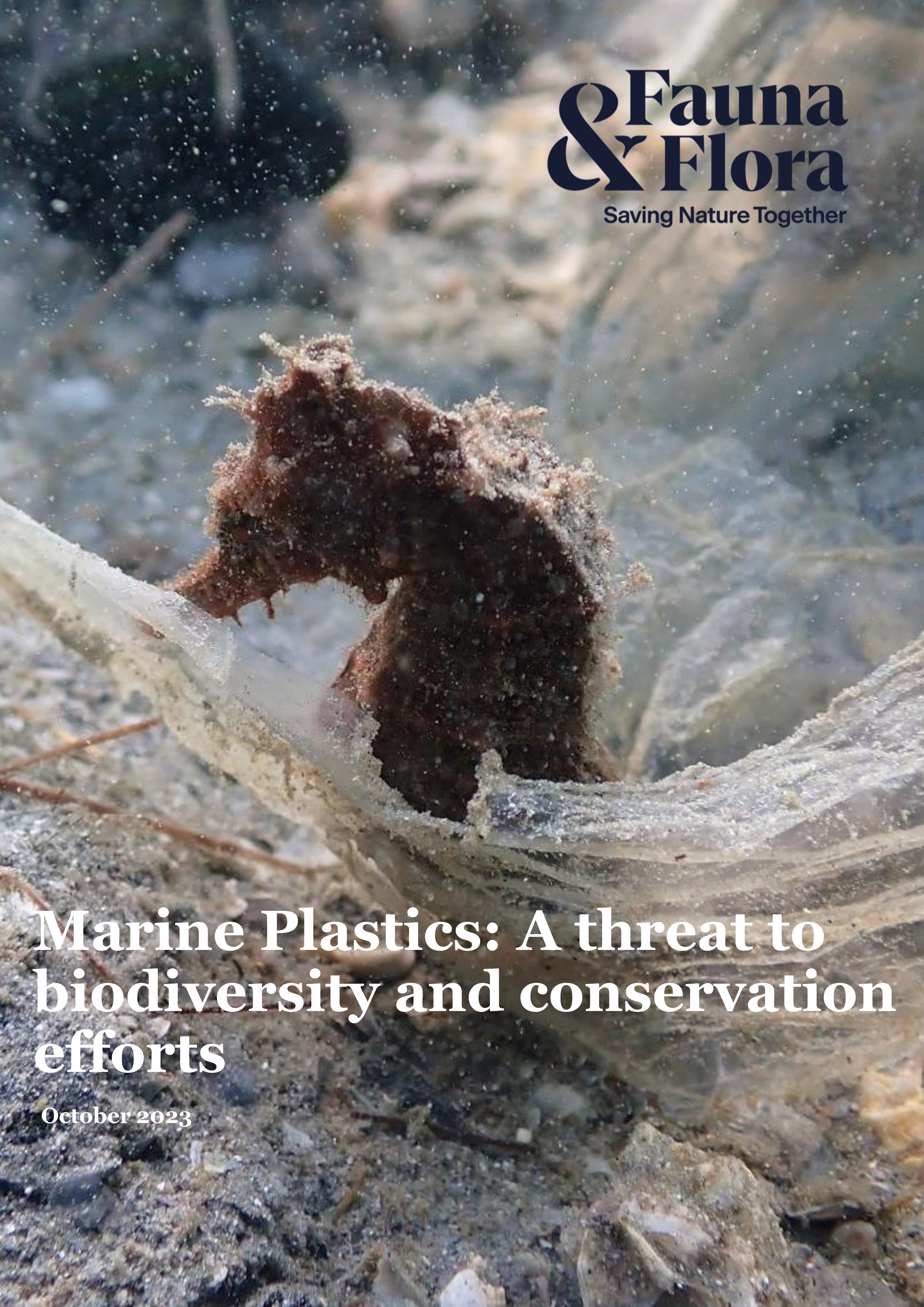
Saving Nature Together



Marine Plastics: A threat to biodiversity and conservation efforts

October 2023

Introduction

Our ocean faces unprecedented challenges. The effects of climate change, environmental exploitation, land and sea use change, and pollution are cited as four key drivers of biodiversity loss[1] threatening life on the planet as we know it. An exponential increase in the volume of plastic produced each year, the intentional addition of toxic, persistent and bioaccumulating chemicals during plastic production and the multiple sources and pathways to the natural environment have culminated in plastic pollution exceeding safe planetary boundaries[2] and compounding the biodiversity crisis. Pollution is characterised by the introduction into or the presence in nature of any compound that has negative impacts on ecosystems and on the wildlife that occur in them. Because of plastic debris' longevity and persistence, it is a widespread threat to the marine environment and its biodiversity[3].

It is estimated that 79% of all plastics ever produced have accumulated in the environment or in landfills[4], and over 14 million tonnes of plastics[5] are estimated to enter the marine environment on an annual basis. Without intervention, this figure could triple by 2060[6]

Plastic pollution comes in many forms, from large plastic items, like fishing gear, plastic packaging and bottles, to microplastic items (<5mm), such as plastic pellets[7] and microplastic fibres shed from textiles[8]. Physical characteristics of plastics vary, such as lightweight properties that allow it to be airborne and buoyant, to more dense and heavy plastics, increasing its capacity to sink and become buried in sediment. This has led to plastic litter becoming ubiquitous in the marine and coastal environment and it is found on all shorelines[9] and throughout[10] the water column, from the sea surface[11] to the seafloor[12].

Impacts

The impacts of plastic pollution are far-reaching. Plastic pollution is causing serious harm to wildlife and ecosystems, as well as to human welfare and livelihoods, both through its immediate impacts and the longer-term effects associated with its degradation and with the chemical properties of plastic.

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Microplastics and why they matter

The small size and bioavailability of microplastics poses a significant and severe threat to biodiversity[13,14] (Figure 1). Microplastics have been recorded in all ocean basins from the surface to the deep-sea floor. They are found in polar ice caps, at the tops of mountains and in rivers and seas. Ocean life is particularly vulnerable to exposure to, ingestion of and the deleterious effects of microplastic pollution. Interdisciplinary research into this field has proliferated since the term was first coined in 2005 and emerging evidence also confirms presence and accumulation in humans[15].

Microplastics enter oceanic systems directly (in microplastic size ranges, such as plastic pellets) and indirectly (from the breakdown of larger plastic items) from a multitude of sources originating on land and at sea (see Figure 1). The complex relationship between the ocean and atmospheric systems means that microplastics are mixed between the air and ocean, dispersed widely due the effects of wind, waves and currents, and assimilated throughout the water column.

Cleaning-up and removing microplastics from the ocean is neither possible nor cost-effective. Research has shown that over 170 trillion plastic particles are floating in the ocean[16], and owing to this ubiquity, every marine species group has encountered microplastic pollution[17]. Due to their small size (<5mm) and bioavailability, microplastics are a significant threat to biodiversity, and numerous studies have revealed that they negatively impact organisms on different levels - such as growth[18], reproductivity[19], immunity[20] - and that these microplastics can be transferred throughout food webs[21].

Microplastics also act as vectors for pathogens and alien invasive species as they move through oceanic systems, further jeopardising biodiversity and healthy ecosystem function.

Fauna & Flora has actively engaged with different types of microplastic pollution. More detailed information on some of our microplastics work can be found below:

- **Microplastic ingredients**
- **Microplastic fibres**
- **Supply chain pellet loss**
- **Expanded polystyrene (EPS)**

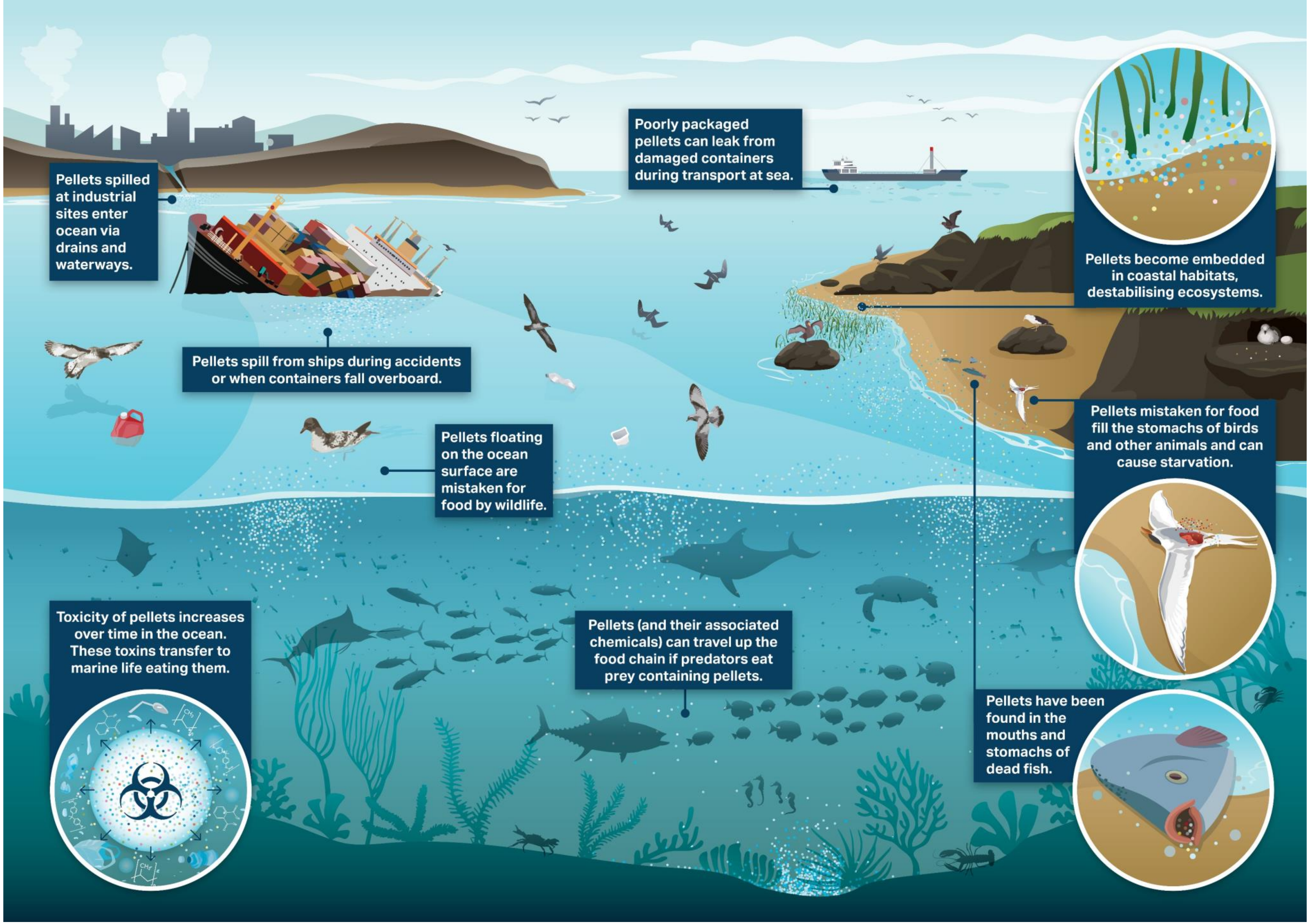

Figure 1. How microplastics enter the environment and harm wildlife, using the example of plastic pellets.

Chemical impacts

All plastics are inherently toxic because of the additives they contain (e.g., plasticisers, flame retardants, phthalates, per- and polyfluoroalkyl substances (PFAS))[22]. These toxic chemicals are known to leach to the environment and to species ingesting microplastics[23]. Further, in aquatic systems, plastics adsorb persistent background toxic chemicals present in the environment onto their surface – a phenomenon accentuated by the surface area-to-volume ratio of microplastics[24]. Plastics in the marine environment act like a sponge, adsorbing and concentrating bacteria and persistent environmental pollutants (e.g., heavy metals, Polychlorinated biphenyls and dioxins) that are present in sea water[25], creating a chemical cocktail for the species that interact with them[26]. When these plastics interact with – or are eaten by – marine animals, the toxins, chemicals and bacteria in and on plastics can potentially be transferred to the animal[27], contaminating food webs and potentially humans, if affected seafood is eaten[28].

Physical impacts

In 2022, academic literature documented over 2000 species[29] had interacted with plastic debris. Charismatic, flagship megafauna, endangered and sentinel species such as turtles, seals, cetaceans and seabirds are all vulnerable to the effects of mega- (>1 m), macro- (<1 m), meso-scale (<2.5 cm), micro- (<5 mm) and nano- (<100 nm) plastic pollution including entanglement, ingestion, suffocation and starvation[30].

Physical impacts of plastic ingestion are known to include a false feeling of fullness (pseudosatiation)[31], with a broad range of knock-on impacts. These include reduced energy stores, which may account for reduced growth[32] and fertility[33], reproductive impairment[34], reduced mobility[35], and weakened immune systems[36].

The physical presence of plastic in the gastrointestinal tract can also result in mechanical obstruction of the gut and accompanying inflammatory responses[37]. A recent study provided evidence of a new plastic-induced fibrotic disease, termed 'Plasticosis'[38] - whereby digestive tract tissues of seabirds become scarred and deformed from plastic ingestion, negatively affecting digestion, growth and survival.

Plastic can also impair feeding ability and result in reduced uptake of necessary food[39], and can lead to physical impairment, starvation and suffocation. For example, a fin whale, that mainly feeds on krill, copepods, fish and squid, was stranded in Ireland in 2000, with a nylon rope partly swallowed and partly stuck in its baleen plates[40,41].

Entanglement and suffocation of marine species by a plethora of plastic debris, including single-use items, plastic bags and ropes, represent the most visible impacts of marine debris. For example, in line with the expansion and intensification of fishing efforts across the globe, Abandoned, Lost or otherwise Discarded Fishing Gears (ALDFGs) (e.g., gill nets and fish aggregation devices) is having a major impact on marine biodiversity. Due to its characteristics and ability to continue to fish once lost to the environment, ALDFGs are known to cause a wide range of negative impacts[42]. Lost gear regularly smothers sensitive ecosystems such as coral reefs or entangles, injures or kills a wide range of vulnerable species such as sharks and rays, marine mammals, turtles and seabirds[43]. The presence and accumulation of ALDFGs is also a source of future pollution as the synthetic materials break down and shed microplastic fibres over time[44].

The health, resilience and productivity of sensitive coastal and marine habitats such as coral reef ecosystems[45], seagrass matts and mangrove forests[46] is significantly reduced by the presence and accumulation of all plastics, because plant seedlings are readily smothered or become entangled by plastic debris[47].

Everything is interconnected and reduced health and resilience of such habitats subsequently affects species that rely on them. For example, in mangrove forests, the presence of plastic pollution can reduce water bird presence[48] and crab activity[49]. Microplastics have been found in fish nursery grounds, potentially reducing the survival of juvenile fish, and increasing threats to fish health and productivity[50] and furthermore, extreme concentrations of macro- and micro-plastics in marine turtle nesting grounds can increase sand temperature, potentially altering the sex ratio of hatchlings and/or nest productivity[51].

Plastic pollution: the nexus of the triple planetary crisis

Plastic is found in rivers and estuaries and in all ocean basins from the equator to the deep depths of the Mariana Trench[52], and to the polar regions, where microplastics have been found to be accumulating in Arctic Sea ice[53].

Over production, poor design and unsustainable linear economies for plastic coupled with limited end-of-life recapture and processing has all contributed to this crisis, but also how we manage and interact with the marine environment can further affect the dispersal of plastic debris. For example, new extractive methods such as deep-sea mining, which is the proposed process of retrieving mineral deposits from the deep seabed, would have a catastrophic impact on biodiversity[54] and potentially release plastics that are currently on or embedded in the sea floor back into oceanic layers[55].

Plastic is a major contributor to climate change – another key driver of biodiversity loss. At the production stage, the majority of plastic materials are derived from fossil fuels, and greenhouse gases are released at every stage of the plastic lifecycle – including during recycling. In 2022, it is estimated that plastics contributed 7% of global emissions[56] and emissions are expected to worsen in line with the predicted growth of the plastic industry. By 2050, the accumulation of these emissions may account for up to 13% of the total remaining carbon budget, severely undermining global efforts to keep global temperatures from rising above the 1.5-degree target[57].

Microplastic pollution and climate change are also intrinsically linked. Increases in temperature due to global warming could lead to the release of microplastics from melting ice into the open ocean[58], and increased wind and rainfall will increase transport of airborne microplastics and will wash plastic debris into waterways[59], worsening the contamination of plastic and threats to biodiversity.

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Fauna & Flora's approach to plastic pollution

Fauna & Flora is well placed to work with colleagues and partners around the world to respond to new and emerging threats to biodiversity borne from plastic and its associated chemical pollution. Across our projects, we focus on developing effective, locally appropriate, scalable solutions, centred on preventing pollution at source and challenging the status quo by fostering a positive change in policy, corporate practices and consumer behaviour.

Examples from around the programme:

Today, the impact of plastic pollution on marine biodiversity, which often undermines broader conservation efforts, is being addressed with locally led initiatives at several of Fauna & Flora's sites: Cambodia, Honduras, Kenya, Myanmar, Nicaragua, Saint Lucia, São Tomé and Príncipe, Scotland, Turkey. The figure below gives an overview of the threat that plastic pollution poses to species and habitats at many of our sites around the world:

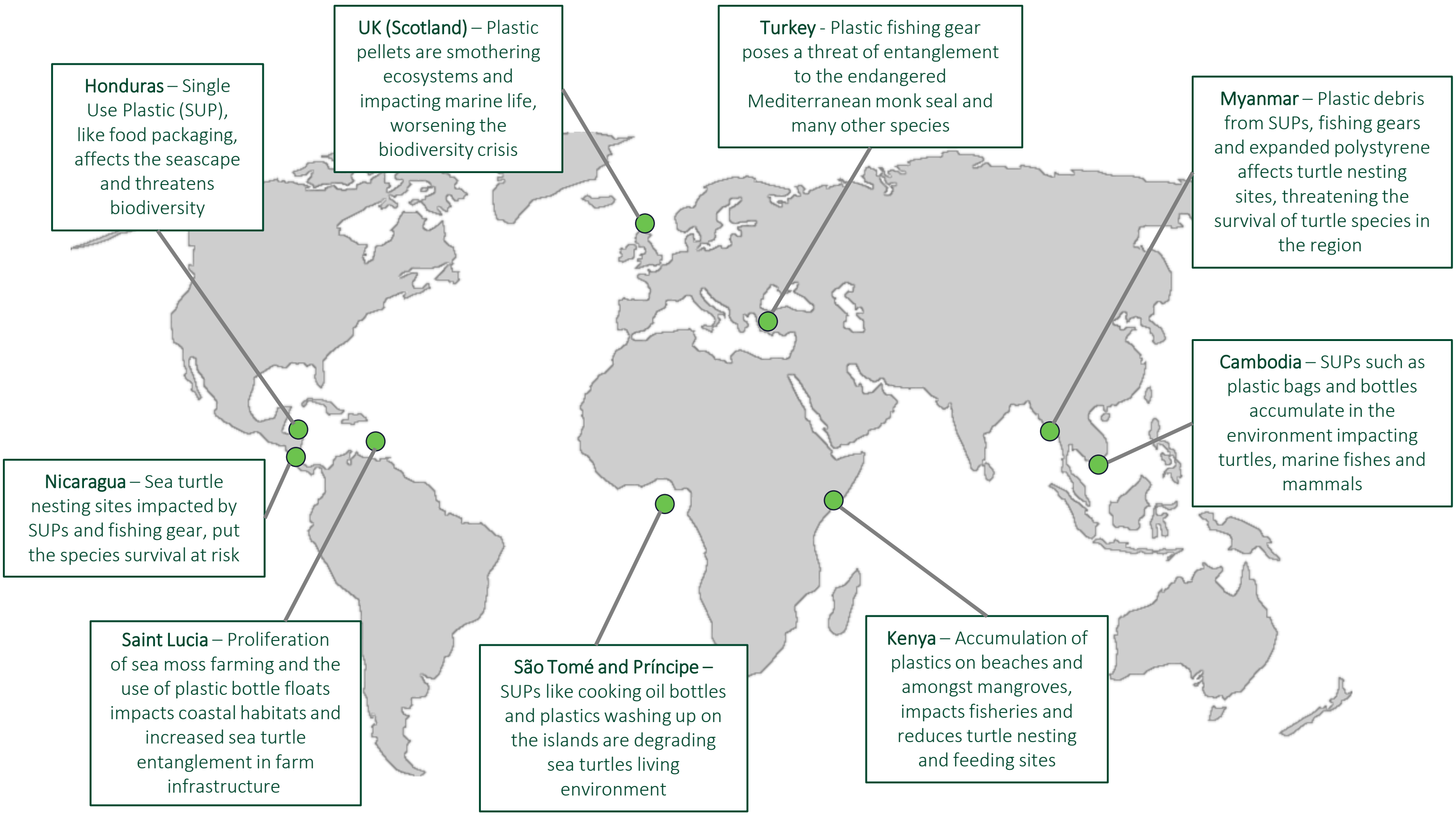

Figure 2: Examples of plastic pollution threats in countries where Fauna & Flora is working with its partners to preserve biodiversity.

To face some of these issues emanating from plastic pollution, solutions, adapted to the local context are being trialled across the sites where Fauna & Flora works. Some of these solutions include:

- Community approach to tackling marine plastic in Cambodia in two marine-protected island communities. Small-site based interventions are being piloted in Koh Rong Archipelago and Koh Sdach Archipelago to reduce the accumulation of single-use plastics in the environment. The project is targeting business and household level use of plastic bags, considering the high rates of consumption and the potential impact on biodiversity, and disposable water bottle usage that is largely associated with tourism. Awareness is built via community engagement, education and training, and the pilot project encourages community members to switch single-use plastics for reusable bags and to use refill water stations where provided. Results of the project are used to influence provincial and national policy plans on marine plastic reduction and marine protected area governance, as well as to evaluate and develop scalable interventions.

- Building on the marine conservation efforts in Nicaragua, plastic pollution was identified as a specific threat to sea turtles, which nest on Nicaraguan beaches. To address this threat, Fauna & Flora is focusing on coastal communities, businesses and policymakers to understand barriers and opportunities to tackle priority plastics to reduce business and household plastic pollution, as well as build on existing government relationships to enable engagement on tackling plastic pollution at a national level. A work plan was developed with four municipalities to reduce plastic waste generation in coastal communities in a participatory manner. Furthermore, to replace single-use plastic packaging used by street vendors and small shops in some coastal municipalities, Fauna & Flora, in collaboration with the Nicaraguan Institute of Agricultural Technology (INTA) and a local university, are working on the development of a packaging prototype based on organic fibres using waste banana leaves.
- Plastic fishing gear (e.g., gill nets and fish aggregation devices) are routinely abandoned, lost or otherwise discarded in the aquatic environment and have a major impact on marine biodiversity. In Turkey, they threaten the endangered Mediterranean monk seal and many other species with entanglement. Fauna & Flora, together with Akdeniz Koruma Derneği (AKD), our long-standing Turkish partner conservation organisation, are actively working on restoring the resilience of marine ecosystems by removing ghost gear from the sea. AKD also engage local fishers in tackling this issue by collaborating in identifying ghost gear hotspots and improving the sustainability of fishing practices through engagement with fishing cooperatives, patrolling and locally led monitoring of fish landings.

These efforts to reduce plastic pollution in different regions of the world are promising and offer some great examples of what could be upscaled and replicated internationally. More action is needed to significantly reduce the pressure plastic pollution poses to biodiversity; it is a transboundary problem that needs to be tackled with global rules, and solutions appropriate to local contexts.

The Global Plastics Treaty

In response to the global plastic pollution crisis, the United Nations Environmental Assembly (UNEA) passed a historical resolution to develop an international legally binding instrument (ILBI) to end plastic pollution on land and the marine environment by the end of 2024.

Fauna & Flora is actively following and engaging with the negotiations by providing technical advice to delegates, regional teams and other organisations. Building on Fauna & Flora's successful track record of influencing policy to tackle microplastic pollution, and by proactively advocating for biodiversity-positive language and elevating the voices and lessons learnt from practical experience of tackling plastic pollution across our network, we will be leading by example and advocating for pragmatic, practicable solutions that protect ecosystem health, function and resilience.

Our key messages are:

- Plastics impact biodiversity, human health and the environment at every stage of its life cycle and as such, we are advocating for a strong and ambitious Treaty that addresses the full life cycle of plastics.
- We want to see a Treaty that is inclusive and listens to and responds to the needs of local voices so that the eventual instrument is fit for purpose.
- Pollution is one of the four main drivers of biodiversity loss and the impacts of plastic pollution – and particularly microplastic pollution - on biodiversity are largely missing from current conversations. We want to ensure that microplastic pollution is given significant attention and must be considered as plastic pollution within each provision of the Treaty across the lifecycle of plastics.
- We advocate following the waste hierarchy principles, focusing on eliminating the drivers of plastic pollution and stemming the flow of plastics with upstream solutions because we recognise that prevention will always be more effective than clean up.
- It is essential that plastics are detoxified, by banning chemicals and polymers of concern in all plastic products. There needs to be a global chain of custody, covering feedstock, material composition and the presence of chemical additives.
- False solutions that lead to negative, unintended consequences must be avoided. There needs to be evidence of sustainability, following a science-based approach and adopting the precautionary principle to any new product (e.g., bioplastics), scheme (e.g., plastic credits), technology and solution.

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