BRIEFING NOTE

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THE ECONOMIC IMPACT OF MARINE PLASTIC IN SA: SUMMARY AND RECOMMENDATIONS

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KEY FINDINGS

The total economic impact associated with the plastic reaching SA's marine environment each year ranges between R3.5 billion and R34.9 billion per year (0.05 to 0.5% of annual GDP), with a mid-range estimate of R14.1 billion per year (0.2% of GDP). The cost per tonne of plastic (per year) ranges between R70 635 and R698 186 (mid-range estimate of R282 028 per tonne). The lifetime cost per tonne of marine plastic, in terms of its impacts on ecosystem services over its lifetime, ranges between R3.4 million and R33.8 million per tonne (mid-range estimate = R13.5 million per tonne). The plastic entering SA's marine environment each year imposes a total cost of between R169 billion and R1.69 trillion (mid-range estimate = R677 billion) in terms of impacts on ecosystem services over its lifetime.

INTRODUCTION

Leakage of plastic waste into the environment is an issue of increasing global concern. In South Africa, an estimated 40 000 tonnes of mismanaged plastic waste enters the marine environment each year from land-based sources (Verster and Bouwman, 2020); with another 10 000 tonnes per year arising from episodic flooding and marine sources (estimated in this study). In the absence of intervention, flows of plastic waste to the ocean will continue to increase (Jambeck et al., 2015; Tekman et al., 2022; Stafford et al., 2022).

Marine plastic debris can affect the delivery of ecosystem services and cause direct damage to industries such as fisheries, shipping and tourism; with resulting impacts on the economy (see Figure 1). The total economic impact of marine plastic can be divided into three components:

1. **Impacts on marine ecosystem services**
2. **Direct damage to industry** (e.g. **fisheries**, **shipping** (marine transport), and marine & coastal **tourism**)
3. **Costs associated with clearing** of plastic debris

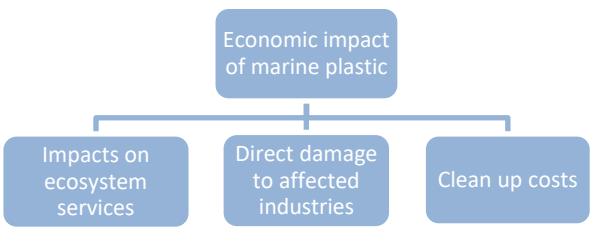

Figure 1. Components of the total economic impact of marine plastic

Policy responses to the plastic pollution crisis must be informed by sound scientific evidence relating to the economic, social and environmental costs and benefits of alternative mitigation strategies. 'Knee-jerk' responses that are not sufficiently informed by evidence can often do more than good. Quantifying the impacts of marine plastic debris in economic terms can therefore provide critical evidence to inform an appropriate policy response, by providing an indication of the benefits of intervention strategies aimed at reducing plastic pollution.

This study provides a preliminary estimate of the costs associated with each of the three components of the total economic impact (see Figure 1); as well as an overall estimate of the economic impact of marine plastic debris in South Africa.

METHODOLOGY

Given the lack of local data and knowledge regarding the impacts of marine plastic on ecosystem services and on industry in South Africa, the study applied the 'benefits transfer' method in order to quantify the costs associated with each of the three components in Figure 1.

This involved adapting the best available global estimates of the impacts of marine plastic (in relevant units) to the SA context, based on relevant local variables. Specifically, it involved the identification of relevant 'unit impact values' from global studies; i.e. estimates that are framed in units (e.g. impacts per

tonne, or in % terms) allowing them to be adapted to a new context based on relevant local variables.

It also involved consultation with relevant local experts and stakeholders to help adapt and refine the unit impact values from the international studies to the SA context as best as possible. An online expert/stakeholder consultation workshop was conducted on 7 December 2022; with 40 participants from government, industry, civil society and academia. The refined unit impact values were then applied to the SA context to derive the total economic impacts of marine plastic in SA.

RESULTS

In terms of impacts on annual ecosystem service delivery, the **plastic entering South Africa's marine environment each year** (estimated at 50 000 tonnes per annum) imposes a cost of **R3.4 billion to R34.1 billion per annum (mid-range estimate = R13.6 billion).** This is equivalent to **R68 142 to R681 423 per tonne of plastic (mid-range estimate = R272 569 per tonne), per annum** (see first row of Table 1).

Table 1. Total economic impact of marine plastic in SA per year (based on 50 000 tonnes of plastic entering the marine environment annually); and costs per tonne

	Annual costs due to plastic entering SA's marine environment each year (R millions)			Annual costs per tonne of plastic entering the marine environment each year (Rands per tonne)		
	Low	Mid-range	High	Low	Mid-range	High
Impacts on ecosystem services (/year)	3 407	13 628	34 071	68 142	272 569	681 423
Direct damage to industry	64	269	475	1 272	5 390	9 507
Clean-up costs	61	203	363	1 221	4 069	7 256
Total	**3 532**	**14 101**	**34 909**	**70 635**	**282 028**	**698 186**

Direct damage to industry (2nd row of Table 1), in terms of **reductions in revenue or GDP in the fisheries, shipping and tourism** sectors, ranges from **R64 million to R475 million per annum (mid-range estimate = R269 million**). This is equivalent to **R1272 to R9507 per tonne of plastic (mid-range estimate = R5390** per tonne).

Clean-up costs for marine plastic (3rd row of Table 1) are estimated at **R61 million to R363 million per annum (mid-range estimate = R203 million** per annum). Note that the clean-up costs per tonne of plastic indicated in Table 1 refer to the costs per tonne of plastic entering the marine environment annually; *not* the costs per tonne of plastic cleared.

The total annual economic impact associated with the plastic reaching the marine environment each year (bottom row of Table 1) ranges from **R3.5 billion to R34.9 billion per year** (**0.05% to 0.5% of SA's annual GDP, or 4.7% to 46% of the plastics industry's direct contribution to GDP)**. The **mid-range estimate is R14.1 billion** per year (**0.2% of GDP,** or **18.6% of the plastics industry's direct contribution to GDP)**.

The total cost per tonne of plastic (per year) ranges from **R70 635 to R698 186 (mid-range estimate = R282 028** per tonne).

Impacts on ecosystem services make up the bulk of the costs associated with marine plastic. Based on the mid-range estimate of annual impacts (R14.1 billion per annum), **impacts on ecosystem services account for 97% of the total**, with direct damage to industry (2%) and clean-up costs (1%) making up a much smaller proportion (Figure 2).

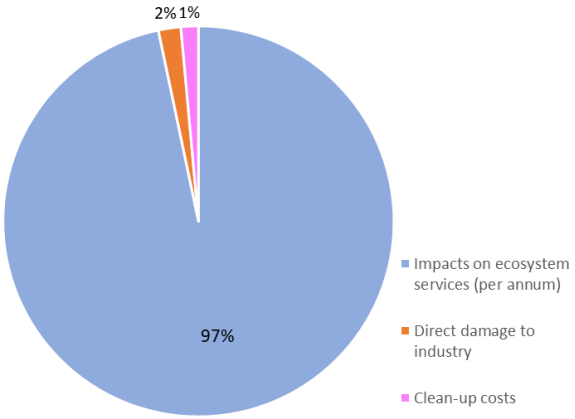

Figure 2. Percentage contribution of each component to the total economic impact

Furthermore, plastic entering the marine environment takes hundreds to thousands of years to break down, and will continue to impose negative impacts on ecosystem services throughout its lifetime. The **lifetime cost per tonne of marine plastic**, in terms of impacts on ecosystem services, **ranges between R3.4 million and R33.8 million (mid-range estimate = R13.5 million**). This implies a total cost of **R169 billion – R1.69 trillion per year (2.5% to 25.5% of SA's annual GDP); with a mid-range estimate of R677 billion (10.2% of annual GDP),** in terms of **impacts on ecosystem services over the lifetime of the plastic entering the marine environment each year.**

CONCLUSIONS

This study provides a *preliminary* estimate of the economic impact of marine plastic debris in SA. The intention was to develop an understanding of the order of magnitude of these impacts; to help move the

discussion forward. Owing to the uncertainties involved, and the lack of relevant South African information; a range of estimates has been provided, based primarily on adapting and adjusting unit impact values from international studies to the SA context as best as possible; while a number of assumptions had to be made. The estimates provided by this study should therefore be used with caution.

In particular, the study underestimates the total environmental impact associated with plastic:

- It only focuses on the impacts of plastic at end of life. Plastic gives rise to various other negative impacts across its life cycle, including greenhouse gas emissions and human health impacts associated with plastic production (WWF, 2021).
- It only focuses on marine plastic. The majority of mismanaged plastic in SA remains in the terrestrial or freshwater environment, or is subject to open burning (Verster and Bouwman, 2020; Stafford et al., 2022).
- It only quantifies impacts in terms of a reduction in ecosystem service delivery, direct damage to industry, and clean-up costs. Impacts on human health and on 'non-use' (existence and bequest) values are more difficult to quantify.
- The estimates are based on current rates of plastic waste generation. In the absence of significant intervention, plastic production and leakage are projected to increase in future (Jambeck et al., 2015; Stafford et al. 2022). This will in turn lead to an increase in the associated impacts.

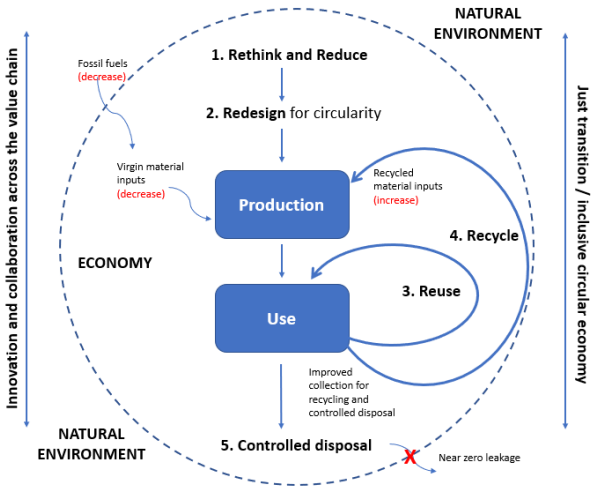

Figure 3. Framework for a circular plastics economy (Source: World Bank and CSIR, 2022)

Given the projected rise in plastic production and consumption in South Africa, **no single intervention strategy implemented in isolation will effectively reduce plastic pollution**. Even with the Extended Producer Responsibility (EPR) Regulations in place, under the current targets for collection and recycling, 2040 levels of plastic pollution will be similar to current levels, given the projected growth in plastic production and consumption (Stafford et al., 2022).

At the same time, the costs estimated in this study should be compared alongside the many benefits of plastic. Plastic is an extremely lightweight, durable and versatile material, which brings significant value to society, and provides a number of socio-economic and environmental benefits as compared to alternative types of materials (World Bank and CSIR, 2022). Life cycle assessment studies show that transitioning away from plastics toward alternatives is not necessarily the solution, particularly if the requisite infrastructure for dealing with alternatives at end of life is not in place.

RECOMMENDATIONS

In order to enable more refined estimates of the impacts of marine plastic in SA, there is a need to **address key gaps in data and knowledge**, particularly regarding:

- How far plastic travels along SA's river systems, and how much of this plastic eventually reaches the marine environment.
- Marine sources of plastic in the SA context.
- Exposure of marine ecosystems in SA to plastic, and the resulting impacts on ecosystem services. Location-specific case studies are needed to enable an improved understanding of impacts across SA's diverse coastal environments.
- The economic value derived by society from the various ecosystem services provided by South Africa's marine ecosystems.
- The total stock of plastic that has accumulated in South Africa's marine environment.
- Impacts of marine plastic on the fisheries, aquaculture, shipping, tourism, and other affected industries; relative to other pressures being faced.
- The total amount of plastic removed from the marine environment through the various types of clean-up efforts in SA, and the costs incurred in such efforts at a national level (or per tonne).
- The other impacts associated with marine plastic not assessed in this study; such as impacts on human health, and on non-use values.

Furthermore, since only a relatively small proportion of waste plastic generated in SA ends up in the marine environment; there is a need to quantify the **negative impacts associated with plastic pollution in terrestrial and freshwater environments** (including impacts on

ecosystem services), as well as the environmental and human health impacts associated with air emissions from **open burning of plastic**.

Finally, in addition to assessing the negative impacts associated with plastic at end of life:

- There is a need to quantify the positive and negative economic, social and environmental impacts (benefits and costs) of both plastic and alternative materials, across their full life cycle, and in different applications; enabling a comparative assessment of plastic and of alternative materials for each application; **to inform a suitable material choice in each application.**
- Building on Stafford et al. (2022); there is a need to assess the cost-effectiveness of alternative intervention strategies (reducing, redesigning, reusing, recycling, and improved waste collection and disposal); as well as their broader economic and social impacts; **to inform an appropriate combination of strategies for reducing plastic pollution in SA** (World Bank and CSIR, 2022).

The cost estimates provided by this study, which can be used to inform the benefits associated with intervention strategies aimed at reducing marine plastic pollution, are one part of this picture.

Given the urgency of the problem, the current lack of data should not be used as an excuse to delay action.

There is a clear need for system-wide change, incorporating a broad range of upstream and downstream interventions; in line with the principles of a circular economy.

In particular, more emphasis is needed on upstream solutions, such as rethinking, reducing and redesigning plastic products for circularity (see Figure 3), so as to avoid the generation of plastic waste in the first place; as compared to the current focus on end-of-pipe solutions aimed at removing plastic that has already entered the environment.

A recent report by the World Bank and CSIR (2022) sets out a vision for a thriving, equitable and inclusive circular plastics economy in South Africa; and recommendations for achieving this vision. Making this transition will require a concerted, collaborative effort among all role players, all working towards a shared vision.

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