WWF

ANALYSIS

INT

2019

NO PLASTIC IN NATURE:

ASSESSING PLASTIC INGESTION FROM NATURE TO PEOPLE

AN ANALYSIS FOR WWF BY

Dalberg

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

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WWF

WWF is one of the world's largest and most experienced independent conservation organizations, with over 5 million supporters and a global network active in more than 100 countries.

WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

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PLASTIC IS POLLUTING THE AIR WE BREATHE, THE WATER WE DRINK AND THE FOOD WE EAT.

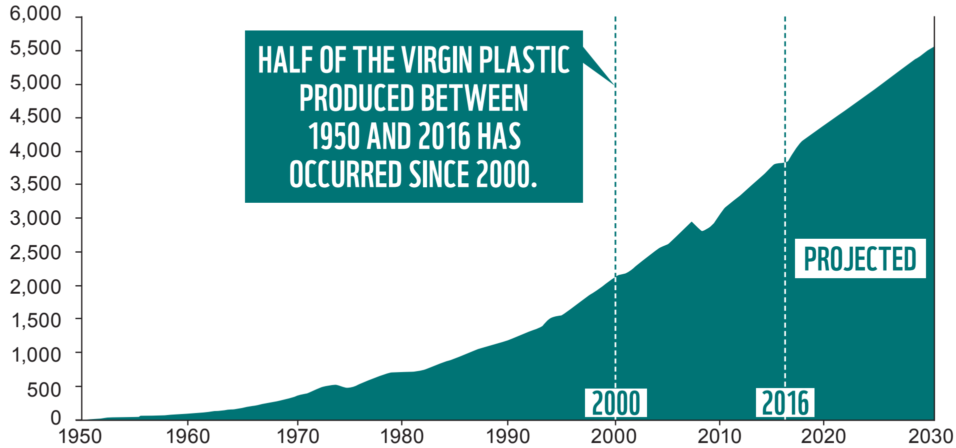
A new study by the University of Newcastle, Australia suggests that an average person could be ingesting approximately 5 grams of plastic every week. The equivalent of a credit card's worth of microplastics. This summary report highlights the key ways plastic gets into our body, and what we can do about it.

Increasing plastic use and limited recycling results in towering plastic production. Since 2000, the world has produced as much plastic as all the preceding years combined[1], a third of which is leaked into nature[2]. The production of virgin plastic has increased 200-fold since 1950 and has grown at a rate of 4 per cent a year since 2000. If all predicted plastic production capacity is reached, current production could increase by 40 per cent by 2030[3].

As of today, a third of plastic waste ends up in nature, accounting for 100 million metric tons of plastic waste in 2016[4]. Plastic is used as a disposable material, to such an extent that over 75% of all plastic ever produced is waste[5]. A significant portion of this waste is mismanaged. Mismanaged waste is a direct result of underdeveloped waste management infrastructure and refers to plastic left uncollected, openly dumped, littered, or managed through uncontrolled landfills[6]. Of this mismanaged waste, about 87% is leaked into nature and becomes plastic pollution[7]. For instance, if nothing changes, the ocean will contain 1 metric ton of plastic for every 3 metric tons of fish by 2025 [8].

Plastic pollution affects the natural environment of most species on the planet. Plastic has been found at the bottom of the Mariana trench[9] and in Arctic sea ice[10], in addition to covering coastal ecosystems and accumulating in ocean gyres in all parts of the world. Animals get entangled in large plastic debris, leading to acute and chronic injury or death. Wildlife entanglement has been recorded in over 270 different species, including mammals, reptiles, birds and fish[11]. Animals also ingest large quantities of plastic and are unable to pass the plastic through their digestive systems, resulting in internal abrasions, digestive blockages, and death[12]. Further, toxins from ingested plastic have also been shown to harm breeding and impair immune systems. Finally,

Figure 1: Total production of virgin plastic by year, 1950-2030 (forecasted)



microplastics pollution has been shown to alter soil conditions, which can impact the health of fauna and increase the likelihood of harmful chemicals leaching into the soil[13].

Microplastics are contaminating the air we breathe, the food we eat, and the water we drink. Microplastics are defined as plastic particles under 5mm in size[14]. Primary microplastics are plastics directly released into the environment in the form of small particulates (shower gel microbeads, tyre abrasion, etc.) while secondary microplastics are microplastics originating from the degradation of larger plastic (e.g. degraded plastic bags).

AN AVERAGE PERSON COULD BE INGESTING APPROXIMATELY 5 GRAMS OF PLASTIC PER WEEK. THE EQUIVALENT OF ONE CREDIT CARD.

A new study by the University of Newcastle, Australia, takes a closer look at the data gap on what plastic pollution means for human nutrition[15]. The study estimates the average amount of plastic ingested by humans by analyzing and synthesizing the existing but limited literature on the topic. The results confirm concerns over the large quantity of plastic we ingest every day.

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AN AVERAGE PERSON COULD BE INGESTING APPROXIMATELY 5 GRAMS OF PLASTIC EVERY WEEK

Study methodology and limitations

The study by the University of Newcastle, discussed below builds on a comprehensive review of existing studies to estimate plastic ingestion through inhalation, food, and beverages. The approach was to focus on available data and to use conservative extrapolations and assumptions when data was not available.

While this study represents a synthesis of the best available data, it builds on a limited set of evidence, and comes with limitations. The consensus among specialists is thus that while these numbers are in a realistic range, further studies are needed to get a precise estimate.

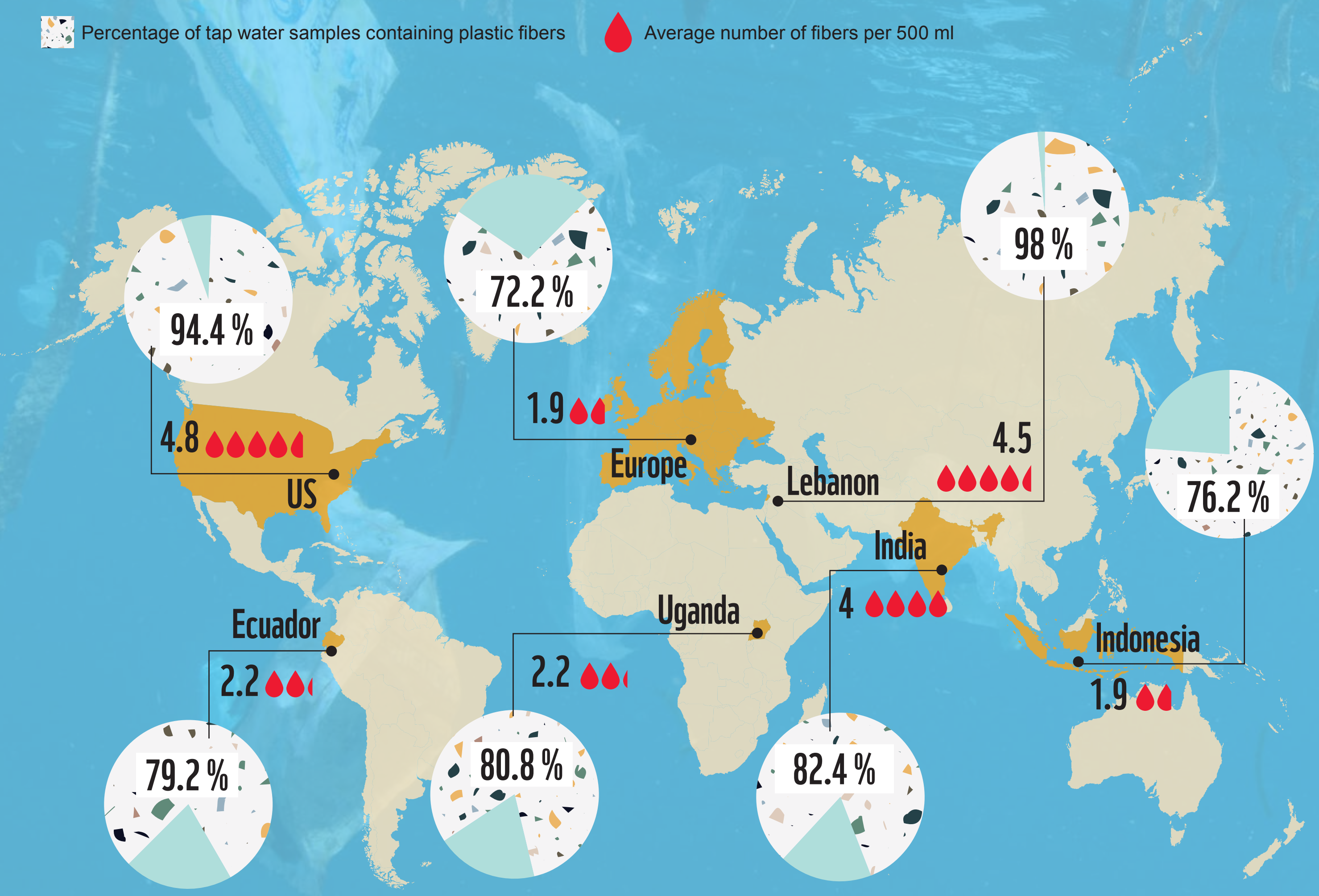
A key limitation is the lack of data available on crucial metrics, such as weight and size distribution of microplastics in natural environments, and the varying quality of data collected. A widespread issue in data collection for instance is variations in sample collection methodologies leading to risks of contamination. This issue was for example raised by the scientific community regarding the Invisible plastics (2017). The Newcastle study team used assumptions and extrapolations to bridge data gaps and adjust for data quality. It is acknowledged that with every assumption and extrapolation, the level of uncertainty increases, and further research and data collection is needed to ascertain these results.

The study reveals that consumption of common food and beverages may result in a weekly ingestion of approximately 5 grams of plastic, depending on consumption habits. Out of a total of 52 studies that the University of Newcastle included within its calculations, 33 studies looked at plastic consumption through food and beverage. These studies highlighted a list of common food and beverages containing microplastics, such as drinking water*, beer, shellfish, and salt. The results are shown in the figure *2*.

Figure 2: Estimated microplastics ingested through consumption of common foods and beverages (particles (0-1mm) per week)

* *Drinking water includes both tap and bottled water*

Figure 3: Map of average percentage of tap water sample containing plastic fibers and average number of fibers (>100um) per 500ml[16]



The largest source of plastic ingestion is drinking water* with plastic found in water (groundwater, surface water, tap water and bottled water) all over the world [17]. All samples were found to contain plastic in a study on bottled water, which used a limited sample of locations around the world[18]. As shown figure 3, a recent study, suggests large regional variations, with twice as much fibres per 500ml observed in American or Indian water as in European or Indonesian tap water [19]. Another key source is shellfish, accounting for as much as 0.5 grams a week. This comes from the fact that shellfish are eaten whole, including their digestive system, after a life in plastic-polluted seas.

Inhalation estimates represent a negligible proportion of microplastics entering the human body but may vary heavily depending on the environment. The study surveys 16 papers focusing on outdoor and indoor air quality. The results show that indoor air is more heavily plastic polluted than the outdoors. This comes from the limited air circulation indoors, and the fact that synthetic textiles and household dust are among the most important sources of airborne microplastics. This estimate is very conservative, but hints at the fact that exposure to airborne microplastics may vary largely depending on local conditions and lifestyle. However, what is clear is the ubiquitous nature of the presence of microplastics in the air: a recent study found microplastics on the top of the Pyrénées mountains in the south of France due to airborne microplastics travel[20].

Going forward, scientists are working to obtain more precise information on pollution from plastic, how it is distributed and how much is consumed. Some important areas of enquiry the research community is currently exploring include mapping the size and weight distribution of plastic waste particles, and how plastic particles – when consumed by an animal – travel into muscle tissue. An example of an ongoing project is the tracking of plastic in the oceans. The project, which lasts until 2022, aims to create a 3D map of ocean plastic litter. A better mapping of microplastics in the environment will allow for more fine-tuned estimation of plastics ingested based on microplastic size, shape, polymer type and particle size distribution, depending on the surrounding environment and geographical location. Another key area of research focuses on identifying the health effects of plastic ingestion on humans.

THE LONG-TERM EFFECTS ON OUR HEALTH OF INGESTING LARGE QUANTITIES OF PLASTIC ARE NOT CLEAR BUT STUDIES ARE UNDERWAY.

The specific effects of microplastics ingestion on human health are not yet fully understood, but scientists suspect that the health hazard may be more important than is currently understood[21].

The long-term effects of plastic ingestion on the human body are not yet well documented. But studies have shown that beyond a certain exposure level, inhalation of plastic fibres seem to produce mild inflammation of the respiratory tract[22]. In marine animals, higher concentrations of microplastics in their digestive and respiratory system can lead to early death[23]. Research studies have demonstrated toxicity *in vitro* to lung cells, the liver, and brain cells[24].

Some types of plastic carry chemicals and additives with potential effects on human health. Identified health risks are due to production process residues, additives, dyes and pigments found in plastic[25], some of which have been shown to have an influence on sexual function, fertility and increased occurrence of mutations and cancers[26,27]. Airborne microplastics may also carry pollutants from the surrounding environment. In urban environments, they may carry PAHs – molecules found in coal and tar – and metals[28].

Studies are underway to better understand the effects of plastic on our health. A key challenge to research is the overwhelming presence of plastic in our daily life, making it very hard to isolate the effect of a specific exposure pathway from other possible causes of exposure. The World Health Organization is currently undertaking a review of the health impact of microplastics[29]. The University of Newcastle in Australia is currently working on a synthesis of existing literature on this topic.

WWF'S CALL FOR COLLECTIVE GLOBAL ACTION

Plastic is affecting entire ecosystems, potentially leading to a collapse in systems supporting people's livelihoods. Plastic pollution has important economic consequences: the UN Environment Programme (UNEP) estimates the economic impact of plastic pollution on oceans at US$8 billion per year[30].

The current global approach to addressing the plastic crisis is failing. Governments play a key role to ensure all actors in the plastic system are held accountable for the true cost of plastic pollution to nature and people. Systemic solutions using strategic and tactical interventions are required to stop plastic pollution at its source, and bold action from a broad range of stakeholders is needed across the full plastic lifecycle to implement these interventions.

WWF CALLS ON ALL GOVERNMENTS TO:

- **Support further research to fill the knowledge gaps on plastic and microplastics in nature**: better understand how plastic and microplastics enter living organisms and what are the exact consequences on their health.
- **Establish a global scientific body to assess and synthesize best available research on plastic and microplastics in nature**. Such a body would enable the scientific community to pool resources and develop common standards for measuring plastic pollution leakage.
- **Agree to a legally binding international treaty to stop plastic pollution from leaking into the oceans**, thereby significantly contributing to Sustainable Development Goal 14.1 and paving the way for an **accountability framework** to address plastic pollution on a global level.
- **Establish national targets for plastic reduction, recycling and management in line with global treaty commitments,** including transparent reporting mechanisms that recognize the trans-boundary nature of the problem.
- **Deploy appropriate policy instruments** to incentivize the creation and use of recycled plastic over new plastic, and the development of viable alternatives to plastic that have smaller environmental footprints.
- **Collaborate with industries and civil society groups** to ensure a systems-based approach that addresses plastic production, consumption, waste management and recycling as a singular system, and refrain from individual, fragmented or symbolic policy actions.
- **Invest in ecologically-sound waste management systems** domestically and in countries where a nation's plastic waste is exported for disposal, thereby locking in long-term economic and environmental benefits.
- **Legislate effective extended producer responsibility** as a policy mechanism for all plastic-producing sectors to ensure the greater accountability of companies in the collection, reduction, recycling and management of the plastic waste originating in their trade chains.
- **Implement sufficient monitoring and compliance measures** for all policies related to the production, collection and management of waste by all stakeholders in the plastic system, supported by a shared global reporting and monitoring framework.
- **Work at appropriate subnational levels** to establish robust management plans and transparent accounting mechanisms that prevent plastic leakage into water systems or other mismanaged waste disposal mechanisms.

For more information on how to solve plastic pollution, you can read the WWF March 2019 report, *Solving Plastic Pollution Through Accountability*, available https://www.worldwildlife.org/publications/solving-plastic-pollution-through-accountability. You can find out more about the University of Newcastle study https://www.newcastle.edu.au/newsroom/featured-news/plastic-ingestion-by-people-could-be-equating-to-a-credit-card-a-week

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Assessing plastic ingestion from nature to people

5g

Average person could be ingesting approximately 5 grams of plastic every week.

75%

Of all plastic ever produced is waste

87%

About 87% of mismanaged waste is leaked into nature and becomes plastic pollution.

1 ton

The ocean will contain 1 metric ton of plastic for every 3 metric tons of fish by 2025.

100% RECYCLED

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To stop the degradation of the planet's natural environment and to build a future in which people live in harmony with nature.

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