumption, the impact on retailers is likely to be negligible; a reduction in aggregate retailer profits across the ACT of approximately \$1,000-\$5,000 in 2018-19. For comparison, total retail turnover in the ACT in 2016-17 was \$473 million.¹¹⁹ Supermarket and grocery store turnover alone was \$181 million. The aggregate impacts are likely to be virtually undetectable.

Impact on households

The average financial impact on households of increasing the minimum thickness requirement of plastic bags is likely to be positive (i.e. a reduction in household bag expenditure) but small. On the basis of the above projections, average households are likely to save approximately \$1 per annum in 2018-19 relative to the situation if the bag ban was not changed.

While the average household impact is likely to be small, there is a risk increasing the minimum thickness requirement could increase shopping costs for financially vulnerable households. A number of studies have found low socio-economic status households are less responsive to increases in plastic bag costs than higher socio-economic status households.¹²⁰ Targeted

¹¹⁹ ABS, *Retail Trade, Australia, 8501.0* (Australian Government, 2018).

¹²⁰ J Dikgang, A Leiman and M Visser (2012) 'Analysis of the plastic-bag levy in South Africa', *Resources, Conservation and Recycling* 66, 59-65; N Rivers, S Shenstone-Harris and N Young (2017) 'Using nudges to reduce waste? The case of Toronto's plastic bag levy', *Journal of Environmental Management* 188, 153-162.

information and social marketing campaigns may assist in alleviating impacts on these vulnerable groups.

Cost to government

Increasing the minimum thickness requirement of plastic bags is likely to have minimal fiscal implications for the ACT Government. Similar to the case with the introduction of the ban in 2011, public service resources would be needed for a retailer and community consultation and education process prior to the commencement of the change. This consultation process would need to settle the scope of any exemptions with retailers (e.g. for fishmongers, restaurants and retailers selling poisonous materials). The negotiations with retailers will require Environment Directorate resources: possibly a senior Environment Directorate Officer and 1-2 support staff for 3-6 months (part-time). The general community and retailer education campaign would require around 2-3 Directorate staff and approximately \$100,000 for general marketing. Further marketing resources may be necessary for any targeted campaign aimed at mitigating impacts on low income households.

After the transitional phase, there is likely to be a need for compliance and enforcement resources to be devoted to ensuring retailers understand and adhere to the new requirements. As with the current ban, once the changes are embedded, there is unlikely to be a need for significant resources to be devoted to compliance and enforcement on an ongoing basis.

8.3 Require all plastic bags to be biodegradable and compostable

Biodegradation is a degradation process catalysed by microorganisms in which materials are metabolised to carbon dioxide, methane, biomass, water and mineral salts.¹²¹ Concern about the persistence of plastics in the environment has promoted considerable research and, more recently, commercialisation of a number of different types of biodegradable plastics, including biodegradable plastic bags. As detailed in Section 2, biodegradable plastics are generally made of a combination of organic materials such as starch and cellulose and chemical additives. Notwithstanding their organic content, the rate of biodegradation of these plastics can vary considerably depending on the materials used to make them and the ambient conditions in the disposal environment. Due to this, the labelling of plastics as

¹²¹ H Sawada (1998) 'ISO standard activities in standardisation of biodegradability of plastics – development of test methods and definitions', *Polymer Degradation and Stability* 59, 365-370; S Grima et al. (2000) 'Aerobic Biodegradation of Polymers in Solid-State Conditions: A Review of Environmental and Physicochemical Parameter Settings in Laboratory Simulations', *Journal of Polymers and the Environment* 8(4), 183-195; S Lampman, *Characterization and Failure Analysis of Plastics* (ASM International, 2003).

'biodegradable' can be misleading unless it is coupled with details of the conditions and timeframe over which the plastics are likely to breakdown.

Compostable plastics are a type of biodegradable plastic that degrades under prescribed composting conditions. Composting involves the accelerated decomposition of materials through the action of microorganisms under controlled aerobic (in the presence of oxygen) conditions.¹²² To be classified as compostable under applicable domestic and international standards, the aerobic decomposition must be capable of occurring under commercial or household composting conditions at rates comparable with other compostable materials.¹²³ In Australia, there are two standards that apply to plastics labelled as compostable: Australian Standard AS 4736-2006 (Biodegradable plastics-Biodegradable plastics suitable for composting and other microbial treatment); and Australian Standard AS 5810-2010 (Biodegradable plastics suitable for home composting). AS 4736-2006 covers biodegradable plastics suitable for composting in municipal and industrial composters. As its title suggests, AS 5810-2010 covers biodegradable plastics suitable for composting in home or domestic composters.

To meet the definition of biodegradable under the *Plastic Shopping Bags Ban Regulation 2011* (ACT), bags must satisfy the requirements of AS 4736-2006. These requirements include:

- at least 90% of the plastic must biodegrade within 180 days in municipal and industrial composting conditions;
- at least 90% of the plastic materials must degrade into less than 2 mm pieces within 12 weeks in municipal and industrial composting conditions;
- the resulting compost must not have toxic effects on plants or earthworms; and
- the plastic materials must contain more than 50% organic materials.

Biodegradable bags meeting the requirements prescribed under AS 4736-2006 are exempt from the ban on <35 µm plastic bags. At present, only a small proportion of plastic bags used in the ACT are biodegradable (approximately 10% of HDPE bags, or 830,000 bags in 2017-18).

One option for reform of the plastic bag ban is to require all plastics bags, including those of ≥35 µm, to be compostable, either in accordance with AS 4736-2006 or AS 5810-2010. We assume for these purposes that such a change would require compliance with AS 4736-2006 only and that it would

¹²² Song et al., above n 24; O'Farrell, above n 22; Thomas et al., above n 49.

¹²³ Song et al., above n 24; O'Farrell, above n 22; Thomas et al., above n 49.

not be coupled with a thickness requirement (i.e. bags could be of any thickness provided they are compostable).¹²⁴

The ACT Government's recently completed Waste Feasibility Study recommended the establishment of a municipal composting facility to process food and garden organics (FOGO) and the expansion of the green bin service to include food waste.¹²⁵ It estimated this combined expanded FOGO green bin service and composting facility could divert over 40,000 tonnes of waste from landfill. Amending the plastic bag ban to require all plastics bags to be biodegradable and compostable could be linked to the introduction of this new FOGO service. A pilot project involving the introduction of compostable packaging, its collection through a household FOGO collection service and subsequent composting at a commercial composting facility was successfully undertaken in Kassel, Germany, in 2001-2002.¹²⁶ The trial found most of the compostable packaging was either disposed of in household composters or in designated FOGO bins, and there was no increase in the misplacement of conventional plastics in the FOGO waste stream.¹²⁷ A similar approach could be adopted in the ACT.

Environmental effectiveness

A number of issues have been raised about the environmental benefits of biodegradable and compostable plastic bags. Attributional LCAs suggest their direct causal impacts on the environment are not dissimilar, and are at times worse than, those associated with conventional plastic bags.¹²⁸ For example, the studies cited in Table 8 found single-use compostable and oxo-biodegradable plastic carry bags had climate change and water impacts that were roughly equal to or greater than those associated with conventional single-use HDPE bags.¹²⁹ The reasons for the 'negative' LCA outcomes on many environmental measures stem largely from the nature of the feedstock. The reliance on biological material as a primary input to polymer production means the assessed attributional LCA impacts include those associated with growing and manufacturing the biomass. In many instances, this can result in attributed water use and greenhouse gas emissions being higher than with conventional plastics. A further issue with biodegradable plastics is that, when

¹²⁴ Requiring compliance with AS 5810-2010 could have greater adverse financial impacts on retailers and householders because of the relative cost of AS 5810-2010-compliant bags.

¹²⁵ ACT NoWaste, *Overview: A Roadmap to Improved Resource Recovery – Waste Feasibility Study* (ACT Government, 2018).

¹²⁶ Song et al., above n 24; J Reske, 'Market Introduction of Compostable Packaging', in E Chiellini and R Solaro (eds), *Biodegradable Polymers and Plastics* (Springer, 2003).

¹²⁷ Reske, *ibid.*

¹²⁸ M Yates and C Barlow (2013) 'Life cycle assessments of biodegradable, commercial biopolymers – a critical review', *Resources, Conservation and Recycling* 78, 54-66; T Hottle, M Bilec and A Landis (2017) 'Biopolymer production and end of life comparisons using life cycle assessment', *Resources, Conservation and Recycling* 122, 295-306.

¹²⁹ O'Farrell, above n 22; Verghese, above n 22.

they degrade under anaerobic conditions (e.g. in landfills), they produce methane, a potent greenhouse gas.

Another issue associated with biodegradable plastics is that their rate of degradation is dependent on environmental conditions, particularly temperature, exposure to ultra-violet radiation, moisture, salinity, mechanical weathering and microbial activity.¹³⁰ The influence that these and other variables have on the degradation process makes it difficult to predict the rate of biodegradation in natural conditions. Compostable plastics degrade rapidly in suitable composting facilities and tend to degrade faster than other plastics in the 'general environment'.¹³¹ However, the degradation process still takes time and depends on the specific environmental conditions.¹³² Due to this, biodegradable and even compostable plastics can still have material litter and aesthetic impacts. Where they persist, they may also cause animal mortality and morbidity, including in marine environments.¹³³

Due to concerns about the environmental performance of biodegradable bags, a number of jurisdictions have included biodegradable bags within the scope of bans on lightweight plastic bags. For example, both Western Australia and Queensland have proposed to include biodegradable bags within the scope of their prohibitions on the distribution of <35 µm plastic shopping bags.

Whether a requirement that all plastics bags be biodegradable and compostable is appropriate for the ACT depends on the priority placed on specific environmental impacts. Of particular importance is the weight attached to the attributional life-cycle impacts associated with their production and litter impacts.

Requiring that all plastics bags be biodegradable and compostable is unlikely to materially reduce, and may even increase, the attributional (direct causal) environmental impacts associated with the consumption of plastic bags in the ACT. As noted above, the available attributional LCA studies suggest compostable plastic shopping bags offer little or no environmental benefit relative to many of the alternatives. Consequently, even assuming there is a

¹³⁰ P Sangwan and K Dean, *Degradable Plastics Packaging Materials: Assessment and Implication for the Australian Environment* (CSIRO, 2011); S Mehdi Emadian, T Onay and B Demirel, (2017) 'Biodegradation of bioplastics in natural environments', *Waste Management* 59, 526-536.

¹³¹ T O'Brine and R Thompson (2010) 'Degradation of plastic carrier bags in the marine environment', *Marine Pollution Bulletin* 60, 2279-2283; E Gomez and F Michel (2013) 'Biodegradability of conventional and bio-based plastics and natural fibre composites during composting, anaerobic digestion and long-term soil incubation', *Polymer Degradation and Stability* 98(12), 2583-2591.

¹³² Mehdi Emadian, Onay and Demirel, above n 130.

¹³³ Song et al., above n 24; Muller et al. (2012) 'Experimental degradation of polymer shopping bags (standard and degradable plastic, and biodegradable) in the gastrointestinal fluids of sea turtles', *Science of the Total Environment* 416, 464-467; A Nauendorf et al. (2016) 'Microbial colonization and degradation of polyethylene and biodegradable plastic bags in temperate fine-grained organic-rich marine sediments', *Marine Pollution Bulletin* 103, 168-178.

1:1 substitution between conventional and compostable plastic bags, the policy change could lead to worse attributional environmental impacts.¹³⁴

In addition to concerns about the comparative performance of compostable and conventional plastic bags in attributional LCAs, there is a risk the imposition of a requirement that all plastic bags be compostable could prompt an increase in plastic consumption. There are two main potential drivers of increased consumption in these circumstances. First, retailer and consumer concern about the environmental impacts of plastic bags may decline when they are all compostable, prompting the substitution of reusable polyethylene and polypropylene bags for single-use (<35 µm) compostable bags. Secondly, because of the often superior durability of conventional plastic bags, the shift to compostable bags might reduce the useful life of reusable bags, leading to increased replacement-related consumption.

It is not possible without more data to accurately predict what impact these factors might have on plastic consumption. For illustrative purposes, if it is assumed the introduction of the mandatory compostable bag requirement prompted substitution of 10% of reusable LDPE and polypropylene bags consumed in 2018-19 on a 1:8 ratio between conventional reusable and single-use compostable bags (8 single-use compostable bags for every 1 reusable PE and PP bag consumed immediately prior to the policy change), plastic bag consumption would increase by 10 tonnes (the equivalent of 7.4 million bags) in 2018-19. With a 1:6 substitution ratio, bag consumption would increase by approximately 5.3 million bags in 2018-19 but plastic consumption would decline slightly by around 1.5 tonnes, primarily because of the lower mass of single-use bags.

In relation to litter, the benefits of a mandatory compostable bag requirement are similarly uncertain and subject to a degree of downside risk. When littered, biodegradable or compostable bags are unlikely to encounter the optimal environmental conditions required for degradation. Due to this, there is a risk they will persist in the environment for a considerable period of time before being absorbed into the soil and surrounding environment. The risk of persistence means a shift to compostable bags may not provide a material improvement in observed litter. Moreover, if the requirement prompted material substitution between reusable and single-use bags, it could significantly increase littering due to the increase in plastic bag consumption.¹³⁵

¹³⁴ It is not possible to predict what the consequential environmental outcomes might be without further data and analysis.

¹³⁵ As in the case of the other options, evaluating the potential impact of a mandatory compostable requirement on the litter stream is made difficult by the small number of plastic bags that appear to be present in the ACT litter stream and uncertainty about the magnitude and composition of the ACT litter stream.

Linking the mandatory compostable bag requirement to the proposed new FOGO collection and composting service would mitigate some of the associated environmental risks. For example, if an education campaign was able to ensure the majority of compostable bags were included in FOGO bins, it would reduce the amount of waste going to landfill, minimise litter issues and potentially reduce methane emissions from landfill. However, the attributional environmental impacts would largely remain, particularly those associated with the production of the bags and their feedstocks. Further, the greenhouse gas benefits associated with the diversion of compostable bags from landfill are likely to be limited because both Mugga Lane and Woodlawn capture landfill gas and use it to generate electricity. Including compostable bags within the green bin collection service may also increase contamination risks through the inadvertent inclusion of conventional plastic bags in FOGO bins.

Impact on retailers

The wholesale costs of compostable (AS 4736-2006 compliant) plastic bags are generally in the order of 20-30% higher than equivalent conventional plastic bags. Due to this, there is a risk that a mandatory compostable plastic bag requirement could increase costs to retailers. However, in most cases, retailers will be able to pass additional bag costs on to consumers through retail bag prices. The most significant financial impacts on retailers are likely to arise through increased costs of single-use bags (if retailers choose not to charge for them) and produce bags, which retailers traditionally do not charge for. However, because of the low cost of plastic bags and potential to pass additional costs on to consumers, any positive or negative impacts are likely to be negligible across the retail sector as a whole.

To illustrate this, we evaluated the aggregate impact on ACT retailers under the scenario described above, where there is 10% substitution of reusable LDPE and polypropylene bag consumption in 2018-19 on a 1:8 ratio between conventional reusable and single-use compostable bags. The estimated aggregate impact in 2018-19 was an increase in profit of approximately \$335,000, growing to \$419,000 in 2024-25. While subject to a high degree of uncertainty, the estimate illustrates that the financial impacts across the retail sector are likely to be small.

Impact on households

Notwithstanding the likelihood of retailers passing additional bag costs on to consumers, the financial impacts on households of a mandatory compostable bag requirement are likely to be small. On the basis of the illustrative scenario described above, the estimated net increase in household bag expenditure in 2018-19 was approximately \$9 per annum (18 cents per week), growing to

\$11 in 2024-25 (21 cents per week). Again, while this estimate is subject to considerable uncertainty, it illustrates the likely magnitude of any adverse household financial impacts.

As indicated in section 8.2.2, any measure that increases the costs of plastic bags to consumers could disproportionately affect low income households. Targeted information and social marketing campaigns may assist in alleviating impacts on financially vulnerable groups.

Cost to government

The cost implications of this option for the ACT Government are likely to arise through four main channels:

- negotiations with retailers over the scope and timing of the ban;
- general community marketing and education;
- targeted marketing and education to alleviate potential impacts on low income households; and
- ongoing compliance and enforcement costs.

The net fiscal impacts of requiring all plastic bags to be compostable are likely to be relatively small. However, ultimately, the magnitude of the costs to government will depend largely on the extent of negotiations, marketing and education that are considered necessary to implement the changes and ensure their sustainability. The extent to which the change is linked to the proposed FOGO collection and composting service will also materially affect government costs and the scope of required community education and marketing.

One of the challenges associated with imposing a mandatory compostable bag requirement is that it is likely to decrease the profits of retailers who distribute significant numbers of bags without charging for them. Retailers like butchers, fishmongers, and fruit and vegetable stores who distribute plastic carry and produce bags for free, will face increased costs but may not be able to pass these costs on to consumers. These types of retailers may oppose the change, which could prolong government negotiations and consultation, and potentially necessitate greater resources for retailer and community marketing and education. There may also be a greater need for ongoing compliance and enforcement efforts because of the incentive to, and relative ease of, using conventional bags without detection.

8.4 Ban plastic shopping bags

Broad-based bans on plastic bags have been introduced in a number of jurisdictions, including the city of Bangalore in India, the Indian state of

Karnataka, and Kenya.¹³⁶ Where these types of bans have been imposed, this has generally been in response to acute problems with plastic bag litter. Anecdotal reports suggest the success of these types of bans has been variable, with the extent of observed reductions in plastic bag consumption and environmental impacts depending on the enforcement capacity of governments.¹³⁷ There are also reports of adverse economic and social side-effects of the complete bans, including obstructions to business activity and the development of black markets for plastic bags.¹³⁸

The imposition of a complete ban on plastic bags in the ACT is likely to result in:

- a reduction in plastic bag consumption, the extent of which would depend on the scope of the ban, the penalties for non-compliance and the strictness with which the ban is enforced;
- an increase in consumption of single-use and reusable substitute jute, calico, paper and other similar bags;
- a small change (likely increase) in retailer profits;
- a minor increase in household shopping costs due to the need to purchase substitute bags; and
- a small increase in the budget impact to government due to the regulatory effort required to introduce and enforce the ban.

For these purposes, we assume the ban would be limited to shopping bags. This would mean it would not cover garbage bags or produce bags. The inclusion of garbage and produce bags within the scope of the ban could give rise to human health risks associated with food hygiene and waste management.

Environmental effectiveness

The imposition of a ban on plastic shopping bags would reduce the consumption of bag-related plastics in the ACT from the six main bag types (single-use HDPE, reusable HDPE, reusable LDPE, polypropylene, garbage and produce) by 50% (approximately 487 tonnes) in 2018-19. The avoided plastic consumption would grow to almost 541 tonnes per annum in 2024-25.

¹³⁶ Gazette Notice No. 2334, *The Kenya Gazette*, Vol. 119(31), 14 March 2017 (Republic of Kenya, 2017); Bruhat Bangalore Mahanagara Palike, No.Comm/PR/774/2016-17, Ban of Plastics & Penalty Impose in Bruhat Bangalore Mahanagara Palike (Office of the Commissioner, Bruhat Bangalore Mahanagara Palike, 4 May 2016); *Karnataka Forest, Ecology and Environment Secretariat Notification*, No. FEE 17 EPC 2012, Bangalore, 11 March 2016 (Karnataka State Pollution Control Board, 2017); S Moudgal, 'Total plastic ban in Karnataka', *The Times of India*, 14 March 2016; Xanthos and Walker, above n 5.

¹³⁷ J Watts, 'Eight months on, is the world's most drastic plastic bag ban working', *The Guardian*, 25 April 2018; 'Plastic shopping bags slowly making a return', *Business Daily*, 4 February 2018.

¹³⁸ *Ibid.*

As with the option of increasing the minimum thickness requirement, the reduction in plastic bag consumption should lead to less plastic in the general environment. However, given the small number of plastic bags in the known ACT litter stream, the scope for further improvements in plastic litter control appear to be small.

The introduction of the ban would increase consumption of substitutes like jute, calico and paper. Attributional LCAs suggest this shift could have adverse environmental impacts, for example, by increasing greenhouse gas emissions and increasing water use. However, in the absence of a robust consequential LCA, it is not possible to speculate on the net environmental outcomes associated with the possible substitution of non-plastic bags for plastic in the ACT following the introduction of a broad plastic bag ban. Extrapolations from the results of attributional LCAs are likely to be misleading.

Impact on retailers

The financial impacts of a broad ban on plastic shopping bags will depend on which substitutes consumers chose to purchase, the prices charged for the substitutes and the extent to which the shift results in greater reuse of the substitute bags. If it is crudely assumed that the demand for 15 µm HDPE bags shifts completely to paper bags on a 1:1 ratio (1 paper bag for every HDPE bag consumed immediately prior to the introduction of the new ban), that demand for reusable polypropylene shifts on a 1:1 basis to calico (50%) and jute (50%), and consumers of LDPE bags shift to calico (50%) and jute (50%) on a 4:1 basis (1 substitute bag for every 4 LDPE bags), it would result in an aggregate net increase in retailer profits of around \$4.6 million in 2018-19, growing to \$6.0 million in 2024-25. The main driver of the increased profits is the shift from reusable LDPE bags to calico and jute, which have greater retail margins. For example, if the substitution rate for LDPE bags is 8:1, the estimated aggregate net increase in retailer profits falls to approximately \$2.3 million in 2018-19. While crude, these estimates indicate any change in retailer profits is likely to be relatively small across the sector as a whole.

Impact on households

As with retail impacts, the financial impacts on households will depend on how consumers respond to the ban (i.e. to what extent they increase the use of reusable bags and what substitute bags they consume) and the prices charged for the substitutes. Assuming the substitutions are the same as described above for retailers, including a 4:1 substitution ratio for LDPE bags, the net impact on households is an increase in average annual household bag expenditure of \$52 in 2018-19, or \$1 per week. With an 8:1 LDPE substitution ratio, the average annual increase falls to \$24 and the weekly increase to 46

cents. Again, while crude, these estimates suggest average impacts on households are likely to be small. However, again, there is the potential that the cost increases may be most pronounced in low income/low socio-economic status households, who may be less responsive to price signals. Targeted information campaigns should be considered as a way of alleviating potential adverse impacts on financially vulnerable households.

Cost to government

The fiscal impacts of this option for the ACT Government are similar to those identified above in relation to options 2 and 3. The government will incur costs associated with negotiations with retailers, general and targeted community marketing and education, and compliance and enforcement. While these costs are likely to be relatively small in the context of the ACT Government budget, their size will depend on the extent of these efforts and how they are undertaken.

A challenge associated with an outright ban on plastic shopping bags is it may be viewed as disruptive of retail activity, and be opposed by many retailers. Household support may also wane in the face of losing the option of acquiring cheap bags when people forget to bring their own. The risk of material opposition from retailers and the broader community may necessitate a broader community consultation, marketing and education campaign than would be needed in relation to the other options.

8.5 Use prices to reduce consumption of plastic shopping bags

Levies and taxes have been imposed on plastic bags as a way of helping to reduce consumption in a number of countries, including Botswana, Canada (Toronto), China, Denmark, Germany, Ireland, Israel, Malaysia (Penang and Selangor), South Africa, Uganda, the United Kingdom (England, Scotland and Wales), and the United States (New York City, Chicago and Washington DC).¹³⁹ In most cases, the levies or taxes have been imposed on retailers at the point of sale, who pass the cost on to consumers.¹⁴⁰ There are also instances where the revenues raised through the imposition of the levies have been hypothecated for particular purposes. For example, in Washington DC, the funds raised have been used to assist in the clean-up of the Anacostia River.¹⁴¹ In Ireland, the funds raised through the levy are remitted to an

¹³⁹ Xanthos and Walker, above n 5; F Convery, S McDonnell and S Ferreira (2007) 'The most popular tax in Europe? Lessons from the Irish plastic bags levy', *Environmental and Resource Economics* 38, 1-11; Dikgang, Leiman and Visser, above n 120; Rivers, Shenstone-Harris and Young, above n 120.

¹⁴⁰ There are instances of the levies or taxes being imposed on bag suppliers.

¹⁴¹ Xanthos and Walker, above n 5.

environment fund, where they are used to support a range of environment measures, including waste reduction and management.¹⁴²

In addition to levies and taxes, another way of reducing plastic bag consumption using prices is to impose a mandatory minimum price for plastic bags. Mandatory minimum prices have a number of advantages over taxes and levies. Most particularly, there is greater certainty over the minimum price effect and there are lower compliance costs for retailers as there is no revenue to collect and transfer to government. On the other hand, because mandatory minimum prices generate no revenue, there is no new revenue source that can be used to manage the negative environmental impacts of plastics.

If price mechanisms were chosen as the preferred means of influencing plastic bag consumption, planning should take account of constitutional constraints upon the permissible form of any new measure. The ACT is constitutionally prohibited from levying taxes in the form of 'excise' duties, as these are an exclusive preserve of the Commonwealth.¹⁴³ An excise duty is a tax upon a commodity that is imposed at some point in the distribution chain prior to consumption.¹⁴⁴ With this in mind, if the ACT resolved to impose a levy on plastic shopping bags it would need to be framed—as a matter of legislative drafting—as an impost attaching at the point of consumption (or sale) rather than at any earlier point in the distribution of bags (e.g. wholesale supply). A legislated minimum price would bring no constitutional complications. Such a measure would raise no public revenue and therefore could not be characterised as a tax (excise or otherwise).

Environmental effectiveness

Imposing a mandatory levy on the sale or distribution of plastic bags in the ACT could help further reduce plastic bag consumption and the associated environmental impacts. The revenues raised could also be used to support other environmental initiatives, including improved flexible plastic recycling services.

The effectiveness of any levy will depend on its design, most particularly the bags it is imposed on and the rate(s) at which it is set. The importance of design is evident in the literature on the effectiveness of other plastic bag levies. Some have had limited success in reducing bag consumption and litter, while others appear to have been highly effective. For example, the

¹⁴² O Laiyemo, *Spending Review 2017: Environment Fund* (Irish Government Economic & Evaluation Service, 2017).

¹⁴³ Commonwealth Constitution, s 90; *Capital Duplicators Pty Ltd v Australian Capital Territory (No 1)* (1992) 177 CLR 248.

¹⁴⁴ *Dickenson's Arcade Pty Ltd v Tasmania* (1974) 130 CLR 177.

South African levy of 46 rand cents per 24 L bag initially resulted in significant reductions in bag consumption but these impacts have diminished over time as a consequence of falls in the relative price of bags and declining responsiveness of consumers to price signals.¹⁴⁵ In Toronto, the imposition of a 5 cent levy led to only modest increases in the propensity of people to reuse bags (3.4%), with the response being more pronounced amongst high socio-economic households.¹⁴⁶

Elsewhere, levies have had greater success. In Ireland and Portugal, for example, the imposition of levies at different levels (initially 15 Euro cents in Ireland and 10 Euro cents in Portugal) resulted in marked reductions in plastic bag consumption.¹⁴⁷ In Ireland's case, the levy also resulted in a significant reduction in the number of plastic bags in the litter stream.¹⁴⁸ In Portugal, the positive impacts of the observed 74% reduction in single-use plastic bag use were partially offset by a 12% increase in plastic garbage bag consumption.¹⁴⁹

The variability in effectiveness of the levies that have been imposed is primarily attributable to design issues. It is also important to emphasise that there are weaknesses in the literature as many of the studies have been based on simple before and after comparisons.¹⁵⁰

In the ACT, one option is to impose a plastic levy (or mandatory minimum price) at the point of sale or distribution on a broad range of shopping and garbage bags, at a rate set on the basis of the mass of the bag. For example, the levy could be imposed at 2 cents per gram of plastic, regardless of the plastic type. Assuming the levy was fully passed on to consumers, this would increase bag prices by roughly the amount outlined in Table 11. To prevent leakage (the substitution of unlevied for levied bags), the levy would also need to apply to any other types of plastic bags that are sold or distributed in the Territory (e.g. PET bags).

¹⁴⁵ Dikgang, Leiman and Visser, above n 120.

¹⁴⁶ Rivers, Shenstone-Harris and Young, above n 120.

¹⁴⁷ Convery, McDonnell and Ferreira, above n 139; M Anastasio and J Nix, *Plastic Bag Levy in Ireland* (Institute for European Environmental Policy, 2016); Laiyemo, above n 139; G Martinho, N Balaia and A Pires (2017) 'The Portuguese plastic carrier bag tax: The effects on consumers' behaviour', *Waste Management* 61, 3-12.

¹⁴⁸ Anastasio and Nix, *ibid*; *National Litter Monitoring Statistics (Ireland)*, http://www.litter.ie/system_survey_results/index.shtml (1 June 2016).

¹⁴⁹ Martinho, Balaia and Pires, above n 147.

¹⁵⁰ Rivers, Shenstone-Harris and Young, above n 120.

Table 11. Approximate increases in plastic bag prices with 2 cents per gram plastic bag levy

	Mass	Current retail price	Levy (dollars)
15 µm biodegradable	5.4	Free to 5 c	0.11
35 µm HDPE bags	14.2	Free to 10 c	0.28
LDPE	28.0	15c	0.56
Reusable polypropylene	99.1	100c	1.98
Garbage	12.5	9c-13c	0.25
Produce bags	2.5	Free	0.05

Source: author estimates based on bag measurements.

One of the attractions of a levy (or mandatory minimum price) like this is that it could capture all bag types and provide a consistent incentive across bag types for reducing plastic consumption. However, there is insufficient information available on the price elasticities of the different bag types to derive reliable approximations of the likely impact of the levy.

For illustrative purposes, we assumed own-price elasticities of demand of -0.15 for 35 µm HDPE bags, reusable LDPE and polypropylene, -0.05 for garbage bags, and that the 2 cents per gram levy reduces consumption of 15 µm biodegradable bags and produce bags by 20% and 10% respectively in 2018-19. On this basis, the introduction of the levy would result in a 340 tonne reduction in plastic consumption across the six bag types in 2018-2019.

This estimate should be seen as illustrative only because of the lack of data on which to base estimates of own-price elasticities of demand. Further, the scenario does not account for substitution between plastic bag types. For example, the imposition of the levy could result in the substitution of lighter weight bags for more durable bags (e.g. 15 and 35 µm bags for reusable LDPE and polypropylene bags) because of the relative magnitude of the price changes. Prior to imposing a levy, further analysis should be undertaken on likely consumer responses.

Impact on retailers

Given the inability to reliably predict the impact of a 2 cents per gram levy on bag consumption, it is also not possible to robustly estimate the likely impacts of the levy on retailer profits. In any case, the direct impacts are likely to be relatively small because bags sales contribute a very small amount to retailer turnover and profits. For example, on the basis of the illustrative scenario described above, aggregate retailer profits across the Territory fall by \$545,000 in 2018-19, reducing further to \$697,000 in 2024-25.

This estimate does not include the transaction costs associated with the collection of the levy or tax and the transfer of the funds to the government. In most cases, these transaction costs are likely to have the most material impact on retailers, particularly small shops and grocers. The use of a mandatory minimum price for plastic bags would avoid these retailer-level transaction costs, while still using price signals to alter consumer behaviour.

Impact on households

Imposing a levy (or mandatory minimum price) on plastic bags could have material adverse financial impacts on average household budgets. This is illustrated using the scenario described above. The imposition of the 2 cents per gram levy in that case increases average annual household expenditure on bags by \$63 in 2018-19 (\$1.20 per week), rising to \$75 in 2024-25 (\$1.44 per week). While this estimate is illustrative only, it demonstrates how material the average household cost increases could be with a 2 cents per gram levy.

If the ACT Government decides to impose a levy (or mandatory minimum price), consideration should be given to how best to mitigate impacts on low income households. These households have lower capacities to absorb price increases and there is evidence to suggest they may be the least responsive to price signals.

Cost to government

Imposing a plastic bag levy would give rise to costs for the ACT Government similar to those associated with options 2, 3 and 4. However, unlike those other options, it would generate revenue, which could be used to offset the implementation costs and potentially allocated to other environmental activities.

As noted above, without additional information, it is not possible to reliably predict what the impact of a levy might be on bag consumption levels. Due to this, it is also not possible to accurately forecast the revenues that are likely to arise from the levy's imposition. However, for illustrative purposes, on the basis of the scenario described above, the imposition of the 2 cents per gram levy generates \$12.5 million in revenue in 2018-19, rising to \$16.4 million in 2024-25.

While a levy has the benefit of generating government revenue, it may also face strong community opposition. As Figure 20 above shows, a plastic bag levy was the least popular of the options for reform identified by respondents in the ReachTel survey. Retailers may also oppose the imposition of a levy because of the transaction costs associated with its collection and transfer to

government. The potential for opposition may increase the implementation costs faced by the government if it decided to pursue this option.

Using a mandatory minimum price rather than a levy or tax is likely to reduce retailer opposition, thereby smoothing the path for implementation. However, a mandatory minimum price would still increase costs for consumers and would generate no revenue.

8.6 Introduce a mandatory disclosure regime for the sale and distribution of plastic bags by retailers

Mandatory disclosure regimes are used in a number of areas associated with environmental and natural resource management as a way of ensuring there is an information base to support evidence-based policymaking. Disclosure regimes also facilitate collaborative governance arrangements, whereby producers, consumers, third parties and governments work together to find solutions to environmental and other problems. Examples of mandatory environmental disclosure regimes in Australia include the National Pollution Inventory (NPI) and the National Greenhouse and Energy Reporting System (NGERS). The NPI is a collaborative federal, state and territory regime that provides free information on emissions of 93 pollutants and the source and location of the emissions. NGERS is an Australian Government initiative that collects and reports on energy use and greenhouse gas emissions from energy, industrial and waste facilities that emit more than 25,000 tCO₂-e per year.

While strictly not a mandatory disclosure regime, during the Millennium Drought the ACT Government publicised average household water consumption levels as a way of increasing awareness of water restrictions and changing water consumption behaviour. This type of approach could equally be used for plastic bags but would require the mandatory extraction of data from retailers or bag suppliers to support the generation of the required information.

A mandatory disclosure regime for plastic bag consumption in the ACT would require retailers who sell or distribute plastic bags to report annually (or on another designated time period) on bag sales and distribution, by bag type, size (volume) and mass. These data could be collated by the ACT Environment Protection Authority and reported on a freely available public website. The data could be reported by retailer or in aggregate.

The reporting of sales and distribution by retailer would better enable collaborative governance arrangements. The ability of retailers, consumers, third parties and governments to find solutions collaboratively is contingent on all parties having information on the nature and magnitude of a given problem.

Reporting only aggregate information would undermine these efforts, shielding underperformers from public scrutiny.

Some retailers are likely to oppose the disclosure of data on their sales and distribution of plastic bags on the grounds the information is commercial-in-confidence. Similar arguments have been raised in relation to other mandatory disclosure regimes. Before a mandatory disclosure regime is introduced, further information should be obtained on the materiality of the commercial risks associated with the disclosure of retail-level plastic bag data. While likely to be less effective, the reporting of aggregated Territory-wide or electoral division data on plastic bag sales and distribution would still provide information for government and the broader community.

Environmental effectiveness

It is not possible to accurately predict whether, and to what extent, a mandatory disclosure regime might reduce plastic bag consumption in the ACT and the associated environmental impacts. The outcomes would depend on a number of unknown variables, including the scheme's design, third party engagement and the responsiveness of retailers and consumers to information and third party pressure.

Impact on retailers

A mandatory disclosure regime is likely to have minimal financial impacts on retailers. As noted above, there is the suggested potential for adverse commercial impacts from the disclosure of retailer-level data. Beyond this, the main impacts on retailers would be the costs associated with the collation and reporting of the bag information.

All retailers already maintain records on plastic bag purchases and sales. This information is maintained for the management of inventories. Retailers are also required to keep these data for tax purposes. Consequently, there should be not additional cost associated with the collation and storage of the information.

The main additional information-related costs relate to the reporting of plastic bag consumption data to the ACT Government. Larger retailers are unlikely to encounter difficulties in absorbing these transaction costs. However, for smaller retailers, who have few staff and limited spare capacity, the reporting costs could be material.

Reporting costs could be minimised through the design of an online reporting portal for registered retailers. Exemptions could also be provided for small retailers to alleviate concerns about their capacity to absorb or pass on

compliance costs. Surveys could be used as an alternative way of tracking bag consumption patterns at exempt retailers.

Impact on households

A mandatory disclosure regime is likely to have no impact on household shopping costs. Retailers may seek to pass reporting costs on to consumers by increasing the cost of plastic bags or other products. However, given the likely magnitude of the reporting costs, the impact of this on retail prices should be small. The ability of retailers to pass on costs is also likely to be constrained by competitive market forces (i.e. retailers may be reluctant to raise prices for fear of losing market share).

Government costs

The establishment of a mandatory plastic bag disclosure and reporting regime would involve additional costs to government, including those associated with:

- the establishment and maintenance of the (preferably online) reporting portal;
- the establishment and maintenance of the online public database;
- negotiations with retailers;
- general and targeted community marketing and education; and
- compliance and enforcement.

The establishment of an online reporting portal and public database is likely to cost in the order of \$200,000-\$400,000, depending on systems and site design. The operation and maintenance of these systems is likely to require 1-2 Environment Directorate staff (possibly part-time). The remaining costs are likely to be similar to those associated with the other options.

9. Conclusions and recommendations

The ACT plastic bag ban has been successful in reducing plastic bag consumption. Cumulatively, plastic bag consumption over the period 2011-12 to 2017-2018 was approximately 1,132 tonnes lower than it would have been if the ban was not introduced. The reduction in 2017-18 alone was approximately 199 tonnes, the equivalent of around 55 million plastic bags.

While the ban has reduced plastic use in the Territory, as time passes consumption appears to be gradually returning to the levels seen prior to the ban's introduction. Consumption in 2017-18 was approximately 953 tonnes, compared to 973 tonnes in 2010-11. By the early 2020s, consumption is likely to pass pre-ban levels unless further policy measures are introduced.

There are two challenges associated with any proposed reforms to the plastic bag ban. The first is ambiguity about the nature of the environmental issues that the ban is designed to address. The primary purpose of the ACT bag ban appears to be to reduce the use of plastic bags. However, it is not clear which benefits of reducing plastic bag consumption are the main priorities associated with the ban. There are a number of environmental reasons for trying to reduce plastic bag use, including reducing production-related impacts, increasing community awareness about sustainability, reducing waste to landfill, reducing litter, and minimising plastic-related impacts on marine and terrestrial animals. Greater clarity about the rationale behind the ban would facilitate improved analysis of its effectiveness and further consideration of alternative ways of addressing the specified environmental problems.

The second challenge associated with reforming the plastic bag ban is the relative absence of information. There are material gaps and uncertainties in the information available on the ban and relevant environmental impacts. Most significantly, there are limited data available on plastic bag consumption and trends. Surveys were used here to provide information on consumption in 2017-18. However, time series data on the consumption of different bag types are essential to inform analysis of the effectiveness of the ban and any other policy instruments that are used to reduce the consumption of plastics and their impacts on the environment. The generation and publication of this information would not only facilitate evidence-based policymaking but would also help non-government actors play a positive role in the governance of plastic bags. The barriers posed by the gaps in knowledge and information are not unique to the ACT. A number of other studies have raised similar issues about the uncertainties associated with plastic bag consumption in Australia and plastic-related environmental impacts.¹⁵¹

Given the importance of information for the cost-effective design and implementation of policy, and the difficulties encountered in obtaining relevant data from retailers and bag distributors, we recommend a mandatory plastic bag disclosure regime be established in the ACT. This disclosure regime should require retailers who sell or distribute plastic bags in the Territory to report annually on bag sales and distribution, by bag type, size (volume) and mass. These data should be reported annually on a freely available public website. Prior to its establishment, further consultation should be undertaken with retailers to inform key design issues, particularly the scope of any exemptions and whether consumption data should be reported by retailer or in an aggregated form.

¹⁵¹ Marsden Jacob Associates, *Plastic Bags Ban Options – Cost Benefit Analysis* (Victorian Government, 2016); Hardesty et al., above n 68.

Recommendation 1: The ACT Government establish a mandatory plastic bag disclosure regime, which would require retailers who sell or distribute plastic bags in the Territory to report annually on bag sales and distribution. Prior to its establishment, further consultation should be undertaken with ACT retailers to inform key design issues.

The establishment of a mandatory disclosure regime is unlikely, on its own, to substantially reduce plastic consumption in the ACT. If there is a desire to significantly reduce plastic bag consumption, additional policy measures are likely to be necessary.

We believe a mandatory minimum price is the best available option at this time to further reduce plastic bag consumption. Ideally, the price would be based on bag mass and would be set at a relatively low level, at least initially. In essence, the minimum price would be designed to prompt behavioural change through a ‘nudge’ rather than by a material change in the economic incentives faced by consumers.¹⁵² Provided the price was set at an appropriate level, the financial impacts on most retailers and households are likely to be small. Most retailers currently charge for plastic shopping bags and many retailers and consumers already believe the plastic bag ban requires plastic shopping bags to be priced. To limit adverse financial impacts and help build community support, the mandatory minimum price could also be introduced in stages, starting with standard shopping bags and then being extended at a later date to other plastic bag types (e.g. produce and garbage bags).

Prior to the introduction of the mandatory minimum price, consultation should be undertaken with retailers on the scope and quantum of the price, particularly those that provide plastic bags for hygiene and safety reasons. Further consideration should also be given to how the mandatory minimum price might affect low income households and what measures can be put in place to mitigate impacts on vulnerable groups.

Recommendation 2: If there is a desire to further reduce plastic consumption, the ACT Government should introduce a mandatory minimum price on plastic bags. The price should be based on bag mass and be designed to prompt behavioural change through a ‘nudge’ rather than by a material change in the economic incentives faced by consumers.

Responsibilities for waste and litter related issues in the ACT Government are currently divided between Transport Canberra and City Services, the

¹⁵² R Thaler and C Sunstein, *Nudge: Improving Decisions about Health, Wealth and Happiness* (Yale University Press, 2008); Rivers, Shenstone-Harris and Young, above n 120.

Environment, Planning and Sustainable Development Directorate, and Access Canberra. Transport Canberra and City Services is responsible for waste management and the administration and enforcement of the *Litter Act 2004*. The Environment, Planning and Sustainable Development Directorate is responsible for the oversight of the *Plastic Shopping Bag Ban Act 2010*, while responsibility for the enforcement of the ban rests with Access Canberra.

Despite this formal governance structure, amongst relevant stakeholders, there is a degree of uncertainty about the division of responsibilities related to the administration of the plastic bag ban. To ensure the effective implementation of current and future plastic bag policy in the Territory, we recommend the ACT Government provide greater clarity about the division of responsibilities between relevant government agencies, particularly in relation to compliance and enforcement.

Recommendation 3: The ACT Government clarify the division of responsibilities between government agencies for the regulation of plastic bags, particularly in relation to compliance and enforcement.

Appendix A: Australian Customs Service harmonised tariff item statistical classification codes and descriptions for plastic bags

Table A1. Harmonised tariff item statistical classification codes and descriptions for plastic bags

Classification code	Description	Comment
3923210024	Shopping bags not designed for prolonged use, of low density polyethylene	Lightweight LDPE shopping bags
3923210025	Shopping bags not designed for prolonged use, of polyethylene (excl. those of low density polyethylene)	Lightweight HDPE shopping bags
3923210026	Shopping bags not designed for prolonged use, of polymers of ethylene (excl. those of polyethylene)	Other lightweight plastic shopping bags of polymers of ethylene (excluding PE)
3923210027	Sacks and bags (incl. cones), of low density polyethylene (excl. shopping bags not designed for prolonged use)	Other, including heavier boutique, LDPE bags
3923210028	Sacks and bags (incl. cones), of polyethylene (excl. those of low density polyethylene and shopping bags not designed for prolonged use)	Other, including heavier boutique, HDPE sacks and bags
3923210029	Sacks and bags (incl. cones), of polymers of ethylene (excl. those of polyethylene and shopping bags not designed for prolonged use)	Other plastic sacks and bags of polymers of ethylene (excluding PE)
3923210030	Plastic sacks and bags (incl. cones), (excl. sacks and bags of polymers of ethylene)	Other plastic sacks and bags (excluding those of polymers of ethylene)

Source: ABS, *International Merchandise Trade: Imports of Specified Plastic Bags, by Country of Origin, By State of Final Destination* (ABS, 2018).

Appendix B. Household and retailer HDPE surveys

B1. Household survey

The household survey was undertaken over 7-15 April 2018. The survey asked shoppers four questions about household plastic bag consumption and use. The questions are set out below. Respondents had to be over 18 years of age to participate in the survey.

Questions

Question 1: [while holding up a barrier bag, researcher states] This is a known as a barrier bag. In the last week, how many plastic barrier bags do you think your household took from grocery stores, including supermarkets and other places like the Fyshwick Fresh Food Markets?

Question 2: [while holding up a reusable boutique LDPE bag, researcher states] This is known as a boutique plastic bag. Over the past month, how many boutique bags do you think your household purchased or took from shops, including department stores?

Question 3: [while holding up a reusable polypropylene bag, researcher states] This is known as a polypropylene or green bag. Over the past 12 months, how many of these bags do you think your household has purchased?

Question 4: On average, how many plastic household garbage bags does your household use in a week?

Site selection

Shoppers were surveyed at randomly selected Woolworths, Coles and Aldi stores. To select the stores, the ACT was stratified into its five electorate divisions: Kurrajong, Ginninderra, Yerrabi, Murrumbidgee and Brindabella. There are 18 Woolworths, 12 Coles and 9 Aldi stores in the ACT, spread across the five divisions. Two Woolworth stores, 1 Coles and 1 Aldi were randomly selected from each district using a random number generator.

Shopper selection

Surveys were undertaken at each selected store on the weekend and during a weekday. There were three stores where surveying was not able to be undertaken on both a weekday and the weekend (i.e. they were surveyed once only). Shoppers were selected using a systematic method to eliminate

bias in selection. This involved researchers choosing a physical starting point at the supermarket and approaching the first shopper who left a designated checkout area after the commencement of the survey. If they agreed to participate and were eligible, the researcher completed the survey and then returned to the start point. If the shopper do not agree to participate or was ineligible, the researcher returned to the start point and, once there, approached the first shopper identified leaving the designated checkout area. Depending on store size and layout, the checkout areas were stratified into groups, including self-serve areas, to help eliminate bias.

Respondents

The number of respondents received, by electorate division and weekday/weekend, are detailed in Table B1 below.

Table B1. Household survey, respondents, by electorate division and weekday/weekend

	Kurrajong	Ginninderra	Yerrabi	Murrumbidgee	Brindabella	ACT total
Weekend	103	134	157	79	200	673
Weekday	46	99	77	78	52	352
Total	149	233	234	157	252	1,025

Results and standard errors

The estimated average household consumption of the four surveyed bag types for the time periods asked in the survey are provided in Table B2, along with the standard errors. These estimates were derived using the household number estimates in Table B3. These estimates were used to derive the 2017-18 estimates presented in Table 6. In calculating 2017-18 consumption, it was assumed consumption of reusable LDPE, single-use produce and household garbage bags in December (the Christmas trading period) was 15% above the mean for the rest of the year.

Table B2. Average household consumption of selected plastic bag types in the Australian Capital Territory, for time period asked in survey (with standard errors)

Division	Monthly consumption of reusable LDPE bags		Weekly consumption of single-use produce bags		Annual consumption of reusable polypropylene bags		Weekly use of household garbage bags	
	Mean	SE*	Mean	SE*	Mean	SE*	Mean	SE*
Kurrajong	4.50	0.66	4.52	0.40	4.77	0.33	3.08	0.42
Ginninderra	4.15	0.63	3.45	0.10	5.43	0.61	3.09	0.15
Yerrabi	4.87	0.29	4.15	0.38	6.43	0.22	3.92	0.11
Murrumbidgee	4.99	0.21	4.27	0.41	4.99	1.04	3.48	0.22
Brindabella	5.06	1.03	3.77	0.26	4.94	0.51	3.33	0.07
ACT total	4.70	0.28	4.06	0.16	5.31	0.28	3.38	0.12

* SE means standard error of the mean.

Source: author estimates derived from shopping survey, using ABS household and population data. ABS, *Census of Population and Housing* (ABS, 2018); ABS, *Australian Demographic Statistics, 3101.0* (Australian Government, 2018).

Table B3. ACT households, by electorate division, 2017-18

Division	Households
Kurrajong	39,088
Ginninderra	32,989
Yerrabi	34,489
Murrumbidgee	33,996
Brindabella	28,318
ACT total	168,880

Source: ABS, *Census of Population and Housing* (ABS, 2018); ABS, *Australian Demographic Statistics, 3101.0* (Australian Government, 2018). The household estimates from the 2016 census were adjusted using estimated population growth to 30 June 2018.

B2. Retailer HDPE survey

The retailer HDPE survey was conducted over the period 18-23 May 2018. The survey was conducted by phone and in person. Retailers were asked to approximate their average weekly sales and distribution of single-use and reusable $\leq 35\mu\text{m}$ HDPE bags.

Store selection

The ACT retailer population was divided into six shop types: supermarkets (excluding the major supermarkets, Woolworths, Coles and Aldi); Asian grocery stores; fruit and vegetable stores; butchers and poultry stores;

fishmongers;¹⁵³ and other retailers. The shop types were designed to capture the major distributors of HDPE carry bags (with the exception of the ‘other retailer’ category).

Using online and physical searches, a database of stores in the ACT in the first five shop types (i.e. excluding ‘other retailers’) was compiled. 113 individual retail stores were identified: 42 supermarkets; 21 Asian grocers; 12 fruit and vegetable stores; 32 butchers; and six fishmongers.

Retailers from the five store types (i.e. excluding ‘other retailers’) were randomly selected and asked about their average weekly HDPE bag sales and distribution. Responses were provided by 43 retailers.

Results and standard errors

The estimated average weekly sales and distribution of HDPE bags is provided in Table B4, along with the standard error. The results by store type, and details of the respondents, have been withheld to protect the identity and commercial information of respondents.

Table B4. Estimated average weekly sales and distribution of HDPE bags, by store types

	No. stores	Mean per store	Standard error of mean	Total
All stores	113	1,458	283	164,778

In calculating 2017-18 consumption of HDPE bags in the ACT (as presented in Table 5), it was assumed:

- unsurveyed store types (‘other retailers’) accounted for 10% of HDPE sales and distribution; and
- sales and distribution of HDPE bags in December (the Christmas trading period) was 15% above the mean for the rest of the year.

¹⁵³ To be classified as butchers or fishmongers, stores had to primarily retail raw meat (rather than cooked meat, like ‘fish and chip’ stores, which were classified as ‘other retailers’ with other restaurants and takeaways).

Appendix C. Legislative design in Australian jurisdictions

This Appendix provides a detailed explanation of the features of relevant legislation in the four Australian jurisdictions with plastic bag bans currently in force—the ACT, South Australia, the Northern Territory and Tasmania—as well as the soon-to-be operative Queensland provisions. The legislative regimes are presented in chronological order of enactment in order to make clear the lineage of certain shared features. A summary of the regimes is provided in Table C1 below.

C1. South Australia

The *Plastic Shopping Bag (Waste Avoidance) Act 2008* (SA) (the ‘SA Act’) took effect on 1 January 2009 and has provided the model for other Australian jurisdictions enacting similar bans subsequently. As enacted, the SA Act provided for a four-month ‘phasing out’ period after which the offence provisions (creating the bag ban) became operational on 4 May 2009.

The SA Act gives ‘plastic shopping bag’ a closed definition (i.e. defined exhaustively) as any carry bag with handles ‘the body of which comprises (in whole or in part) polyethylene with a thickness of less than 35 microns’, or as otherwise specified in regulations (s 3). The definition specifically excludes biodegradable bags and any ‘plastic bag that constitutes, or forms an integral part of, the packaging in which goods are sealed prior to sale’ (s 3).

There are two offence provisions within the SA Act, one relating to supply and the other to false and misleading statements. The supply offence applies to retailers who provide plastic shopping bags to customers for the carrying of purchased goods (s 5(1)). A defence is available where a retailer ‘believed on reasonable grounds that the bag was not a plastic shopping bag’ (s 5(2)). The second offence relates to the selling, supplying or providing of a plastic shopping bag while representing that it is not such a bag (s 6). The s 6 offence attracts a maximum penalty of \$20,000, whereas the maximum penalty for a supply offence is \$5,000. While penalties of that order may follow a successful prosecution, most offences under s 5 are instead dealt with by the issue of infringement notices, to which the SA Act attaches a \$315 fee (s 5).

An innovative feature of the SA Act is the provision that it be considered ‘integrated’ with the *Environmental Protection Act 1993* (SA), meaning they must be ‘read together and construed as if the 2 Acts constitute a single Act’ (s 7(1)). This integration allows officers empowered under the *Environmental Protection Act* to utilise those powers in administering and enforcing the SA

Act (s 7(2)). Section 8 of the SA Act mandates a review of the Act two years after its central provisions entered into operation. That review was duly undertaken and the report, completed in November 2012, was put before the State Parliament.¹⁵⁴

C2. Northern Territory

The Northern Territory plastic shopping bags ban is contained in Part 3 of the *Environment Protection (Beverage Containers and Plastic Bags) Act 2011* (NT) ('the NT Act'). The legislation is closely modelled on the SA Act. Following the South Australian example, the NT Act provided for a 'phase out' period of four months (ss 52(1), 55, 56) after which the plastic bag ban commenced in the Territory on 1 September 2011.

The NT Act also follows the South Australian model closely in defining the bags to which its provisions apply. Although choosing the different terminology of 'prohibited plastic bag', the NT Act defines this in almost identical terms to the equivalent term in the SA Act. Specifically, in the NT Act, a 'prohibited plastic bag' is any carry bag, with handles, 'the body of which comprises (in whole or in part) polyethylene with a thickness of less than 35 microns', or any other bag so prescribed in regulations (s 51). As in the SA Act, the definition of prohibited plastic bags in the NT Act specifically excludes biodegradable bags and any 'plastic bag that is, or forms an integral part of, the packaging in which goods are sealed prior to sale' (s 51).

Still in line with the South Australian model, there are two offence provisions in Part 3 of the NT Act, one of which relates to supply of prohibited plastic bags while the other concerns the making of false and misleading statements. Section 57 makes it an offence for retailers to 'make a prohibited plastic bag available to a customer for carrying goods purchased, or to be purchased, from the retailer.' An innovative aspect of this offence provision is its explicit framing as an offence of strict liability, meaning that a retailer or its employee can supply a prohibited bag inadvertently yet remain liable to penalty. The other offence, contained in s 58, applies to a manufacturer or distributor of plastic bags who falsely represents that bags are not 'prohibited plastic bags'. A conviction for this offence requires proof of intention as to both the sale or supply and the representation, along with proof of recklessness as to the composition of the bags (s 58).

The penalties prescribed in Part 3 of the NT Act differ by category of offence. The more serious offence of false or misleading representation attracts a penalty of up to 200 penalty units (\$30,800), while penalties for the supply offence can be up to 50 units (\$7,700) (NT Act ss 57,58; *Penalty Units*

¹⁵⁴ Aspin, above n 97.

Regulations (NT)). The s 57(1) supply offence can also be dealt with by the issue on an infringement notice, currently carrying a penalty of 2 units (\$308).¹⁵⁵ Like its South Australian predecessor, the NT Act mandated a comprehensive review of Part 3 after its first two years of operation (s 59). The review was conducted in 2013-2014, published in June 2014 and is available on the NT EPA website.¹⁵⁶

Unlike other examples of plastic bag regulation in Australian jurisdictions, the NT Act itself contains detailed provisions as to the executive administration and enforcement of the Part 3 ban. These provisions are unnecessary to describe here but mirror those achieved in other jurisdictions through the linking of plastic bag legislation with broader statutory regimes administering and enforcing environmental rules and standards.

C3. Australian Capital Territory

The *Plastic Shopping Bag Ban Act 2010* (ACT) ('the ACT Act') took full effect on 1 November 2011, after a four-month transition period (s 100, expired). This compact legislation borrows from the pre-existing South Australian model, while also incorporating some refinements. The ACT Act gives 'plastic shopping bag' a closed definition as either (i) a bag made from polyethylene with a thickness of less than 35 microns or (ii) any other bag so designated in regulations made under the Act (s 6(a)). The definition in the ACT Act contains two innovations not present in the forerunner SA Act. First, the ACT Act does not specify 'handles' as a necessary feature of bags to which its ban applies. Second, the ACT Act's definition specifically exempts biodegradable bags, integrated packaging and barrier bags (s 6(b)). The latter two categories of exempt bag are grouped together under more general terms in the SA Act.

The ACT Act contains only one operative provision, in the s 7 prohibition upon the supply of plastic shopping bags. Section 7 is directed exclusively to retailers and makes it an offence to supply a 'plastic shopping bag' to a customer. A distinctive feature of the s 7 offence is its imposition of 'strict liability', meaning that retailers and their staff need not be aware of the ban, or aware that a breach has occurred, in order to be liable to a penalty (s 7(2)).

Under the ACT Act, the maximum penalty that can be imposed for a prosecuted breach of the s 7 offence is 50 penalty units, which equates to \$37,500 for a corporation or \$7,500 for an individual.¹⁵⁷ While the potential for prosecution with high maximum penalties may have some deterrent effect, most breaches of the ACT Act are likely to be dealt with via the issuance of

¹⁵⁵ *Environmental Protection (Beverage Containers and Plastic Bags) Regulations 2011*, reg 7.

¹⁵⁶ Wheeler, above n 104.

¹⁵⁷ The value of ACT penalty units is set out in the *Legislation Act 2011* (ACT), s 133(2).

infringement notices. The penalty incurred under an infringement notice is \$110 for an individual and \$385 for a corporation.¹⁵⁸

Section 9 of the ACT Act, now expired, provided for review of the ACT Act's operation and for the publication of the review's findings. An interim review was published in November 2012,¹⁵⁹ one year after the ACT ban came into force, with the final review published in April 2014.¹⁶⁰

Along with its distinctive provision for the highest maximum penalties in Australia, the ACT Act also stands apart from other banning jurisdictions in not directly criminalising the giving of false or misleading information in relation to the composition of plastic bags. Some degree of community protection against such activity may, however, be conferred through an indirect means; the ACT Act is among the 'fair trading legislation' overseen by the ACT Commissioner for Fair Trading, who may investigate and act on 'fraudulent conduct or unfair practices'.¹⁶¹

C4. Tasmania

The *Plastic Shopping Bags Ban Act 2013* (Tas) ('the Tasmanian Act') took full effect on 1 November 2013. Combining elements from the SA Act and ACT Act, 'plastic shopping bag' is given a closed definition as a bag 'with handles' that is either (i) made from polyethylene with a thickness of less than 35 microns or (ii) designated as a plastic shopping bag in regulations made under the Act (s 3). The definition specifically exempts biodegradable bags, integrated packaging and barrier bags (s 3).

The offence provision is s 4, which contains two prohibitions directed to retailers. The first prohibition is upon the supply of plastic shopping bags to customers for the purpose of taking away purchased goods (s 4(1)). The second prohibition is upon the provision, by a retailer (defined to include wholesalers), of false or misleading information concerning the composition of a plastic shopping bag (s 4(2)). Prosecutions of the supply offence (s 4(1)) attract fines of up to 50 penalty units (\$7,000) for a corporation and 20 units (\$2,800) for an individual.¹⁶² Prosecutions of the second offence, relating to the provision of false and misleading information, attract greater penalties: 100 units (\$14,000) for corporations and 50 units (\$7,000) for individuals. In most instances, breaches are likely to be dealt with by the issue of infringement notices carrying on the spot fines varying from \$260 (for an

¹⁵⁸ *Magistrates Court (Plastic Shopping Bags Ban Infringement Notices) Regulation 2011*.

¹⁵⁹ Directorate of Environment and Sustainable Development, above n 92.

¹⁶⁰ Directorate of Environment and Sustainable Development, above n 94.

¹⁶¹ *Fair Trading (Australian Consumer Law) Act* (ACT), ss 2, 33(1)(a).

¹⁶² 1 penalty unit = \$140; *Penalty Units and Other Penalties Order 2014* (Tas).

individual, supply offence) to \$1,300 (for a corporation, misrepresentation offence).¹⁶³

A further regulatory measure incorporated directly into the Tasmanian Act allows the Director of the Environment Protection Authority to demand proof from a retailer of the biodegradability of bags being used by that retailer (s 5(1),(2)). Non-compliance by retailers with s 5 directives attracts fines in the same range as those attaching to the s 4(1) supply offence (s 5(3)).

Following the South Australian model, the Tasmanian Act is explicitly linked with the *Environmental Management and Pollution Control Act 1994* (Tas). Section 6(1) of the Tasmanian Act provides that '[t]his Act and the *Environmental Management and Pollution Control Act 1994* are to be read together as if the 2 Acts constituted a single Act'. The intent of this provision is to harness the administrative arrangements and enforcement powers established under the *Environmental Management and Pollution Control Act*. For example, through this coupling of the two Acts, authorised officers are empowered to enter and inspect premises to enforce the plastic shopping bags ban and anyone obstructing them commits an offence.

C5. Queensland

In September 2017, the Queensland Parliament amended the *Waste Reduction and Recycling Act 2011* (Qld) ('the Queensland Act') to include new provisions implementing a plastic shopping bag ban. The ban will take effect on 1 July 2018.

The new provisions are contained within Ch 4, Pt 3A of the Queensland Act. A 'banned plastic shopping bag' is defined as a 'carry bag with handles ... made, in whole or in part, of plastic (whether or not the plastic is degradable) that has a thickness of less than ... 35 microns' (s 99B(1)). The definition specifically excludes barrier bags and integrated packaging (s 99B(2)). The innovative feature of the definition of 'banned plastic shopping bag' is its explicit coverage of 'degradable' (i.e. biodegradable and/or compostable) plastic bags, which will give the Queensland bag ban the widest ambit of operation of all of the Australian regimes. Another provision unique to the Queensland Act is its explicit confirmation that retailers are allowed to charge for alternative shopping bags (s 99F).

There are two offence provisions relating to plastic bags within the Queensland Act, one dealing with supply and the other with false and misleading statements. Each offence incorporates small, but deliberate, refinements upon precursors in other jurisdictions. Section 99D provides that

¹⁶³ *Environmental Management and Pollution Control (General) Regulations 2017* (Tas), reg 19, schedule 2.

'[a] retailer must not give a banned plastic shopping bag to a person to use to carry goods the retailer sells from the retailer's premises'. This prohibition applies 'whether or not a price is charged' for the bag (s 99D(2)). The second offence, in s 99E, is framed very broadly and provides that '[a] person must not give information that the person knows is false or misleading to another person about (a) the composition of a banned plastic shopping; or (b) whether or not a plastic bag is a banned plastic shopping bag'. Both offences will attract maximum penalties of 50 penalty units, currently \$6,307.50.¹⁶⁴

Like precursor regimes in other Australian jurisdictions, the Queensland Act mandates a review of the plastic bag ban at its second year anniversary, expected to be July 2020 (s 99G).

¹⁶⁴ *Penalties and Sentences Regulation 2015* (Qld).

Table C1: Plastic ban regulatory regimes in Australia

Jurisdiction	Legislation	Start date	Operative provision(s)	Penalties	Bags applied to
ACT	<i>Plastic Shopping Bag Ban Act 2010</i>	1 November 2011	s 7: A retailer commits an offence if: a. the retailer supplies a plastic shopping bag to a customer of the retailer; b. the plastic shopping bag is supplied for the customer to carry goods bought, or to be bought, from the retailer.	Maximum fine of 50 penalty units per offence: \$7,500 for an individual; and \$37,500 for a corporation. Infringement notice (on the spot fine): \$110 individual; and \$385 corporation.	s 6: 'plastic shopping bag' defined as 'a bag that is made (in whole or in part) of polyethylene with a thickness of less than 35 microns', or as prescribed in regulations. Specifically excludes biodegradable bags, integrated packaging and barrier bags.
NT	<i>Environment Protection (Beverage Containers and Plastic Bags) Act 2011</i>	1 September 2011	s 57: It is an offence to 'make a prohibited plastic bag available to a customer for carrying goods purchased, or to be purchased, from the retailer.' s 58: An offence is committed if a manufacturer or distributor of plastic bags 'sells, supplies or otherwise provides prohibited plastic bags ...[and represents] that the bags are not prohibited plastic bags.'	Maximum fine of 50 penalty units (\$7,700) for prosecutions; or \$308 for on the spot fine. Maximum fine of 200 penalty units (\$30,800).	s 51: defines a 'prohibited plastic bag' as any carry bag, with handles, 'the body of which comprises (in whole or in part) polyethylene with a thickness of less than 35 microns' or as prescribed in regulations. Specifically excludes biodegradable bags and any 'plastic bag that is, or forms an integral part of, the packaging in which goods are sealed prior to sale'.
SA	<i>Plastic Shopping Bag (Waste Avoidance) Act 2008 (SA)</i>	4 May 2009	s 5(1): Offence committed if '(a) a retailer provides a plastic shopping bag to a customer ... and (b) the plastic shopping bag is provided to the customer as a means of carrying goods purchased ... from the retailer'. No offence committed if a retailer 'believed on reasonable grounds that the bag was not a plastic shopping bag' (s 5(2)).	Maximum fine of \$5,000 per offence for prosecutions; or on the spot fine of \$315.	s 3: 'plastic shopping bag' defined as any carry bag, with handles, 'the body of which comprises (in whole or in part) polyethylene with a thickness of less than 35 microns' or as prescribed in regulations. Specifically excludes biodegradable bags and any 'plastic bag that constitutes, or forms an integral part

			s 6(1): An offence is committed if '(a) a person sells, supplies or provides a bag to another knowing that it is a plastic shopping bag; and (b) prior to, or in the course of, selling, supplying or providing the bag, the person represents to the other that the bag is not a plastic shopping bag'.	Maximum fine of \$20,000 per offence	of, the packaging in which goods are sealed prior to sale'.
Tas	<i>Plastic Shopping Bags Ban Act 2013</i>	1 November 2013	s 4(1): A retailer must not provide to a person a plastic shopping bag for the purpose of enabling goods sold, or to be sold, by the retailer, to be carried from the retailer's premises. s 4(2): A retailer must not give to a person information, about the composition of a plastic shopping bag, that the retailer knows, or ought reasonably be expected to know, is false or misleading.	Maximum per offence of: 50 penalty units, corporations (\$7,000); 20 units, individuals (\$1,400). On the spot fines: \$260 individual, \$650 corporation. Maximum per offence of: 100 units for corporations (\$14,000); 50 units for individuals (\$7,000). On the spot fines: \$650 individual, \$1300 corporation.	s 3: 'plastic shopping bag' defined as a bag 'made, in whole or in part, of polyethylene with a thickness of less than 35 microns', or as prescribed in regulations. Specifically excludes biodegradable bags, integrated packaging and barrier bags.
Qld	<i>Waste Reduction and Recycling Act 2011</i>	1 July 2018	s 99D: a 'retailer must not give a banned plastic shopping bag to a person to use to carry goods the retailer sells from the retailer's premises.' s 99E: a 'person must not give information that the person knows is false or misleading to another person about (a) the composition of a banned shopping bag; or (b) whether or not a plastic bag is a banned plastic shopping bag.'	Maximum penalty is 50 penalty units (\$6,307.50) Maximum penalty is 50 penalty units (\$6,307.50)	s 99B: defines 'banned plastic shopping bag' as 'a carry bag with handles ... made, in whole or in part, of plastic (whether or not the plastic is degradable) that has a thickness of less than ... 35 microns', or as otherwise defined in regulations. Specifically excludes barrier bags and integrated packaging.

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