

'What happens to plastic in the sea?' and 'How to stop two thirds of plastic waste getting into the sea' references

'What happens to plastic in the sea?' infographic

Sources of plastic entering the ocean:

Green Alliance used data from Australian environmental group Boomerang Alliance to estimate sources of marine litter for the UK

(www.d3n8a8pro7vhmx.cloudfront.net/boomerangalliance/pages/198/attachments/original/1457910411/Media_backgrounder_Government_All_at_Sea_on_Marine_Plastic_Pollution.pdf?1457910411).

The figures are mainly calculated based on plastic consumption by category and assumed leakage rates – this is consistent with methodologies used in peer-reviewed papers – and data from the CSIRO, Australia’s federal agency for scientific research, which has some of the best marine plastics data in the world. In February 2016, this data was put before an Australian senate inquiry, and so subjected to scrutiny by the Australian parliament: www.smh.com.au/environment/marine-plastics-pollution-senate-inquiry-covers-the-ugly-truth-of-the-issue-20160218-gmxoe1.html

Green Alliance believes the comparison between the two countries is reasonable as Australia and the UK have similar wealth and consumption patterns, and the UK’s overall municipal recycling rate is below that of Australia, which was around 50% when the government published its waste review in 2013. We also know from RECOUP that the UK’s overall rigid plastic packaging recycling rate is 45%, and that the figures for Australia are similar: according to the Australia Packaging Covenant’s ‘National Recycling and Recovery Survey (NRRS) 2014–15’, the overall recycling rate for plastic packaging was 46.9%. For plastic bottle recycling in particular, the rate in the UK is 57%, while Australia recycles 81% of PET – the plastic most bottles are made out of – but less than a third of HDPE, which is used to make milk bottles (though these are less likely to be littered) as well as most plastic bags.

The analysis is further supported by evidence from the European Commission, which states: “More than half of the plastic fraction [of marine litter] is composed of plastic packaging waste with plastic bottles and bags being predominant types of plastic packaging”

(<http://ec.europa.eu/environment/marine/pdf/Integration%20of%20results%20from%20three%20Marine%20Litter%20Studies.pdf>). As plastic bags make up relatively little of the plastic waste stream by weight, it is reasonable to assume that plastic bottles make up at least a third of marine plastic litter.

We also cross-referenced our estimates with those based on beach clean-ups – which use a different methodology and so only capture plastics that float and have washed up on the beach (~6% of plastic floats) or which blows onto the beach. These suggest that 46 per cent of items that wash up on beaches are food related packaging, cutlery and straws: www.packagingdigest.com/sustainable-packaging/spc-tackles-global-problem-packaging-and-marine-debris

Our assessment looks at total weight of plastics getting into the ocean – whereas beach clean-up data tends to be presented as numbers of items rather than weight/volume. The total volume of plastic getting into the ocean is likely to be the best proxy for environmental harm: plastics fragment in the ocean so even larger plastic items become small enough to entangle wildlife or to be ingested.

Proportion of plastic that floats or sinks:

Eunomia, 2016, www.eunomia.co.uk/reports-tools/plastics-in-the-marine-environment/

70 per cent or more sinks to the floor, estimates vary. Sources: National Geographic Society, www.nationalgeographic.org/encyclopedia/great-pacific-garbage-patch/ and Earth Institute Columbia University, www.blogs.ei.columbia.edu/2011/01/26/our-oceans-a-plastic-soup/.

Size split of floating plastic:

M Erikson, 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*, vol 9(12)

Local Authority costs of beach cleaning:

This figure is an average of €146,000 per municipality per year for UK, and €200,000 per municipality per year in Belgium and the Netherlands.

As referenced in UNEP, Marine Plastic Debris and Microplastic Technical Report Annex, p35, www.unep.org/about/sgb/Portals/50153/UNEA/Marine%20Plastic%20Debris%20and%20Microplastic%20Technical%20Report%20Advance%20Copy%20Annex.pdf

Species affected by entanglement and plastic ingestion:

D W Laist, 1997, 'Impacts of marine debris: entanglement of marine life in marine debris including a comprehensive list of species with entanglement and ingestion records', *Marine debris, sources, impacts, and solutions*, pp 99–139, Springer-Verlag

Human ingestion of plastic microparticles:

L Van Cauwenberghe and C R Janssen, 2014, 'Microplastics in bivalves cultured for human consumption', *Environmental Pollution*, 193, pp 65-70

Microbead toxicity:

www.web.archive.org/web/20160820231637/http://www.5gyres.org/the-plastic-problem

'How to stop two thirds of plastic waste getting into the sea' infographic

Sources of plastic entering the ocean

(see above)

Deposit return schemes

Deposit return schemes are effective in virtually eliminating beverage litter, which accounts for a third of the volume of plastics entering our seas. Such systems see a small charge placed on container packaging at the point of sale (between 5p and 20p), which can later be redeemed upon the return of the packaging to an authorised centre or the original seller. They are widespread throughout Europe, where 130 million people live in countries with deposit return schemes, and in large portions of North America and Australia.

This study on the effectiveness of 38 bottle deposit return schemes around the world reveals that the best deposit return systems capture over 95 per cent of beverage containers:

<http://www.cmconsultinginc.com/wp-content/uploads/2017/05/BOOK-Deposit-Global-24May2017-for-Website.pdf>

Operation Clean Sweep

Nurdles are small plastics pellets that are used to manufacture nearly all plastic, and that end up in the marine environment as a result of spills and mishandling. Operation Clean Sweep is an international industry led programme to prevent nurdle leakage into the environment. It involves the whole value chain across the plastics industry, from plastics producers to processors, to logistics operators. At present, Operation Clean Sweep is only a voluntary initiative and there is no enforcement mechanism to

ensure that companies adhere to best practice to prevent pellet loss. Mandatory measures should be put in place to address what is effectively a form of industrial pollution.

Marlisco, 2017, <http://www.marlisco.eu/operation-clean-sweep-plastic-pellet-loss-prevention-manual-and-pledge-uk.en.html>

Enforcing existing bans on maritime litter

Norway has put a ban in place on fish discards, an initiative that has proven successful in reducing discards over the years. Enforcement includes a marine patrol presence through the coastguard, which was found to be a key deterrent to discarding. A similar catch quota management scheme implemented in the North Sea includes a remote electronic monitoring system with CCTV cameras on board fishing vessels. Based on the success of this scheme in reducing fish discards, similar enforcement mechanisms could be applied for existing bans on maritime litter. This could include mandatory GPS on board to facilitate the location of maritime waste for retrieval, mandatory reporting of gear loss and monitoring through aerial footage.

Based on recent discard estimates for Norway (2- 8 per cent), we estimate the Norwegian ban to have cut fish discards by 90 per cent.

B Diamond and B D Beukers-Stewart, 2011, 'Fisheries Discards in the North Sea: Waste of Resources or a Necessary Evil?', *Reviews in Fisheries Science*, 19: 3, pp 231-245
[https://www.york.ac.uk/media/environment/documents/msc/mem/publications/Diamond%20&%20Beukers-Stewart%20\(2011\)-1.pdf](https://www.york.ac.uk/media/environment/documents/msc/mem/publications/Diamond%20&%20Beukers-Stewart%20(2011)-1.pdf); European Commission, 2011, p1 and p7,
https://ec.europa.eu/fisheries/sites/fisheries/files/docs/body/report_en.pdf

Enforcement measures are discussed in: European Commission, 2011, p 7
https://ec.europa.eu/fisheries/sites/fisheries/files/docs/body/report_en.pdf; Eunomia, 2016, pp v-vii
<http://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/pdf/MSFD%20Measures%20to%20Combat%20Marine%20Litter.pdf>

Sand filtration for waste water treatment

Synthetic fibres from clothing enter the wastewater system as microplastic fragments through industrial laundries or domestic washing machines. Standard waste water treatment cannot remove such small particles, and consequently plastic fibres are prevalent in the marine environment. Sand filtration is a tertiary treatment that can be introduced in addition to the currently implemented waste water treatment processes. In this step, the pre-treated waste water passes through a sand layer that removes contaminants including suspended solids like synthetic fibres.

As detailed in the Environment Audit Committee inquiry, sand filtration is estimated to remove about 85 per cent of microplastics during waste water treatment.

Environment Audit Committee,
2016, <https://publications.parliament.uk/pa/cm201617/cmselect/cmenvaud/179/17907.htm>

Similar results on the effective removal of microplastics are reported in:

J Talvitie et al, 2017, Solutions to microplastic pollution – Removal of microplastics from wastewater effluent with advanced wastewater treatment technologies, *Water Research*, 123, pp 401-407.

Ban microbeads

Plastic microbeads are commonly used in personal care products and cosmetics. Over 680 tonnes of plastic microbeads are estimated to be used in the UK every year. Use of these products, which can contain several thousand microbeads per gram of product, results in the direct entry of plastic beads into the wastewater system and eventually the aquatic environment. Various cosmetics companies have

committed to phasing out microbeads, but the commitment is not universal. Speaking to WWF on 21 July 2017, Defra Secretary of State Michael Gove confirmed that a UK ban on the manufacture of microbeads in rinse-off cosmetics and personal care products will be implemented by the end of the year.

The Environment Audit Committee inquiry provides an overview of microbeads and the role of legislative action in preventing microbeads pollution:

Environment Audit Committee, 2016,

https://publications.parliament.uk/pa/cm201617/cmselect/cmenvaud/179/17906.htm#_idTextAnchor014