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91243R

Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Level 2 Geography 2026

91243 Apply geography concepts and skills to demonstrate understanding of a given environment

Credits: Four

RESOURCE BOOKLET

Refer to this booklet to answer the questions for Geography 91243.

Check that this booklet has pages 2–16 in the correct order and that none of these pages is blank.

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Relevant geographic concepts

Environments
May be natural and/or cultural. They have particular characteristics and features, which can be the result of natural and/or cultural processes. The particular characteristics of an environment may be similar to and/or different from another. A cultural environment includes people and/or the built environment.

Perspectives
Ways of seeing the world that help explain differences in decisions about, responses to, and interactions with, environments. Perspectives are bodies of thought, theories, or world views that shape people's values and have built up over time. They involve people's *perceptions* (how they view and interpret environments) and *viewpoints* (what they think) about geographic issues. Perceptions and viewpoints are influenced by people's *values* (deeply held beliefs about what is important or desirable).

Processes
A sequence of actions, natural and/or cultural, that shape and change environments, places, and societies. Some examples of geographic processes include erosion, migration, desertification, and globalisation.

Patterns
May be spatial: the arrangement of features on the Earth's surface; or temporal: how characteristics differ over time in recognisable ways.

Interaction
Involves elements of an environment affecting each other and being linked together. Interaction incorporates movement, flows, connections, links, and interrelationships, which work together and may be one- or two-way interactions. Landscapes are the visible outcome of interactions. Interaction can bring about environmental change.

Change
Involves any alteration to the natural or cultural environment. Change can be spatial and/or temporal. Change is a normal process in both natural and cultural environments. It occurs at varying rates, at different times, and in different places. Some changes are predictable, recurrent, or cyclic, while others are unpredictable or erratic. Change can bring about further change.

Sustainability
Involves adopting ways of thinking and behaving that allow individuals, groups, and societies to meet their needs and aspirations without preventing future generations from meeting theirs. Sustainable interaction with the environment may be achieved by preventing, limiting, minimising, or correcting environmental damage to water, air, and soil, as well as considering ecosystems and problems related to waste, noise, and visual pollution.

Key terms

Biomagnification – the process by which the concentration of toxic substances increases in organisms at successively higher levels of a food chain, e.g. from plankton to fish to human

Debris – scattered pieces of rubbish

Gyre – a large, rotating system of ocean currents

Microplastic – broken down pieces of plastic under 5 mm in size

Nurdle – a pellet of plastic used as raw material in the manufacture of plastic products

Pescatarian – someone who follows a mostly vegetarian diet but also eats seafood such as fish and shellfish

THE PACIFIC OCEAN AND THE GREAT PACIFIC GARBAGE PATCH

RESOURCE A: Introduction

The Pacific Ocean is the largest and deepest ocean on Earth, stretching from Asia and Australia in the west to the Americas in the east. It covers around one-third of the planet's surface, which means it is bigger than all the continents combined.

For New Zealand, the Pacific Ocean is especially important. Aotearoa sits right in the southwest Pacific, surrounded by its waters.

The Pacific is rich in marine life, from tiny plankton to massive whales. Many Pacific nations rely on the ocean for food, transport, and cultural identity.



Figure 1: Map of the Pacific Ocean.

The Great Pacific Garbage Patch

The name 'Great Pacific Garbage Patch' sounds like it might be a huge, floating island of rubbish, perhaps visible from space, where discarded bottles and fishing nets form a solid landmass large enough to walk on. But this popular idea is incorrect.

A giant, contained island of trash would seem like a straightforward problem with a simple solution: just 'scoop it up'. However, the scientific reality is far more complex.

The Great Pacific Garbage Patch (GPGP) is one of five main areas of ocean pollution, and it is not a single, solid entity. Instead, it is an immense area of the ocean where marine debris and rubbish has accumulated. It is more accurately described as a 'plastic soup' or a 'plastic smog'. Most of this debris consists of tiny plastic pieces, invisible to the naked eye, swirling just below the surface. While larger items do exist, they are scattered widely.

The debris, present in far greater concentrations than in other parts of the ocean, is continuously mixed by winds and waves, and large amounts of it is made up of microplastics.



Figure 2: An area of the Great Pacific Garbage Patch, off the coast of Hawaii.



Figure 3: The locations of the five main areas of ocean rubbish.

Location and size of the GPGP

The GPGP is an interaction of natural processes in terms of its location, but a human-made catastrophe in terms of its existence. It exists because of a powerful natural ocean current system, known as a gyre.

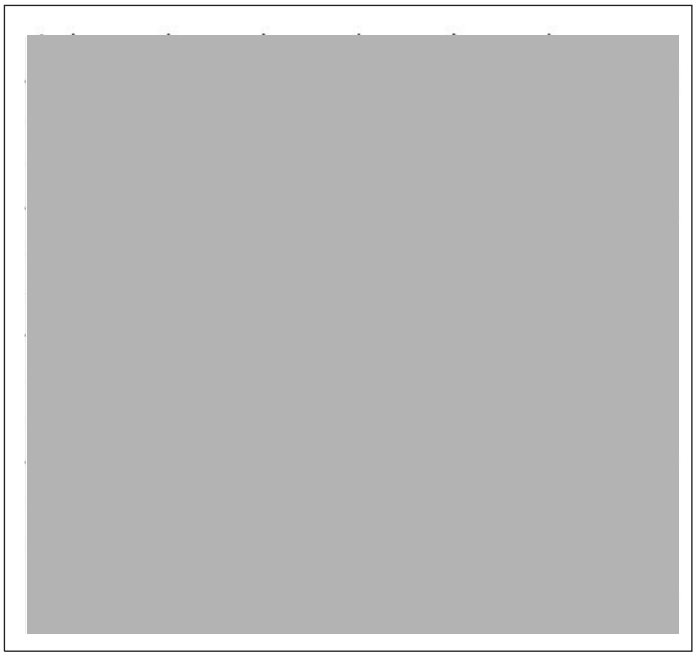


Figure 4: The location of the ocean gyres or currents.

A gyre is a large, rotating system of ocean currents, much like a giant whirlpool, that pulls objects into its centre. The GPGP is specifically located in the North Pacific Gyre. This is a vast swirling mass of four major ocean currents that collect floating debris from across the Pacific Ocean. These currents draw in waste material from the coastal waters off Japan, China, Taiwan, and the western United States, gradually moving it toward the calm centre of the gyre, where it becomes trapped.

The patch is located in the central North Pacific Ocean, roughly between Hawaii and California. More precise coordinates place it from approximately 135°W to 155°W longitude and 35°N to 42°N latitude.

The sheer size of the GPGP is difficult to comprehend. Estimates suggest that it covers an area of 1.6 million square kilometres, which is nearly six times the size of Aotearoa New Zealand.

Aspect	Measurement
Size	1.6 million km^2, or roughly six times the size of Aotearoa New Zealand
Total mass	79,000 metric tons
Number of pieces	1.8 trillion

Figure 5: The Great Pacific Garbage Patch by numbers.

An interesting fact about the GPGP is the huge contrast between the number of pieces it is made of and its mass. While the patch is estimated to contain trillions of plastic pieces, the vast majority of these are tiny fragments. These are known as microplastics, which are plastic pieces smaller than 5 mm.

Microplastics can be primary, meaning they were manufactured to be small, like the microbeads once found in face wash or the small plastic pellets called nurdles that are used to make larger items. However, the majority are secondary microplastics, which are pieces that have broken down from larger items over time.

Surprisingly, scientific research shows that while microplastics dominate the GPGP by count, the overall mass is dominated by much larger, heavier objects. Studies have found that 90% of the mass of the patch consists of these larger items, including abandoned fishing nets, bottles, buoys, and other consumer goods.

The difference between composition by count and by mass is a powerful indicator of how the GPGP is changing, and the urgency of cleanup. The large objects, or megaplastics, which form most of the mass today are slowly disintegrating. This is due to a process by which sunlight breaks down plastics into smaller and smaller pieces. The process creates countless microplastics, which is why there are so many tiny pieces in the GPGP.

This reveals a great opportunity. Removing the larger, more easily targeted objects now is a critical strategy to prevent them from becoming billions of tiny, dangerous, and practically irremovable microplastics. Acting now will address a problem that is currently manageable, before it becomes an impossible task.

By count	By mass
The overwhelming majority of pieces (estimated 1.8 trillion) are tiny microplastics (<5 mm) and nurdles.	90% of the total weight consists of larger objects like fishing nets, ropes, buoys, and plastic bottles.

Figure 6: Composition of the Great Pacific Garbage Patch by count and mass.



Figure 7: Larger items found in the Great Pacific Garbage Patch. Left to right: a plastic crate produced in 1977; a hard hat from 1989; the cover from a Nintendo Gameboy produced in 1995.

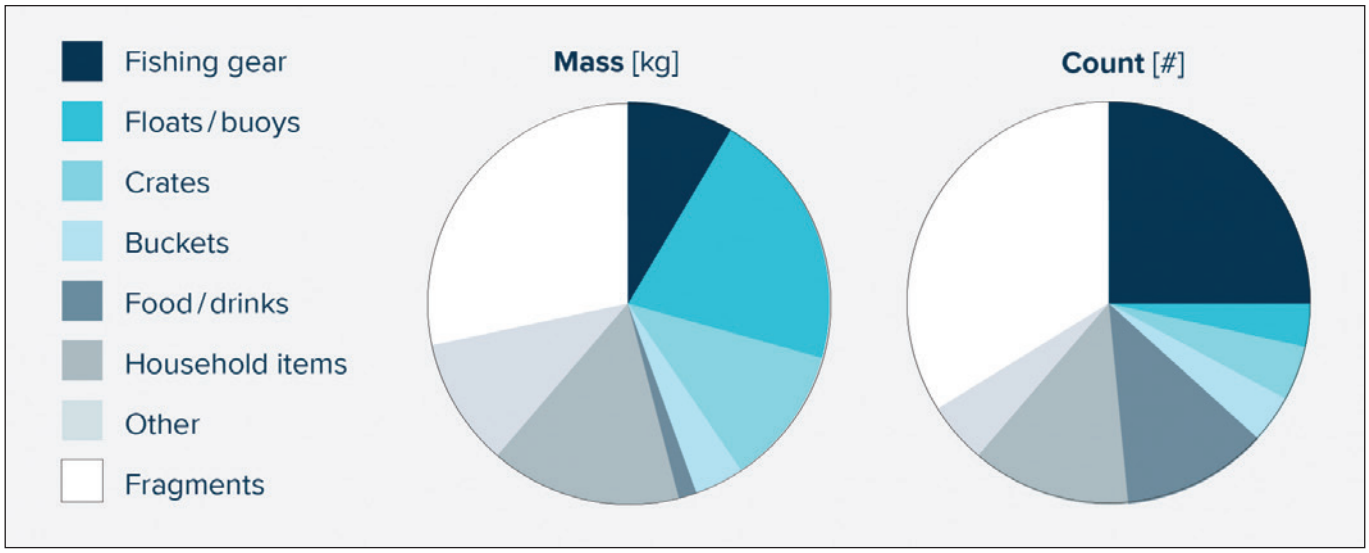


Figure 8: Composition of larger hard plastic debris (>5 cm) found in the Great Pacific Garbage Patch, by mass and count.

RESOURCE B: Causes of the Great Pacific Garbage Patch

Plastic enters our oceans from two primary sources: activities that take place on land or at sea. Land-based pollution accounts for approximately 80% of all plastic that enters the ocean globally. This comes from mismanaged waste, littering, and stormwater runoff that carries plastic from streets and landfills into rivers, streams, and eventually the sea. For example, the plastic from a straw dropped on the street hundreds of kilometres inland can be carried by wind and rain into a drain, a river, and ultimately to the sea.

The second major source is sea-based. This plastic originates from ships, offshore platforms, and most significantly, the fishing industry.



Figure 9: 'Ghost nets' floating just under the surface.

The specific composition of the GPGP is different. Far more than 20% of its mass comes from sea-based waste. According to recent studies, between 75% and 86% of the floating plastic (by mass) could be from abandoned, lost, or discarded fishing gear, including massive 'ghost nets' and ropes.

Further analysis of the waste in the patch, including markings and text, has helped researchers trace the material back to its origins. Most of the identified plastic comes from a handful of industrialised fishing nations located around the Pacific.

A 2022 study found that most of the plastic emissions originated from Japan, China, South Korea, the United States, and Taiwan, with the oldest piece of rubbish dating back to the late 1970s.

This reveals that different regions of the ocean have different pollution profiles and that solving the problem requires changing perceptions of industries and countries, not just asking people to recycle more.

Source	Percentage of total mass	Contributing countries
Fishing and aquaculture	75% of floating plastic mass	Japan, China, South Korea, United States, Taiwan
Land-based sources	25% of floating plastic mass	Global, including the United States as the third-largest contributor

Figure 10: Sources of plastic pollution in the Great Pacific Garbage Patch.

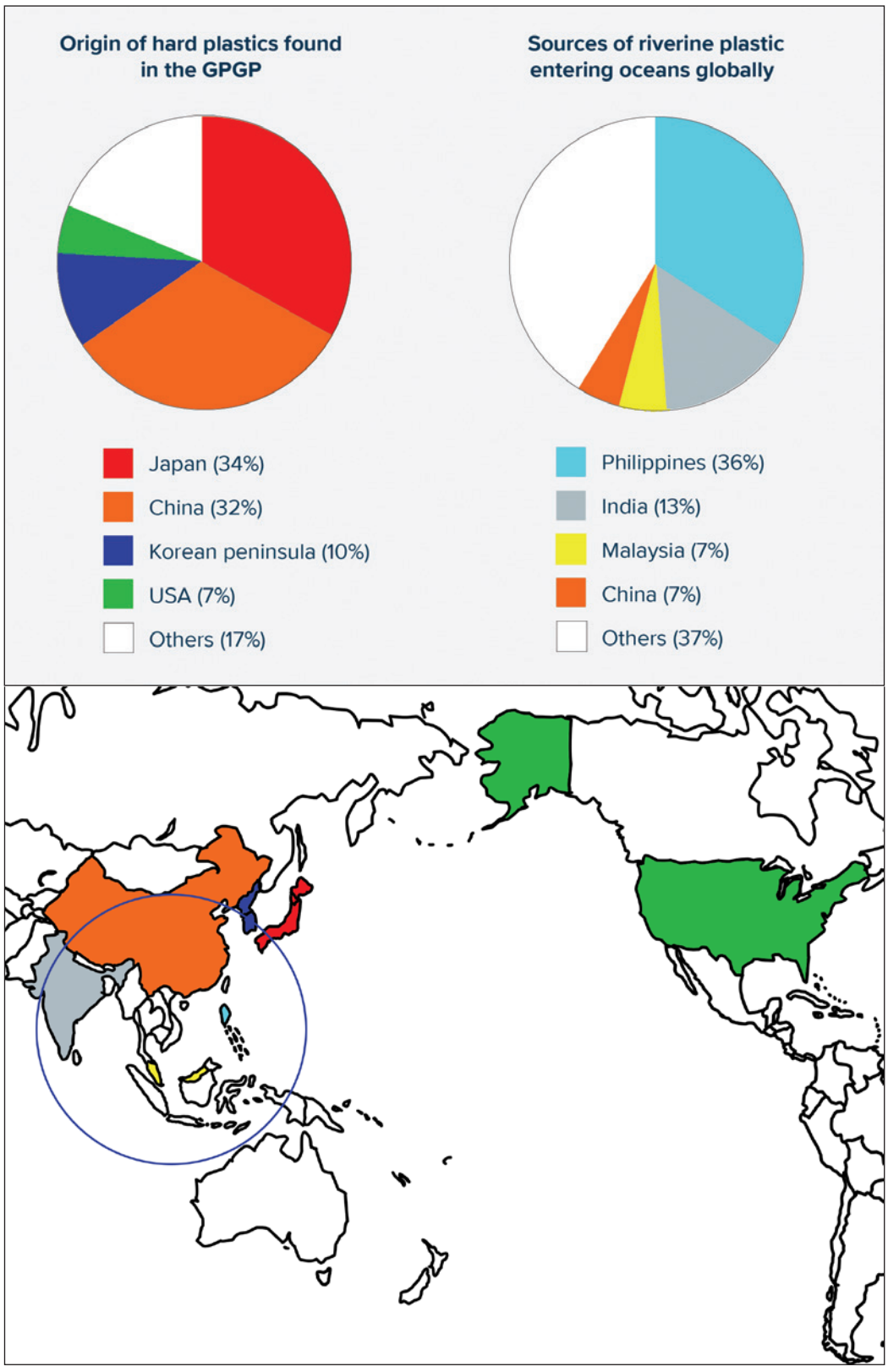


Figure 11: Origin of hard plastics and riverine plastics entering the oceans. More than half of the world's population live within the circle on the map.

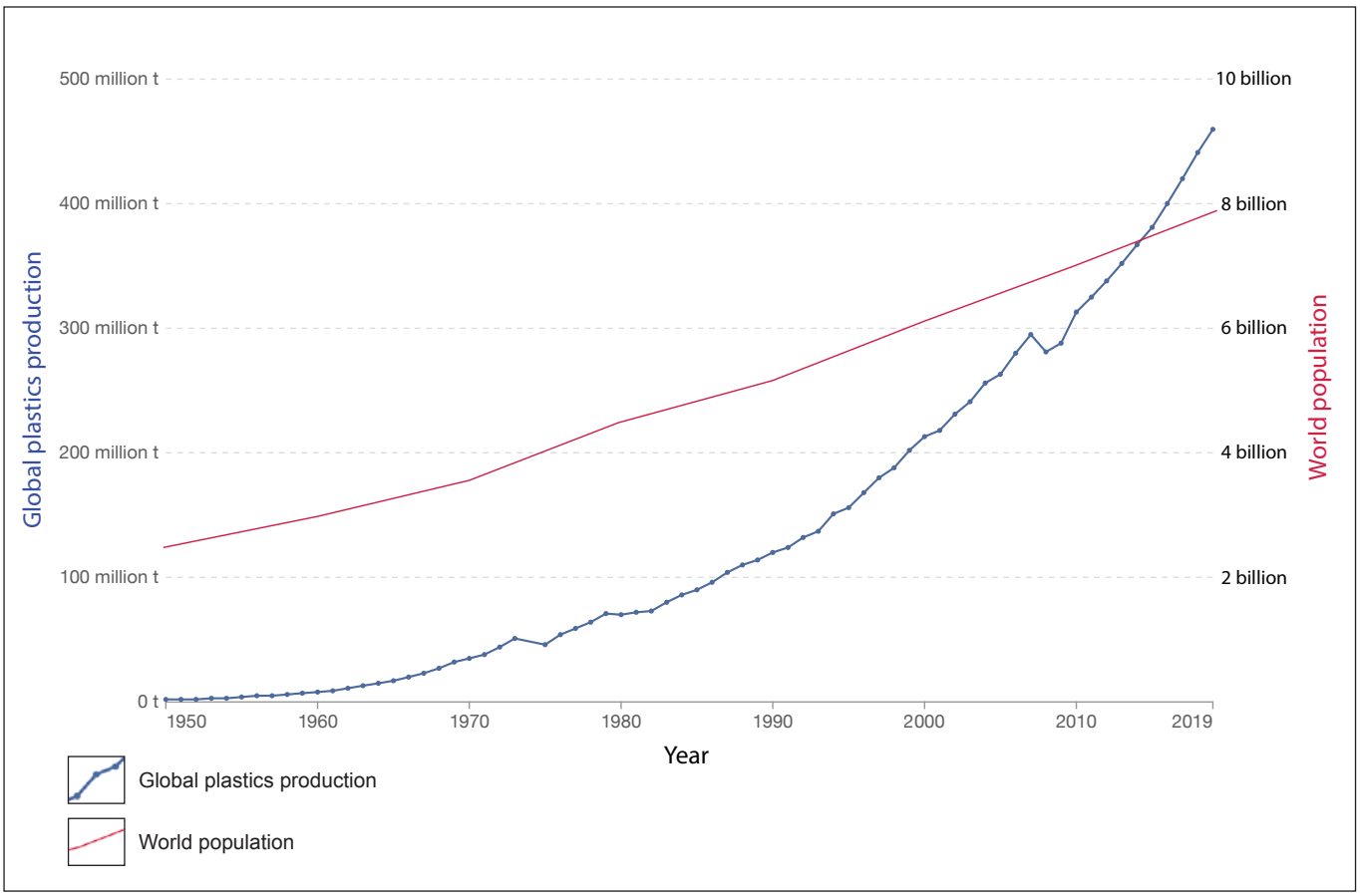


Figure 12: How the demand and production of plastic has increased with global population growth.

Plastic production has sharply increased over the last 70 years. In 1950, the world produced just two million tonnes. It now produces over 450 million tonnes.

When plastic waste is mismanaged – not recycled or kept in sealed landfills – it becomes an environmental pollutant. One to two million tonnes of plastic enter our oceans yearly, affecting wildlife and ecosystems.

Improving the management of plastic waste across the world – especially in developing countries, where most of the ocean plastics come from – is therefore critical to tackling this problem.

Global seafood market

The global seafood market reached the value of approximately US$397 billion in 2025, up from about US$207 billion in 2018. Though seafood features heavily in the food of many different cultures, the three largest markets for processed fish and seafood worldwide are China, India, and Japan.

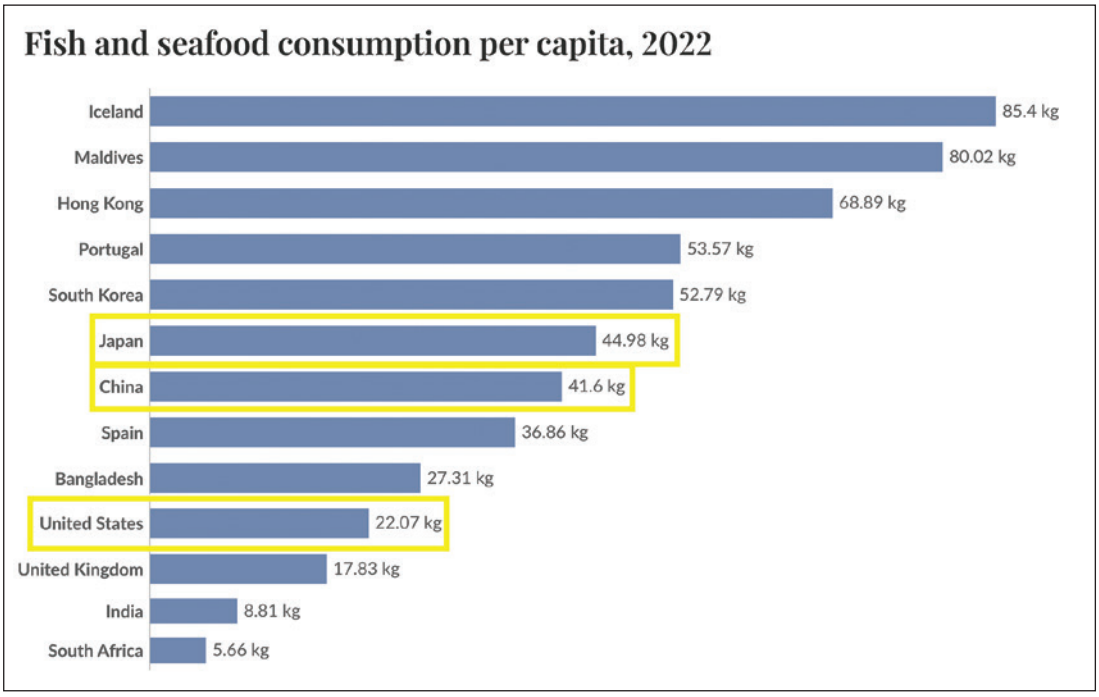


Figure 13: Three of the top ten countries that consume the most fish and seafood are some of the biggest contributors to the GPGP.

Commercial fishing value



The European Union was the top exporter of fish and fishery products worldwide in 2020, at US$36.2 billion in export value. China came in second at US$20.8 billion in fish and fishery exports.

Figure 14: Leading exporting countries of fish and fishery products in 2020.

RESOURCE C: The social and environmental impacts of the GPGP



Figure 15: Fish caught in a 'ghost net'.

The buildup of plastic debris in the GPGP poses a big threat to marine life. The impact occurs in two primary ways: entanglement and ingestion.

Larger debris, particularly lost or abandoned fishing nets, can be devastating. These are called 'ghost nets' and they continue to trap and kill marine animals. This is known as 'ghost fishing'. Seals, sea turtles, dolphins, and even large whales can become hopelessly tangled in these deadly traps, leading to injury, suffocation, or drowning.

Animals also often mistake plastic for food. Sea turtles, for example, frequently mistake clear plastic bags for jellyfish, their main prey. The plastic fills their stomachs, creating a false sense of fullness that prevents them from eating real food. This ultimately leads to starvation.

When animals eat plastic, toxins can leach into their bodies, causing a variety of health problems, including reproductive issues and liver damage. This process, where toxins build up as they move up the food chain, is called biomagnification. This means that a toxin-carrying microplastic eaten by a tiny fish can eventually affect the body of a larger fish, a marine mammal, or a human who consumes that seafood.

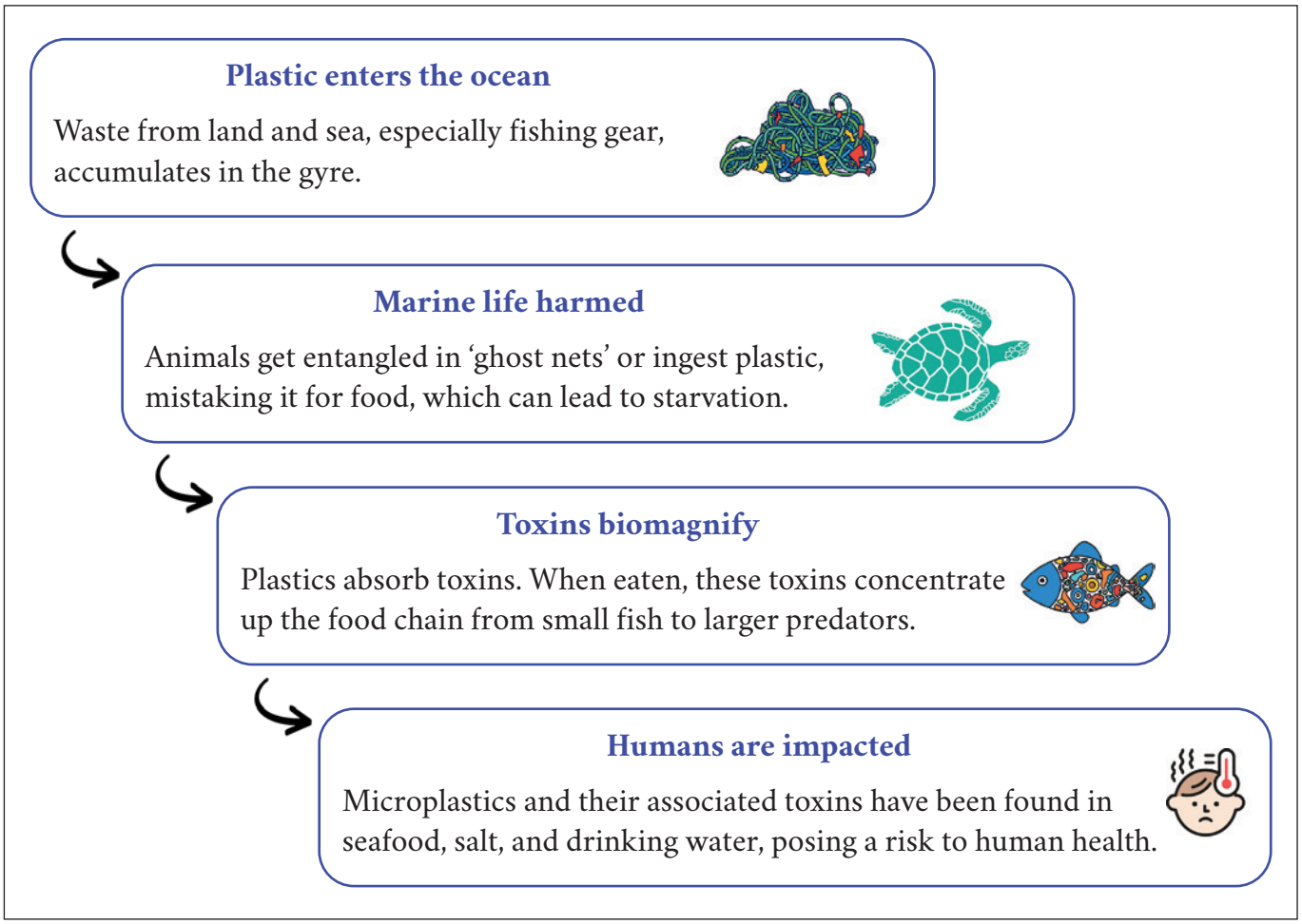


Figure 16: Food chain showing how plastics in the ocean impact human health.

The problem of plastic pollution is not just an environmental issue; it is a direct threat to entire ecosystems and even human health. Microplastics have been found in a wide variety of human consumables, including seafood, salt, honey, and even drinking water, both bottled and from the tap.

The chemicals associated with plastics, such as bisphenol A (BPA), can lead to various health problems. This makes the GPGP and the global issue of plastic pollution a personal one, as the problem comes full circle to affect the very people who created it.



Figure 17: The origins of, and damage caused by, microplastics.

Perspectives

Pescatarian (someone who eats fish but not meat)
"The garbage patch threatens the health of our oceans and the safety of the seafood I rely on, making it harder to maintain a sustainable, ocean-friendly diet. Securing safe fish to eat will only become more expensive over time."





Commercial fishing company representative
"The Great Pacific Garbage Patch isn't just an environmental issue – it disrupts our operations through damaged equipment, it harms fish stocks, and it puts the livelihoods of coastal workers at risk, as jobs become at risk too."

Pacific Island Community spokesperson
"This pollution damages our reefs, our fisheries, tourism, and our way of life. The garbage patch is a global problem that we barely contribute to, but we are left to deal with direct consequences facing our island communities."





Environmentalist
"The Great Pacific Garbage Patch is a huge symbol of our wasteful systems. Unless we transform how we produce and use materials, marine ecosystems will continue to collapse. As a global community, we must act together, as ocean health is vital for human well-being."

Company that relies on plastic packaging
"We recognise the concerns about ocean plastic, but meaningful change requires collective action across industries, consumers, and governments – not just packaging companies alone. If we change our packaging practices, consumers must be prepared to pay for increased costs."



Figure 18: There are a range of perspectives relating to the economic and social impacts of plastic use.

RESOURCE D: Turning the tide – solutions and actions

The immense scale and nature of the GPGP make traditional cleanup methods, such as scooping debris with a net, nearly impossible and very expensive. The debris is spread out over millions of square kilometres and is distributed from the surface to the seafloor, not in a contained, dense mass.

The Ocean Cleanup, a nonprofit environmental engineering organisation, has called on the world, governments, corporations, individuals, and foundations to prioritise cleaning up the ocean. It believes this should become a global priority.

The organisation is developing a dual strategy to tackle the problem. The first part involves the development of innovative ocean systems designed to remove 'legacy plastic'. This is the debris that has been building up in the ocean for decades.

The system uses a large, U-shaped floating barrier that is towed through the water by two vessels. This is designed to remove the larger, heavier plastics, such as ghost nets, ropes, and bottles, *before* they have a chance to break down into microplastics. This strategy has already been successful, with tens of thousands of kilograms of rubbish removed from the GPGP.



Figure 19: A U-shaped barrier towed by two boats helps to capture larger and heavier plastics.

Prevention is the second, and perhaps more crucial, part of the strategy. Researchers have identified that approximately 80% of plastic pollution enters the ocean from just 1,000 rivers worldwide. To address this, *The Ocean Cleanup* developed the Interceptor, a solar-powered, automated system that catches plastic in key rivers before it reaches the sea.

The Interceptor system helps to 'turn off the tap' of plastic flowing into the ocean. Intercepting plastic in rivers is much more cost-effective than dealing with the consequences downstream.



Figure 20: Trash being offloaded from the Interceptor Barrier in Kingston Harbour, Jamaica.

To rid the oceans of plastic, it is essential not only to clean up what is already out there but also to stop new plastic from entering the ocean. In New Zealand, this conversation is already well underway. We have taken a leading role in the fight against plastic pollution, having already banned single-use plastic bags. We are also committed to phasing out other problematic single-use items like drink stirrers, straws, and plastic cutlery. New Zealanders have shown strong support for these changes, demonstrating their commitment to protection of the oceans that surround us and our Pacific neighbours.



Figure 21: The Interceptor Barricade in Guatemala – aerial view of the upstream boom.

CONCLUSION

The Great Pacific Garbage Patch is a vast, evolving, and dangerous concentration of debris that reflects a global crisis of plastic pollution. The reality of a gyre filled with microplastics and ghost nets is critical to understanding the true nature of the problem. While the sheer size of the GPGP and its composition can seem overwhelming, the scientific and societal response has already begun. At the same time, we need to balance the need to clean the oceans with the needs of the fishing industry, which provides food to billions of people each year.

The evidence points to a clear path forward: a dual strategy of targeted cleanup and aggressive prevention, partnered with sustainable fishing practices. Cleaning up the legacy plastics in the gyre prevents them from fragmenting into a more dangerous, irremovable problem. At the same time, stopping new plastic from entering the ocean is an effective long-term solution that enables a healthy supply of fish while protecting the oceans.

Acknowledgements
Material from the following sources has been adapted for use in this assessment:

Figure 1: https://cdn.britannica.com/20/89920-050-809B5D63.gif

Figure 2: https://resource.geospatialworld.net/casestudy/combatting-plastic-pollution-using-aerial-mapping-for-environmental-protection

Figure 3: https://exhibit-services.de/initiative/the-ocean-cleanup/

Figure 4: https://oceantracks.org/library/the-north-pacific-ocean/major-currents

Figure 5: https://theoceancleanup.com/great-pacific-garbage-patch

Figure 6: https://theoceancleanup.com/great-pacific-garbage-patch

Figure 7: https://theoceancleanup.com/great-pacific-garbage-patch

Figure 8: https://theoceancleanup.com/updates/the-other-source-where-does-plastic-in-the-great-pacific-garbage-patch-come-from/

Figure 9: https://www.greenprophet.com/2009/06/water-pollution-sea/

Figure 10: https://en.wikipedia.org/wiki/Great_Pacific_Garbage_Patch

Figure 11: https://theoceancleanup.com/updates/the-other-source-where-does-plastic-in-the-great-pacific-garbage-patch-come-from/
https://stock.adobe.com/nz/1619267721

Figure 12: https://www.worldometers.info/world-population/world-population-by-year/
https://ourworldindata.org/plastic-pollution CC BY

Figure 13: https://ourworldindata.org/grapher/fish-and-seafood-consumption-per-capita CC BY

Figure 14: https://www.statista.com/statistics/268269/top-10-exporting-countries-of-fish-and-fishery-products/

Figure 15: https://images.newscientist.com/wp-content/uploads/2024/01/12102013/SEI_186653864.jpg

Figure 16: https://stock.adobe.com/nz/1961073476
https://stock.adobe.com/nz/1921949075
https://stock.adobe.com/nz/620799738

Figure 17: https://www.sciencedirect.com/science/article/abs/pii/S0013935121001511

Figure 18: https://stock.adobe.com/nz/366787827

Figure 19: https://www.abc.net.au/news/science/2023-03-17/ocean-cleanup-plastic-pollution-great-pacific-garbage-patch/102075810

Figure 20: https://theoceancleanup.com/rivers

Figure 21: https://theoceancleanup.com/updates/the-ocean-cleanup-makes-biggest-ever-river-catch-in-guatemala/