Plastic references

1. Two strains of marine *Prochlorococcus* (the most abundant photosynthesising organism on earth – responsible for producing 10% of the world's oxygen) were exposed to leachate from common plastic items: high density polyethylene bags and polyvinyl chloride matting. Leachate exposure strongly impaired in vitro growth and photosynthetic capacity, and resulted in genome-wide transcriptional changes. Consequently, plastic leachate exposure could potentially influence the broader composition and productivity of ocean phytoplankton communities.
   Tetu S, Sarker I, Schrameyer V, Pickford R, Elbourne L, Moore L, Paulsen I. 2019. *Plastic leachates impair growth and oxygen production in Prochlorococcus, the ocean's most abundant photosynthetic bacteria.* Communications Biology (2019)2:184

   https://doi.org/10.1038/s42003-019-0410-x

2. Plastic has been found as deep as the Mariana Trench, over 10,000 metres below sea level. Plastic waste in the open is broken down by wind, waves and sunlight. This fragmentation process releases chemical additives, which can have grave effects, ranging from reduced reproduction rates in fish, hormones imbalances, reduced fertility, cardiovascular diseases, diabetes and cancer in humans. The scale and potential impacts of plastic pollution may be far greater than previously thought as new research (1.) shows severely reduced rate of growth and oxygen production of marine photosynthesising bacteria. Article discusses potential actions including physical removal such as The Ocean Clean Up and investing in chemical removal technologies.
   Petra Cameron, Senior lecturer in Chemistry at University of Bath; Philippa Kearney, PhD researcher, University of Bath. May 23, 2019. *Plastic poisons ocean bacteria that produce 10% of world's oxygen and prop up the marine food chain*

   https://theconversation.com/plastic-poisons-ocean-bacteria-that-produce-10-of-the-worlds-oxygen-and-prop-up-the-marine-food-chain-117493

3. Around 570 000 hermit crabs killed on Coco Islands (Indian Ocean) and Henderson Island (Pacific Ocean) by being trapped in plastic debris. Hermit crabs play a crucial role in the health of tropical environments by aerating and fertilising soil, dispersing seeds, removing detritus and being a key part of the ecosystem. The loss of their population risks the natural environment and ultimately will have an economic impact as it will affect the marine ecosystems that humans rely on for fishing and tourism.
   Dr Jennifer Lavers, Institute for Marine and Antartic Studies. December 5, 2019. *Half a Million Crabs Killed by Plastic Debris on Remote Islands*

   https://www.imas.utas.edu.au/news/news-items/half-a-million-crabs-killed-by-plastic-debris-on-remote-islands

4. Eco glitter: a supposedly environmentally friendly alternative made from PET has been shown to affect root length and chlorophyll levels in plants. All glitter impacts aquatic

ecosystems within a short period of time. The biodegradable cellulose based glitter encouraged an invasive New Zealand mud snail.
Green DS, Jefferson M, Boots B, Stone L. 2021. *All that glitters is litter? Ecological impacts of conventional versus biodegradable glitter in a freshwater habitat.* Journal of Hazardous Materials. Vol 402. Jan 15 2021.

https://www.sciencedirect.com/science/article/abs/pii/S0304389420320604?via%3Dihub

https://www.sciencetimes.com/articles/27723/20201015/glitters-makeup-dresses-damaging-freshwater-habitats.htm

Morrisons, Waitrose and John Lewis were set to remove glitter and 50 tonnes of plastic from their shelves by Christmas 2020

5. Plastic debris in Marine Environment. Laboratory studies have shown microplastics are readily ingested by filter-feeders, deposit feeding worms and detritivores and chemicals used in plastics have been found in fish, marine mammals and molluscs. In addition to potentially toxic chemicals being released from the plastics, small quantities of plastics also have the potential to increase the transport of contaminant to marine organisms, thereby acting as a vector.
Prof Richard Thompson OBE, School of Biological and Marine Sciences, University of Plymouth.

https://publications.parliament.uk/pa/cm201213/cmselect/cmsctech/writev/932/wq17.pdf

https://impact.ref.ac.uk/casestudies/CaseStudy.aspx?Id=4586

6. Lugworms ingesting microplastics become contaminated with hydrocarbons, antimicrobials and flame retardants. Lugworms eat plastic, then starve to death and are poisoned by the chemicals. We need to reduce plastic waste entering the seas.
Professor Tamara Galloway, Professor of Ecotoxicity, Plymouth University
Stephanie Wright, Biosciences researcher, Exeter University
Wright SL, Rowe, D, Thompson RC, Galloway TS. 2013. *Microplastic ingestion decreases energy reserves in marine worms.* Current Biology. Vol 23; Issue 23; R1031-1033

https://www.sciencedirect.com/science/article/pii/S0960982213013432

7. Plastic production and incineration will add 850 million metric tons of greenhouse gases to the atmosphere – this equates to 189 coal fired plants. 99% plastic made from natural gas, oil and coal. Refining raw materials into plastic is most energy intensive and carbon intensive of all industrial processes. Exxon, Shell and other petrochemical producers are massively expanding in infrastructure for making plastic. Fracking is boosting plastic production: Centre for International Environmental Law Report 2019

https://www.ciel.org/wp-content/uploads/2019/05/Plastic-and-Climate-FINAL-2019.pdf

Less than 4% of all single use plastics made are currently recycled i.e. less than 9% of the 45% recyclable single use plastics manufactured.
Microplastics continually release small amounts of greenhouse gases indefinitely as do the plastics found on land – on beaches, farmland etc.

8. Every human on earth ingests nearly 2000 particles of plastic a week. More than half the plastic on Earth has been created since 2002 and plastic production is on pace to double by 2030. Plastic is being found everywhere that anyone is looking. The Great Pacific Garbage Patch is now twice the size of Texas, but unlike crude oil, the long molecular chains in plastic do not meaningfully degrade. Many countries are waking up to the plastic crisis, but USA is promoting the plastic industry's aggressive expansion. PLASTICS (Plastics Industry Association) is a trade group working to thwart state and municipal bans on SUPs.
   Reluctance from big companies to look at alternatives to plastic and admit extent of the problem.
   Tim Dickinson. March 3, 2020 *How Big Oil and Big Soda kept a global environmental calamity a secret for decades.* Rollingstone.com

   https://www.rollingstone.com/culture/culture-features/plastic-problem-recycling-myth-big-oil-950957/

9. Dangers of burning plastics – dioxins, furans and carbon monoxide are all released when plastic is burnt. Dioxins and furans have been linked to cancer and respiratory diseases in humans. Dioxin is the most potent synthetic carcinogen ever tested in laboratory animals. Dioxins disrupt hormones and accumulate within the human body, therefore being passed on to babies via the placenta.
   Heba Soffar. Jul 4 2015, updated Jan 19 2021.

   https://www.online-sciences.com/health/dangers-and-bad-effects-of-burning-plastics-and-rubber-on-humans-and-global-warming/

   Incineration of plastic waste in an open field is a major source of air pollution as it releases dioxins, furans, mercury and polychlorinated biphenyls into the atmosphere. Dioxins settle on our crops and in our waterways and eventually enter our food and hence the body system, causing cancer and neurological damage, and disrupting the reproductive, thyroid and respiratory systems. Thus, burning of plastic waste increases the risk of heart disease, causes respiratory diseases and rashes, nausea and headaches, and damages the nervous system.
   Verma R, Vinoda KS, Papireddy M, Gowda ANS. 2016. *Toxic Pollutants from Plastic Waste – A Review*. Procedia Environmental Sciences vol 35, 2016: 701-708

   https://www.sciencedirect.com/science/article/pii/S187802961630158X

10. Toxic chemicals released during manufacture – a multitude of carcinogenic, neurotoxic and hormone disruptive chemicals, and standard ingredients and waste products of plastic pollution. Online article 2020

https://www.sciencedaily.com/releases/2020/12/201215131242.htm

11. BPA-free plastic containers may be just as hazardous. Animal studies find that a replacement for the oestrogen-mimicking chemical Bisphenol A may also be harmful to human health. BPS was used as a replacement. Then it was found that 81% of Americans tested have detectable levels of BPS in their urine. BPS can disrupt a cell's functioning leading to such metabolic disorders as diabetes, obesity, asthma, birth defects and cancer. Jenna Bilbrey. Aug 11 2014 Scientific American

    https://www.scientificamerican.com/article/bpa-free-plastic-containers-may-be-just-as-hazardous/

    Sonya Lunder, a senior analyst with the Environmental Working Group, suggests staying away from the culprits that we commonly associate with BPA: water bottles, baby bottles, the lining of canned goods, thermal paper, receipt paper, FedEx waybills, medical imaging results eg ultrasounds, deli meat paper and number 7 plastics such as hard plastic toys, straws and food containers. It may also be wise to limit use of BPA fee products after a study published in the journal, Environmental Health, found that these products leached the same type of oestrogenic chemicals similar to BPA.
    Article by Carey Rossi. Jul 9 2014

    https://www.prevention.com/health/a20474623/danger-of-bpa-and-plastic-alternatives-like-bps/

12. "what happens to your recycling": Today in Focus podcast – Guardian reporters

    https://www.theguardian.com/news/audio/2019/jul/08/what-really-happens-to-the-waste-in-your-recycling-bin-podcast

13. Cattle grazing on plastic waste photo (Indonesia): Rollingstone.com. March 5 2020

14. Elephants foraging at rubbish dump photo (Oluvil, Sri Lanka): Thanmaplan Tilaxan – cover images. Oct 4 2020

15. Seal in plastic rope photo: A Plastic Ocean trailer screenshot – Telegraph.co.uk

16. A 2017 study found that sperm counts fell 59% from 1973 to 2011, citing "everywhere chemicals found in plastics, cosmetics and pesticides that affect endocrine system eg phthalates and BPA; also found more miscarriages, earlier puberty in girls and more genital abnormalities among boys".
    Environmental and reproductive epidemiologist Dr Shanna Swan, Icahn School of Medicine, Mount Sinai, New York 2017 (article Guardian online Feb 27 2021)

    https://www.theguardian.com/us-news/2021/feb/26/falling-sperm-counts-human-survival

    https://www.nytimes.com/2017/08/16/health/male-sperm-count-problem.html

17. Toxic chemicals leach their way into our food.
Nydia Gutierrez, Earth Justice. Aug 22 2019

https://earthjustice.org/blog/2019-august/toxic-chemicals-leach-into-food

18. Evaluating leachable chemicals from inhaler devices etc / how much leaches from packaging - European Food Safety Authority (EFSA) + US FDA
Sarah Everts, cen.acs.org. Aug 31 2009 Vol 87 Issue 35

https://cen.acs.org/articles/87/i35/Chemicals-Leach-Packaging.html

19. Scientists claim synthetic chemicals leach into food: formaldehyde, (present in plastic fizzy drinks' bottles and melamine tableware), BOA, tribulytin, triclosan, phthlates etc altogether 400 chemicals are involved.
Journal of Epidemiology and Community Health (BMJ group) – reported in Guardian Sarah Bosley, Health Editor. Feb 19 2014

https://www.theguardian.com/world/2014/feb/19/chemicals-leaching-food-packaging-safety-bmj

https://www.sciencedaily.com/releases/2014/02/140219205215.htm

20. Sicker, Fatter, Poorer: The Urgent Threat of Hormone Disrupting Chemicals to Our Health and Future & what we can do about it. (book)
Leonardo Trasande MD MPP, New York University School of Medicine. Jan 8 2019

21. Plastic planet: how tiny plastic particles are polluting our soil. Micro plastics in the soil may carry disease causing organisms and act as vectors for diseases in the environment. Microplastics can also affect health and functioning of soil fauna e.g. earthworms.

UN environmental programme. Apr 3 2018

https://www.unep.org/news-and-stories/story/plastic-planet-how-tiny-plastic-particles-are-polluting-our-soil

22. Persistent contaminants and herpesvirus OtHVI are positively associated with cancer in wild Californian Sea Lions.
Conclusion: This study has implications for human health, as virally associated cancer occurs in humans and likelihood of cancer developing could similarly be increased by exposure to environmental contaminants. Efforts to prevent ecosystem contamination with persistent organic pollutants (POPs)must be improved to protect both wildlife and human health.
Frances Gulland, Frontiers in Marine Science (marinemammalcenter.org). Dec 10 2020

https://www.frontiersin.org/articles/10.3389/fmars.2020.602565/full

23. Me, My Clothes and the Ocean. The role of textiles in microfibre pollution; accumulation of microplastic on shorelines worldwide.
Browne MA, Crump P, Niven SJ, Teulen E, Tonkin A, Galloway T, Thompson R: Environmental Science and Technology (2011) 45: 9175-9179

https://assets.ctfassets.net/fsquhe7zbn68/4MQ9y89yx4KeyHv9Svynyq/8434de64585e9d2cfbcd3c46627c7a4a/Research_MicrofibersReport_191004-e.pdf

24. "Bali's beaches buried in tide of plastic rubbish during monsoon season"
"90 tonnes of rubbish were collected on Friday and Saturday"
Dr Denise Hardesty, a principal research scientist at Australia's CSIRO Science Agency, and an expert on global plastic pollution says, "It's been growing over the last decade"
Graham Readfearn with Australian Associated Press. Jan 3 2021

https://www.theguardian.com/world/2021/jan/04/balis-beaches-buried-in-tide-of-plastic-rubbish-as-monsoon

25. Mussels sold in grocery stores around the world contain microplastic particles.
Yale School of the Environment. Dec 17 2020

https://e360.yale.edu/digest/mussels-sold-in-grocery-stores-around-the-world-contain-microplastic-particles

26. *Bank lending to plastics industry faces scrutiny as pollution concerns mount.*
Banks have provided $1.7 trillion of finance to 40 companies in the plastic supply chain without imposing any requirements to tackle plastic pollution pouring in to the world's rivers and oceans.
Matthew Green, Reuters. Jan 7 2021

https://www.reuters.com/article/us-environment-plastic-banks-idUSKBN29C002

27. The billions upon billions of items of plastic waste choking our oceans, lakes and rivers and piling up on land is more than unsightly and harmful to plants and wildlife. The 9 facts on the fact sheet shed light on how single-use-plastic is a large problem that most people are part of (includes references for all the facts). Mar 29 2018

https://www.earthday.org/fact-sheet-single-use-plastics/

28. Plastic warms the planet twice as much as aviation. Plastics account for 3.8% of global gas emissions. Demand is set to rise. If the demand for plastic continues to grow at its current rate of 4% per year, emissions from plastic production will reach 15% of global emissions by 2050.
Laurie Wright, Senior Lecturer, Warsash School of Maritime Science and Engineering, Solent University. May 17 2019

https://environmentjournal.online/articles/plastic-warms-the-planet-twice-as-much-as-aviation-heres-how-to-make-it-climate-friendly/

29. Recycling is not going to solve the plastic pollution – Greenpeace

    https://www.greenpeace.org/africa/en/blogs/11670/recycling-is-a-false-solution-to-plastic-pollution/

    https://www.greenpeace.org.uk/wp-content/uploads/2020/07/GP-11-14-Plastic-Final.pdf

    Key facts about plastic pollution – Greenpeace
    8.3 billion tonnes produced since 1950s. Only 9% of this has been recycled, 12% has been burned and 79% has ended up in landfills or the environment.

    https://www.greenpeace.org/usa/key-facts-about-plastic-pollution/

30. Plastic pollution has a negative impact on our oceans and wildlife health. High-income countries generate more plastic waste per person. However, it is the management of plastic waste that determines the risk of plastic entering the ocean so the improvement of waste management systems across the world is critical to reducing plastic pollution.
    Hannah Ritchie, Max Roser. Sep 2018. *Plastic pollution.*

    https://ourworldindata.org/plastic-pollution

31. Per- or poly-fluorinated alkyl substances (PFAS) are a group of over 4700 industrial chemicals used in everyday products. PFAS are often referred to as 'forever chemicals' because of their extreme persistence in the environment. We know very little about the health and environmental toxicity of the vast majority of this huge group of chemicals, but the ones that have been studied in depth are toxic. They cause harm to humans and wildlife and once they get into the environment there is virtually no way of getting rid of them. Continuing to produce and use PFAS at our current rate is a risk too great to accept.

    https://www.pfasfree.org.uk/about-pfas