

# Nature

## New South Wales

### Spring 2012

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Everyone's a winner

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Humpback whale watching  
off Sydney

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A story of combs,  
elephants and our  
oceans





# Marine Debris

A story of combs, elephants and our oceans

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## A bit of history

What would be your life like with no plastics? Probably landfills would be emptier, but how about your lifestyle and pressures on other natural resources? Like it or not, plastics are part of our lives; they are used in household utensils, packaging, technology, and even in more superfluous purposes, such as combs.

Before the invention of plastics, many goods and processes that we now take for granted could just not happen, and some others could but at the expense of other natural materials. During the 19th Century rich people in the United States and Europe accounted largely for the depletion of Elephant populations as ivory was used to produce billiard balls and other items. Plastics revolutionised our world by supplying a novel material that separated us from the limitations of natural materials both in quantity and applicability.

Since ivory and other natural materials were becoming scarcer by the end of the 19th century, substitutes became desperately needed. It was then in 1862 that Alexander Parkes patented the Parkesine, the first man-made plastic. However, it was John Wesley Hyatt who produced the first commercially successful plastic known as celluloid. Later, Leo Baekeland created the Bakelite in 1909, the first synthetic plastic with high insulation properties. With wars

happening in the first half of the 20th Century, “the age of plastics” was delayed by the military industry as this material was monopolised for warfare purposes. Finally, with the end of World War II, production of plastics was diverted into society at large, ramping up production ever since.

## What is marine debris?

The first pieces of plastics were recorded in the oceans by the 1960s, just a decade after they had become a commodity. Therefore, it is not surprising that man-made litter in the oceans, also known as marine debris, is primarily composed of such material. For instance, 70% of litter items found on beaches in New South Wales are plastics. The same characteristics that make plastics a favourite material are what make them an environmental problem. Plastics are light, long-lasting and buoyant; they can be taken far away from the initial source of disposal by wind and water currents; and remain in the environment for a long time.

Even though plastics dominate marine debris, other materials are also part of it. For example, glass and aluminium are discarded into the oceans in the form of bottles and cans; however, as they generally are not as light as plastics, they are not transported as far from their sources of disposal. These items generally sink in the water and as a result do not have impacts at the same magnitude that plastics do.

## Why is it a problem?

Marine debris can affect wildlife and ecosystems in different ways. Plastic does not generally degrade; it just breaks down into smaller pieces.

### Birds do not eat plastics, or do they?

The Flesh-footed Shearwater *Puffinus carneipes*, a migratory seabird species, has recently declined due to unclear reasons. Adding to many other threats affecting their survival, such as commercial fishing, plastics may be taking their toll. Around 80% of chicks sampled on Lord Howe Island, one of their main breeding colonies, are getting fed by their parents with plastic pieces from the surrounding ocean, which in some cases may be resulting in death due to starvation.



Skeleton of a Flesh-footed Shearwater chick from Lord Howe Island with pieces of plastic inside what used to be its stomach. **Photo:** Ian Hutton.

Marine debris is now far from being just an aesthetic problem on our coastlines or an animal welfare concern due to entangled charismatic animals; this issue is actually modifying ecosystems on which humanity relies and driving population declines in some species.

**Photo:** Eduardo Gallo-Cajiao.

Floating pieces of plastic can act as rafts spreading species, such as molluscs, out of their natural distribution changing biological communities. Plastics can be ingested by vertebrates leading in some cases to death and population declines (see text boxes). Additionally, minuscule fragments of plastic are also consumed by microorganisms, such as zooplankton, with still unknown effects in food webs. On the other hand, derelict fishing gear can entangle vertebrate species, such as turtles, leading to injuries and sometimes death. One of the most worrying traits of marine debris is its everlasting impact, because exactly the same individual items can have the aforementioned consequences over and over again, as animals die and those particles are eventually released back into the environment.

This issue does not just have an effect on the biophysical environment; it also presents socio-economic implications. For instance, plastic bags fouling nets can reduce catch levels amongst subsistence fishermen. Furthermore, marine debris represents a hazard for shipping and may also damage boat motors by entangling propellers. As litter has a visual consequence, tourism can be hit in heavily polluted areas. Marine debris may cost US\$1.265 million annually in the APEC region from its disruption to shipping, tourism and fishing industries.

### Where is it coming from?

Marine debris' sources include land-based and ocean-based activities, with the former accounting for up to 80% worldwide. Activities on land, even from far inland locations, can produce litter that ends up in the marine environment, through storm water discharges, littering, and run-off from landfills. Activities at sea, including shipping and oil exploitation, can also generate refuse directly dumped into the oceans. In Australia, marine debris close to big cities is due to poor land-based waste management, whereas sea-based activities are more associated with debris in remote areas, such as the Great Australian Bight.

### The extent of it

Marine debris has been increasing all over the world's oceans with regional differences. For instance, small plastics have doubled in the northern Pacific in the last four decades. Marine litter is now found from beaches and the sea surface to seabeds at different depths. In a recent report all 28 beaches surveyed on the New South Wales north coast presented marine debris, and only four out of 49 subtidal areas did not have any litter at all. It is also estimated that an average of 13 000 pieces of plastic may be floating on every square kilometre of the oceans. Coastal regions close to large cities are heavily affected as well as the five ocean subtropical gyres, where rotating currents "trap" small fragments of plastic. More remote regions, such as the poles, have also been affected, though at a lower magnitude.

### Are we doing enough about it?

The answer is clear: no, we are not. Policies to tackle this issue have included remediation and prevention amongst different stakeholders, but responsibility is something no one really wants to take. Clean-ups along beaches in Australia have become popular amongst community groups funded by the government and the corporate sector. Conversely, educational campaigns, such as "do the right thing", have tried to solve the problem at the source. Under the current scenario a combination of

both approaches is needed; we need to reduce the amount of litter being released into the marine environment, and at the same time the litter that is already there needs to be removed.

It is imperative we adopt a national container deposit scheme in Australia, which would create a financial incentive to reduce the amount of plastics in one of the most important components of the biosphere: our oceans!

### In NPA's view

A national container deposit scheme (CDS) will reduce waste, protecting our marine and terrestrial environments. State and federal environment ministers are due to meet in August 2012 to consider options for reducing the amount of packaging waste that goes to landfill, including a national CDS. This scheme is strongly supported by many environment groups, including NPA. See [www.boomerangalliance.org.au](http://www.boomerangalliance.org.au) for further details and updates.

### References and further reading

- Barnes, D. K. A., Galgani, F., Thompson, R. C. and M. Barlaz. 2009. Accumulation and fragmentation of plastic debris in global environments. *Philosophical Transactions of the Royal Society B: Biological Sciences* 364: 1985-1998.
- Freinkel, S. 2011. *Plastic: a toxic love story*. The Text Publishing Company, Melbourne, Victoria.
- UNEP. 2005. *Marine litter, an analytical overview*.

The plastic irony is that the same material that was invented more than a century ago slowed down demand for ivory, saving thousands of elephants at that time, has now become one of the most important threats to the marine environment, which includes many animals such as turtles and seabirds.



The Flesh-footed Shearwater is a trans-equatorial migratory seabird that breeds on approximately 60 islands across the Indian and the south-western Pacific Oceans. **Photo:** Ian Hutton.



Carcass of a Flesh-footed Shearwater chick from Lord Howe Island with pieces of plastic inside its stomach. **Photo:** Ian Hutton.