

The Great Pacific Gyre – What a load of rubbish!

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Ocean Gyres of the World

A gyre broadly refers to any vortex or spiral (e.g. wind patterns). In oceanic terms, it is a large system of circulating current caused by wind and the earth's natural spin (the Coriolis Effect). As an ocean gyre cannot extend past land, the continents form a boundary which limits the size and shape of the gyre. There are five gyres within Earth's oceans (see figure 1), which act like giant whirlpools moving in slow motion and essentially guide debris to a predictable central destination. (Garbage Facts, Garbage Gyres in Oceans - Population Education)

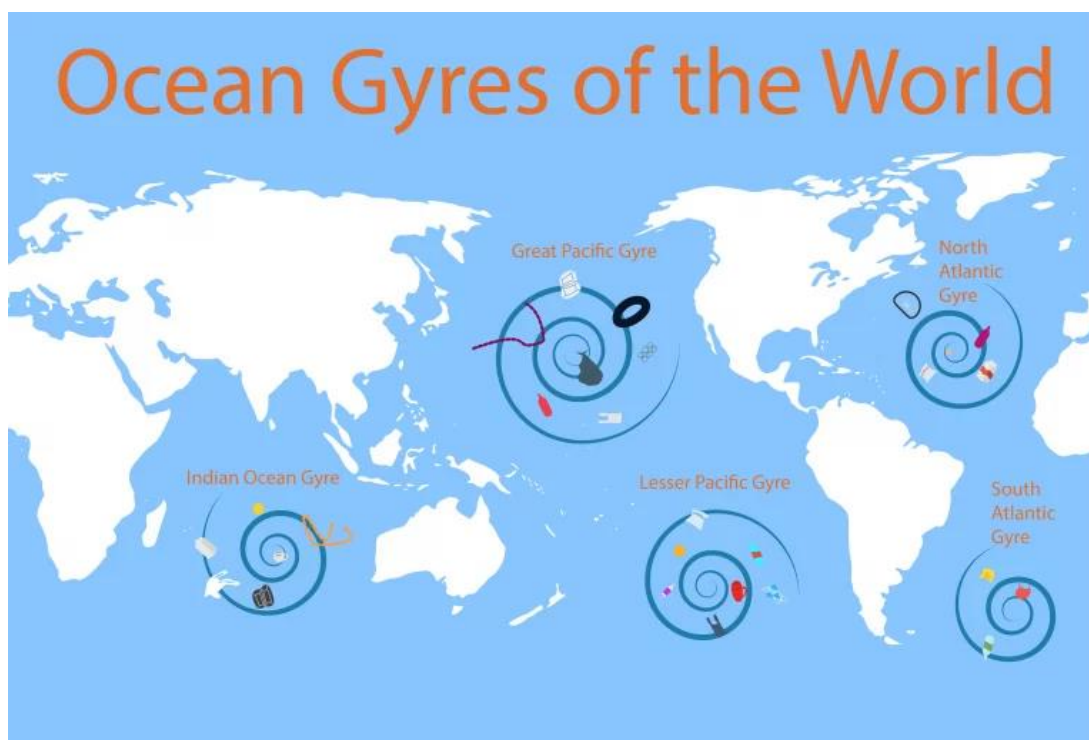


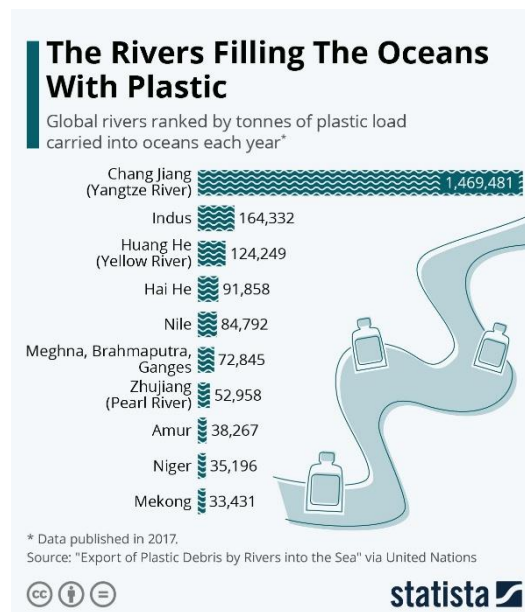
Figure 1 (above) – Ocean gyres of the world

Our Oceans are a plastics dumping ground

It has been estimated 5.25 trillion bits of plastic enter our oceans daily, and this figure is expected to grow over time. About 90% of all ocean plastic comes from ten rivers, five of which pass through China (see figure 2).

Unfortunately, much of the plastic in ocean gyres is difficult to remove as it is either underwater or in the form of microplastic and cannot be easily scooped in nets. Marine animals have been known to ingest ocean plastic, with sea turtles found to have up to 74% (by dry weight) of their diets composed of microplastics. The most obvious solution to addressing this issue is to stop using and producing plastic in the first instance. (Garbage Facts, Garbage Gyres in Oceans - Population Education)

Figure 2 (right) – Global rivers ranked by tonnes of plastic load carried into oceans each year (2017)



The Great Pacific Gyre

The Great Pacific Gyre (or North Pacific Gyre) is in the northern Pacific Ocean (see figure 1). It is a vast and complex ecosystem which plays a key role in absorbing the atmosphere's increasing carbon dioxide levels. It is also the site of an unusually intense collection of human-created marine debris, the **Great Pacific Garbage Patch**, much of which originates from Pacific rim countries in Asia, North America and South America. Estimates put the size of the patch today to be about twice the size of Texas, U.S.A., and it has increased 10-fold each decade since 1945. ([Ecosystem of the North Pacific Subtropical Gyre - Wikipedia](#))

The Ocean Cleanup



Plastic pollution in our oceans is a global crisis and has a devastating impact on marine wildlife and ecosystems. Plastic persists for decades and degrades into microplastics which are ingested by marine animals and subsequently enter the human food chain. **The Ocean Cleanup**, a non-profit organisation is the largest cleanup program in history where cleaning technologies are deployed around the world to remove plastics from oceans and coastal ecosystems. They also focus their attention further upstream to remove plastic flow from rivers and waterways and advocate for better international plastic regulations.

Figure 3 (above) – Taken from “The Ocean Cleanup” media gallery, featuring Boyan Slat, Founder and CEO on a beach in Honduras. ([The Ocean Cleanup](#))

Cleaning the Great Pacific Garbage Patch

The **Great Pacific Garbage Patch** is a major threat to marine ecosystems as animals mistake plastic for food. After running multiple expeditions since 2015, The Ocean Cleanup formed strategic partnerships and developed a system in 2019 to systematically remove plastic debris from the Great Pacific Garbage Patch. Here's how it works:

Target → Capture → Extraction → Recycle

1. Target: circulating currents in the gyre move garbage towards central hotspots. With the assistance of computational modelling, cleanup systems are placed in these predicted hotspots
2. Capture: by maintaining relative speed, plastic is caught in the retention zone of the cleanup system
3. Extraction: once the retention zone is full, it is sealed off and taken onboard the vessel. The retention zone is put back into place and the process continues
4. Recycle: Plastic is returned to shore for recycling to produce durable and sustainable products

Their systems capture plastics ranging from small pieces (mm in size) to large debris (e.g. discarded fishing nets). By deploying fleets of systems to all ocean gyres, the Ocean Cleanup hopes to remove 90% of all floating ocean plastic by 2040.

Further upstream – Removing River plastic

The Ocean Cleanup project also recognises that as well as cleaning up our oceans, we also need to stop plastic from entering our oceans. In addition to ocean deployed clean up systems, they work with government leaders and private organisations to deploy river-based interceptor systems to fit in with local waste management strategies. As rivers vary in terms of their width, depth, flow speed, tides and seasonality, different technology systems are used to maximise plastic removal from the river.

Figure 4 (right) – The Original Interceptor used on The Ocean Cleanup's first ever river cleanup, featuring solar powered mechanics, smart processing. Being autonomous with a large cleaning capacity, it is the main technology they used to evaluate for the feasibility in any new river project.



Other interesting facts taken from The Ocean Cleanup website - <https://theoceancleanup.com/>

- The Great Pacific Garbage Patch does not consist of solid “islands” of trash, rather the plastic is dispersed in massive debris fields.
 - The greatest concentrations of microplastics are found near the ocean surface, but trace concentrations are found a few metres below sea level.
 - Largest pieces of plastic are more buoyant and are generally found at the surface.
 - Some of the plastic entering the ocean is heavier than water and sinks to the bottom. Fortunately, most ocean plastic is of the buoyant type.
 - Tips to help prevent plastic pollution:
 - Spread awareness
 - Take part in beach or river cleanups
 - Reduce use of disposable plastics
 - Dispose of trash properly
 - Wash synthetic clothing as little as possible.
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