



Reducing marine litter arising from the fishing industry in South Africa

Fisheries training development report

The Commonwealth Litter Programme

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Executive Summary

Plastic has become the most ubiquitous material in our oceans. Currently it is estimated that over 8 million tons of plastic is deposited in the oceans globally, coupled with the already pervasive presence of plastic, this has become one of the major crises facing both people and the planet. Preventing plastic pollution from entering the environment will require focused efforts on behaviour change (reducing our reliance on single-use plastics), improvements in waste management, with a strong movement toward a circular economy for plastics. While it is purported that 80% of all plastic in the oceans is from land-based sources, there currently exists very little information and data about how much marine litter in the form of lost fishing gear is lost at sea (both nearshore and offshore) by large scale, highly industrialized fishing industries as well as small scale fishing industry.

This holds true for South Africa and similarly, there is no quantitative data on how much plastic land-based fishing operations use and discard in the public space. This problem is further exacerbated by fishers being unaware of their plastic footprint and how their actions at sea affects contributes to plastic pollution. While there exists many training courses that relate to fishing, the ecosystem and the impacts of fishing and associated operations, very little exists in the way of the impacts of plastics on the oceans, how this relates to fishing operations and the role the fishing industry can play in helping to arrest the plastic problem.

The fishing industries plastic footprint both at sea and in factories has not been quantified, the development of this training programme is aimed at creating awareness, building local capacity and provide economical, practical solutions that provide long-term impact in reducing marine litter amongst fishers and fishing crew while at sea and from fish factories. This project also provides the potential for further funding to be sourced that will look at how the fishers can be used to collect data (citizen science) on plastic at sea.

Thus far only the training module for large scale fishers has been tested and implemented on the 05 and 06 March 2020. The module was very well received with much excitement about having a section in the course focusing on plastic pollution and the fishing industry. The other modules, as well as, the monitoring and evaluation framework have also been completed and will be fully incorporated in the other Responsible Fisheries Alliance, small scale training programmes and the WWF-SASSI training at WWF-SA. Unfortunately, until June 2020 all further training has been cancelled due to the COVID -19 virus.

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1. Introduction

Plastic has become the most ubiquitous material in our oceans. Currently it is estimated that over eight million tons of plastic is deposited in the oceans globally, coupled with the already pervasive presence of plastic, this has become one of the major crises facing both people and the planet. Preventing plastic pollution from entering the environment will require focused efforts on behaviour change (reducing our reliance on single-use plastics), improvements in waste management, with a strong movement toward a circular economy for plastics. While it is purported that 80% of all plastic in the oceans is from land-based sources, there currently exists very little information and data about how much marine litter in the form of lost fishing gear is lost at sea (both nearshore and offshore) by large scale, highly industrialised fishing industries as well as small scale fishing industry.

This is true for South Africa and similarly, there is no quantitative data on how much plastic land-based fishing operations use and discard in the public space. This problem is further exacerbated by fishers being unaware of their plastic footprint and how their actions at sea affects contributes to plastic pollution. While there exists many training courses that relate to fishing, the ecosystem and the impacts of fishing and associated operations, very little exists in the way of the impacts of plastics on the oceans, how this relates to fishing operations and the role the fishing industry can play in helping to arrest the plastic problem.

This report covers a training programme developed by WWF, as part of the Commonwealth Litter Programme (CLiP), an initiative delivered by the Centre for Environment Fisheries and Aquaculture Science (Cefas) and funded by the United Kingdom's Department for Environment, Food and Rural Affairs. It supports developing countries across the Commonwealth in preventing plastics entering the oceans.

2. Objective

The fishing industries plastic footprint both at sea and in factories has not been quantified, this report covers the design and implement of a training programme to reduce marine litter arising from the fishing industry in South Africa.

Specifically, to:

1. To create awareness of the plastic problem amongst fishers and the impacts of their actions at sea
2. Build local capacity
3. Provide economical, practical solutions that provide long-term impact in reducing marine litter amongst fishers and fishing crew while at sea and from fish factories.

This project also provides the potential for further funding to be sourced that will look at how the fishers can be used to collect data (citizen science) on plastic at sea.

3. Methodology

The course material was developed by Dr Judy Mann who specialises in changing behaviour through education and conservation psychology and is the head of education at the South African Association of Marine Biological Research (SAAMBR). The material was developed in-line with adult education methodology used by SAAMBR at the uShaka marine aquarium teaching modules and fits within the current fisheries training module that was developed and implemented by the Responsible Fisheries Alliance and the WWF Small Scale Fisheries training programme.

The project is aimed at designing and implementing a training programme to reduce marine litter arising from the fishing industry in South Africa.

The priority of the training programme is based on a stepped hierarchy and is as follows:

1. Large scale industrial fishing industry – sea-based fishing
2. Large scale industrial fishing industry – land-based processing
3. Small scale fisheries

This training includes a formal monitoring and evaluation (M&E) process to measure the effectiveness of the training based on an assessment methodology used by SAAMBR and WWF-SA.

The M&E framework will include pre-course assessment to assess fishers knowledge, attitudes and actions regarding plastics in the oceans and its impact, before undertaking the course and then a post-assessment to see what was learnt and how the fishers believe could be the best mechanism to apply what was learnt.

4. Progress

All the modules for the various sectors has been developed and while the training module for the large scale industrial fishing industry (land-based processing), is the only module that has been beta-tested in a training session held on the 05 & 06 of March 2020. The module was very well received with much excitement about having a section in the course focusing on plastic pollution and the fishing industry.

There has also been a setback in terms of implementing the other training modules due the COVID – 19 virus as WWF has postponed all training indefinitely. However, a new officer will only be employed to undertake the training post COVID-19.

A successful train-the-trainer course was hosted and conducted on the 05 and 06 of March 2020. Fifteen attendees from the fishing industry, NOG's and universities.

6. Going forward

As has already been done with the large scale industrial fishing industry – sea-based fishing module, all modules will be fully incorporated into the WWF training programme going forward. Relevant components of the modules will also be incorporated into the WWF-SASSI retailer and chefs training module. These training courses are run twice a year with the various WWF-SASSI retailer/supplier participants (<http://wwfsassi.co.za/sassi-participants/>) and the WWF-SASSI chefs (<http://wwfsassi.co.za/chefs-sassi-works-with/>).

Appendix i: Large scale industrial fishing industry – sea-based fishing

Module 5

Marine Litter

Contents

Marine Litter

- What is marine litter?

- Where does marine litter come from?

- What is the impact on fishers and fisheries?

- What is the impact on marine life?

- How does marine litter move around the ocean?

- Why is plastic such a problem?

Some Solutions

In the previous modules we learnt about South Africa's fisheries and their management. In this module we are going to learn about marine litter, where it comes from and its impact on our fisheries and marine life. We will also learn how we can help to solve the problem.

Marine Litter

What is marine litter?

Marine litter is simply man-made waste in the ocean or coastal environment. It includes items made of plastic, glass, paper, metal and other man-made materials, as well as organic items such as discarded food and sewage. It includes lost or discarded fishing gear, lost cargo and waste items.

Marine litter enters the ocean in three ways - i) indirectly via rivers, storm water drains, or sewage lines that open into the ocean, ii) items deliberately discarded at sea, or by people on the coastline on beaches or alongside rivers or iii) fishing gear and cargo accidentally lost or discarded at sea, including the ropes and strapping used to secure the cargo.

The litter either sinks to the bottom of the ocean or floats in the water column or at the surface. Currents in the ocean move the litter around the ocean – from pole to pole. And currents gather floating litter to create giant 'garbage patches'. Plastic has been found in the deepest parts of the ocean, at depths of 11km!

Some marine litter decomposes – breaks down until there is nothing left. Organic waste will decompose completely, although it can take a long time. Some man-made litter does break down, but it takes a very long time – cotton items, paper, cardboard, etc. Sunlight, weathering and water action degrade plastic, metal and glass. Degrade means that they break down into smaller and smaller pieces – but they remain in the environment. Glass and metal break down into tiny pieces, but these never disappear completely and remain in the ocean. Plastic breaks down into smaller and smaller pieces until it eventually becomes microplastics.

Box on the side:

Did you know: Key facts about plastic

- The raw material production of plastics in SA is still primarily derived from fossil-fuels (coal), and the industry ownership is highly sophisticated and concentrated.

- South Africa ranks in the top 20 plastic polluting nations globally due to our relatively high per capita plastic consumption coupled with 56% of waste which is mismanaged.
- Of the waste materials found on beaches 94% is plastics and 80% of that is plastic packaging.

So, most of what we have deposited in the ocean is still there, accumulating more and more, and slowly destroying the environment that sustains our fisheries and livelihoods.





© WWF-SASSI

Where does marine litter come from?

Around 80% of marine litter comes from land-based sources. About 10% comes from abandoned, lost or discarded fishing gear and 10 % comes from other fishing and shipping activities. Around 8 million tonnes of plastic enters the oceans each year from land-based sources (the equivalent to a dump truck per minute). Uncollected waste is responsible for 75% of plastic leakage into the ocean.

The land-based litter enters the ocean because of:



- Poorly managed landfill sites
- Poorly maintained sewage treatment plants and sewer overflows
- People using beaches for recreation or shore fishing
- Factories, plastic processing and transport
- Shore-based dump sites and processing facilities
- Inadequately covered waste containers and waste-container vehicles
- Street litter that is washed by rain or blown by the wind into rivers or storm water drains that enter the ocean.
- Just over half the households in South Africa have some form of waste collection.

Sea-based sources of litter include:

- Vessels that dump waste at sea
- People on vessels who throw their litter overboard. This is either deliberate or accidental when litter is blown off a vessel or washed overboard.
- Lost or discarded fishing gear
- Waste from offshore oil and gas platforms

What is the impact on fishers and fisheries?

- Marine litter has negative social and economic impacts. These can be direct, e.g. damaged equipment, lost catches, or indirect, e.g. cost of clean-ups and disposal. The cost of the damage to the marine environment is estimated to be around \$13 billion globally.

Ecosystems impacts = lower catches

Impacts on the food web in the ocean impact on the availability of fish and other marine resources. Unlike direct damage such as damaged fishing gear or facilities, it is difficult to estimate the exact scale and impact of damage to marine ecosystems. It also takes a long time for habitats and biodiversity to show the real impact of the damage and then to recover from the impacts. In other words, marine litter is a threat to biological diversity in the marine environment and may lead to a decrease in fisheries resources. Estuaries are important for the life-cycle of many commercially important marine species. Litter in estuaries impacts on the natural functioning of the estuaries and may impact on the ability of these systems to support fish and other valuable resources.

Vessel and harbour impacts

Marine litter often becomes stuck or entangled in vessel equipment. A fouled propeller or blocked water cooling system costs time and money to repair. Harbours have been known to become so choked with litter that it is impossible for vessels to move.

Small inshore vessels are more susceptible to the impact of marine litter than larger offshore vessels.



The Durban Harbour after a flood event in 2018. ©Judy Mann

A story from Korea

In October 1993, the Seohae Ferry was returning to port due to bad weather but became entangled in derelict rope, which got caught in the propeller. This reduced the speed of the engine; then a huge wave caused the vessel to capsize and sink, claiming 292 lives.

From: NOWPAP MERRAC 2013: Negative Impacts of Marine Litter in the NOWPAP Region: Case Studies

Catch impacts

When nets are hauled in filled with marine litter, the litter displaces fish, meaning that fishers catch less fish. Nets can also snag on junk on the seabed. Removing the litter and repairing nets and fishing gear wastes time and money.



Plastic removed from a Durban Bay seine net. ©J.Mann

A story from Oman

It is estimated that as much as 80 kg of fish per trap are progressively captured by each of the 15,000 lost fishing traps along the shores of Oman every year resulting in a loss of USD 2.6 million to the fishing industry every year. This is an example of 'ghost fishing'.

From: Al-Masroori, Al-Oufi, McIlwain & McLean, 2004

A story from Korea

A huge mass of blue crabs was found dead in discarded fishing gear in Korea. The Korean government knew that blue crab catches were decreasing so they decided to remove derelict fishing gear. The Navy removed about 235 tons of derelict nets between 2008 and 2010. After the clean-up, there was about a two-fold increase in the blue crab catch.

Source: NOWPAP MERRAC 2013: Negative Impacts of Marine Litter in the NOWPAP Region: Case Studies

Negative impacts of marine litter on humans

Sectors

Fishing and aquaculture

Marine ecosystems

Shipping and navigation

Tourism and recreational activities
divers

Impacts

Damage to fishing gear

Damage to aquaculture facilities

Interruption of fishing operation

Human casualties (death, injury, disease, etc.)

Ghost fishing

Destruction of marine species habitats

Decrease of fishery resources

Entanglement

Sailing delay

Breakdown/repair of vessel

Collision, sinking and other deadly accidents

Hazards to beach goers, swimmers and

Destruction of aesthetic value / Costs for removal

Source: NOWPAP MERRAC 2013: Negative Impacts of Marine Litter in the NOWPAP Region: Case Studies



Clean-up events are essential, although costly and time-consuming. ©Judy Mann

What is the impact on marine life?

Marine litter has many impacts on marine life. The impacts can be divided into three main groups.

Entanglement / entrapment

Entanglement occurs when an animal becomes trapped by marine litter, leading to difficulty in moving, finding food and escaping predators, which could result in death. Animals are attracted to litter items due to their natural curiosity or while in search of food or shelter. Entanglement / entrapment may not necessarily cause death but torturous pain, as the litter becomes embedded in the animal's flesh as it grows around it. Thousands of marine animals become entangled in litter each year, and many of them die because of the entanglement. Entanglement affects turtles, seals, whales and dolphins and seabirds. Fish and invertebrates also become victims of entanglement.

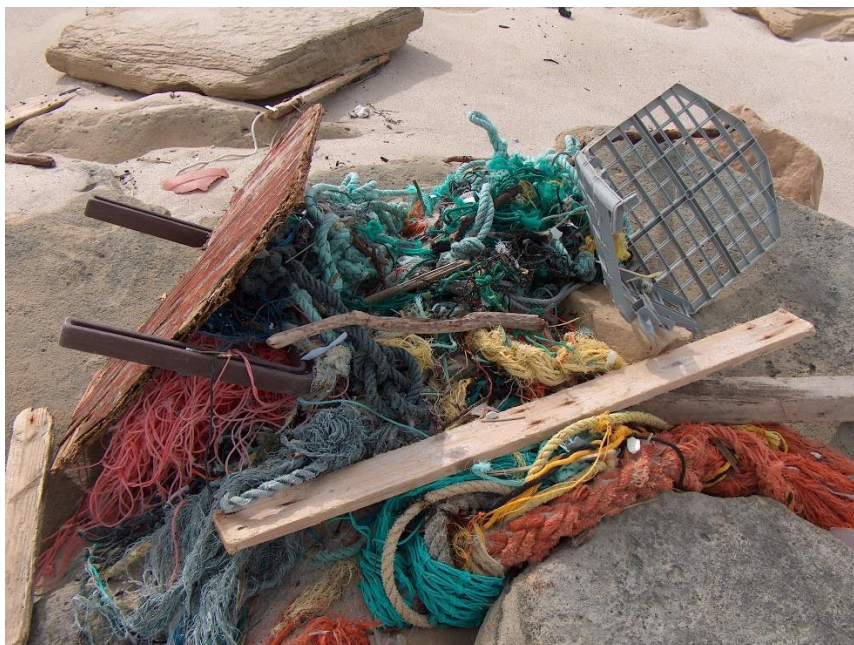
Discarded fishing gear is most often responsible for entanglements – fishing line, rope and netting and other abandoned fishing gear. Research suggests that, compared to other consumer items discarded in the ocean, fishing gear poses the greatest ecological threat. Buoys, traps, monofilament line and fishing nets are the most dangerous items for entanglement.



A seal entangled in rope. ©Two Oceans Aquarium

A story from Cape Town

The Two Oceans Aquarium disentangled almost 1 000 seals in the Western Cape between 2010 and 2018. The seals are mostly entangled in fishing gear including fishing line, box bands and various kinds of ropes. And the number of animals entangled is increasing.



On the De Hoop beach in Western Cape - fishing gear discarded off vessels ©Judy Mann



Turtle on a beach in Gabon entangled in a fishing net. ©Ewan Kyle

Ingestion

Ingestion of litter occurs unintentionally, intentionally, or indirectly through the ingestion of prey species containing litter. Plastic has now been documented in many different marine species, including marine turtles, seals, whales and seabirds. Fish, birds, turtles and mammals may swallow plastic accidentally or because it resembles their prey. For example, turtles eat plastic bags mistaking them for jellyfish; birds feed on or feed their chicks with plastic pellets or bottle tops, mistaking them for fish eggs or crabs, etc. Ingestion can lead to starvation or malnutrition if the ingested items fill up their stomach. The animal feels full and does not eat, and slowly starves to death. Plastic bags, balloons and plastic utensils are amongst the most often ingested items.



© WWF International

Sharp objects, e.g. fish hooks, metal and broken glass, can wound the digestive tract and cause infection and pain, and ultimately death. Plastic materials, particularly plastic bags, have been found blocking the airways and stomachs of many terrestrial and aquatic animal species.



An X-ray of fishing hooks inside a Cape Gannet. This bird was treated by the uShaka Sea World vet team but unfortunately died. ©SAAMBR

Microplastics can be taken up by filter feeding animals such as oysters and mussels, or small fish such as sardines. Microplastics attract toxins, which, when ingested, can harm the animals. The size of the animal determines the size of the litter ingested.

Interaction

Interaction includes contact with debris (with the exception of entanglement) including collisions, obstructions or abrasions. There are many ways that this can happen. Fishing gear, for example lobster traps, cause abrasion and damage to reefs. Discarded fishing line or nets cover and interact with mussel beds or redbait pods, or smother sponges and corals. Algae growing on discarded fishing gear can kill corals and other reef animals.

What is 'Ghost Fishing'?

Lost (accidentally or deliberately) fishing gear including nets, fishing lines, anchors, ropes and traps, may continue to catch marine life long after they have been abandoned. Ghost fishing occurs when marine animals get caught, entangled and or trapped in lost gear. This gear continue to catch fish, turtles, mammals or birds, as they keep on drifting in the sea or along the bottom, often for very long periods. Their "catch" may attract other fish, sharks, mammals or seabirds searching for food, causing these predators to also become entangled. When the nets become too heavy, filled with dead animals, they sink, the animals decompose, and the nets get lighter. The nets then float again and start killing animals in a lethal never-ending cycle. The loss of these fish to the commercial catch means less fish for fishers to catch.

Rankings of marine debris items by their expected impact on marine animals.
1 highest, 20 lowest.

Item name	Rank of expected impact			
	Mean	Bird	Turtle	Mammal
Buoys/traps/pots	1	1	1	1
Monofilament line	2.3	3	2	2
Fishing nets	2.7	2	3	3
Plastic bags	5.7	4	9	4
Plastic utensils	5.7	7	4	6
Balloons	6.7	8	5	7
Cigarette butts	7.3	5	12	5
Bottle caps	7.7	9	6	8
Food packaging	8.7	10	7	9
Other packaging	9.7	11	8	10
Hard plastic containers	11.3	6	13	15

Item name	Rank of expected impact			
	Mean	Bird	Turtle	Mammal
Plastic food lids	11.3	13	10	11
Straws/Stirrers	12.3	14	11	12
Takeout containers	15.3	15	18	13
Cans	15.7	17	14	16
Beverage bottles	16	12	17	19
Unidentified plastic fragments	16.3	16	19	14
Cups & plates	16.7	18	15	17
Glass bottles	17.7	19	16	18
Paper bags	20	20	20	20

Source: C Wilcox, N J. Mallos, G H. Leonard, A Rodriguez, B D Hardesty. 2016. Using expert elicitation to estimate the impacts of plastic pollution on marine wildlife, Marine Policy, Volume 65

A story from Cape Town

Professor Peter Ryan from Cape Town is one of the world's leading researchers in marine litter. His research indicates that at least 147 seabird species, as well as 69 freshwater birds and 49 landbirds from 53 families have been entangled in plastic or other synthetic materials. Fishing gear is responsible for entangling most species (83%), although it is often difficult to differentiate entanglement from bycatch (animals caught accidentally) on active gear. He suggests that we could address the problem by banning high-risk items where there are alternatives (e.g. six-pack rings), discouraging the use of high-risk items (e.g. balloons on strings) and encouraging fishers not to discard

waste fishing gear by providing bins and associated educational signage in fishing areas.

Source: Ryan, P. 2018. Entanglement of birds in plastics and other synthetic materials. Marine Pollution Bulletin. 135:159-164

A story from KwaZulu-Natal

Over 23 years, 53 sharks caught by the KZN Sharks Board had polypropylene strapping bands around the body. The dusky shark was the most frequently entangled species. The number of sharks entangled in this way is increasing. A total of 60 sharks had ingested plastic debris, over half of these were tiger sharks. The most common items were packets or sheets.

Source: Cliff, Dudley, Ryan & Singleton 2002 Large sharks and plastic debris in KwaZulu-Natal, South Africa
Marine and Freshwater Research 53(2) 575 - 581

How does marine litter move around the ocean?

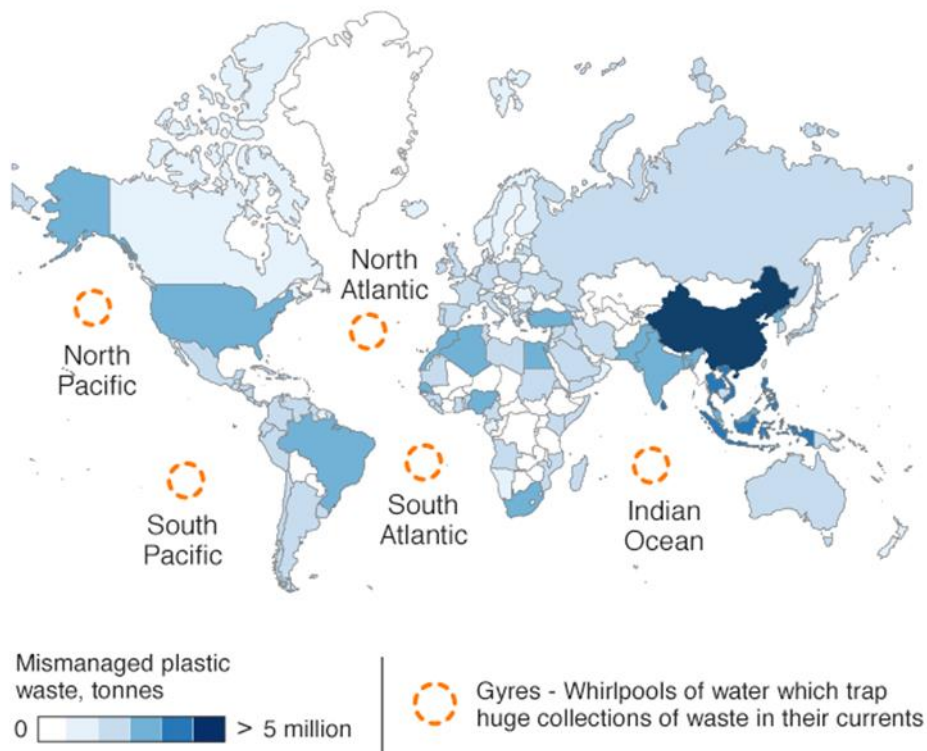
The 'garbage patches' mentioned earlier are formed when plastic waste accumulates in the centres of ocean basins, areas where winds create swirling circular currents, known as gyres.

Isolated oceanic islands, many thousands of kilometres from land, can become catch points for marine litter waste when they are near a gyre. Their shores collect a disproportionate amount of pollution, despite being far from the major plasticwaste sources. Our waste knows no borders – the waste we discard here could impact animals or people thousands of kilometres away.



Uninhabited islands far from any cities are littered with plastic items. ©Pam Lenoury

Ocean plastic



Source: Jambeck et al, Science Feb 2015, UNEP, NCEAS

BBC

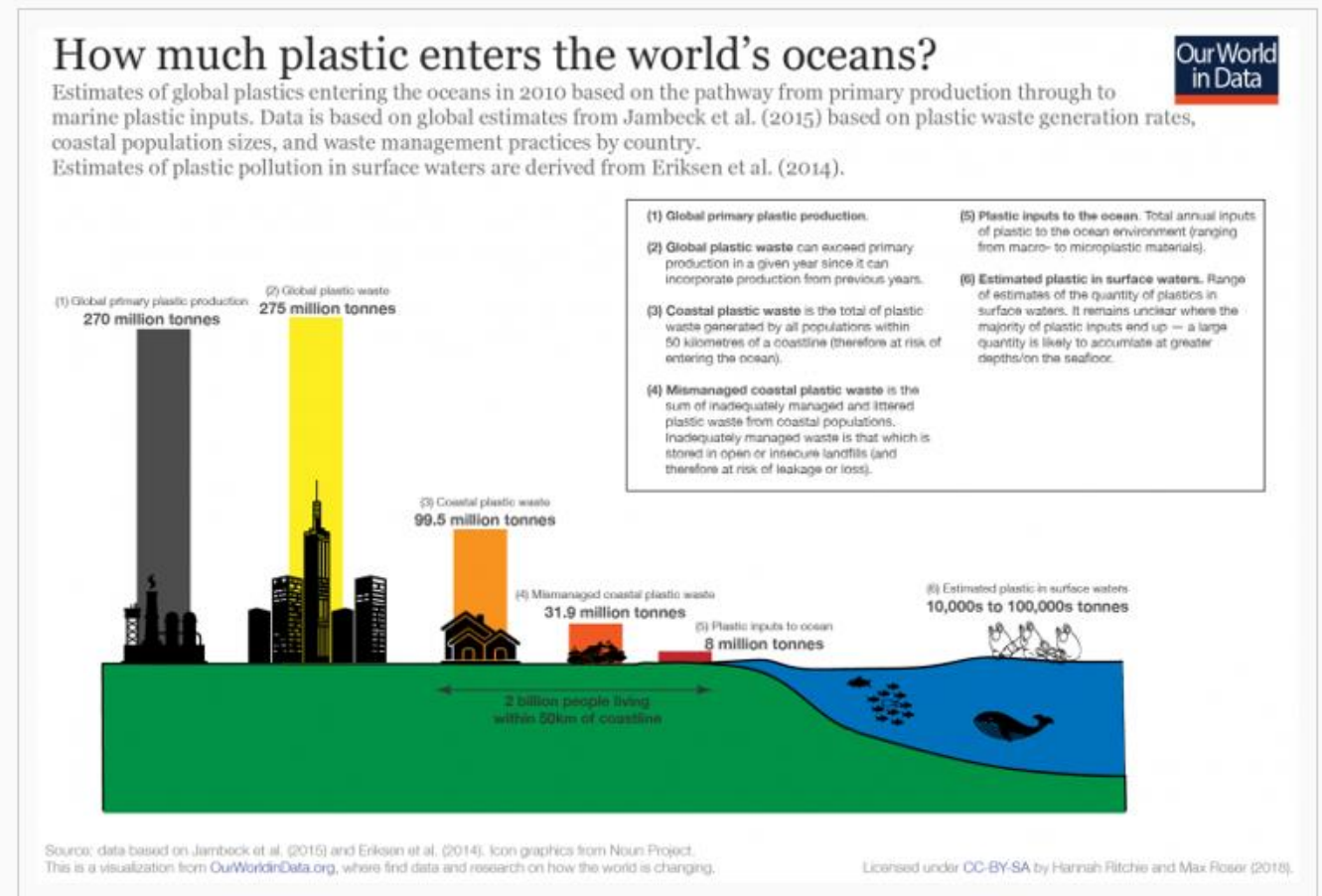
Gyres in the ocean where plastic accumulates.

Why is plastic such a problem?

We have produced over 8 billion tons of plastic since the 1950s. The production of plastic has outpaced that of almost every other material. Of this, less than 10% has been recycled. Over 275 million tonnes are produced each year. It is estimated that over 8 million tons of plastic enter the ocean each year – that is the same as 22 000 tons of plastic every DAY!

Single-use plastic, or disposable plastic, are plastic items that are only used once before they are thrown away into landfill or recycled (although many of them are not recycled or are difficult to recycle). These items include plastic bags, straws, cooldrink and water bottles, take-away coffee cup lids and most food packaging. Plastic can only be recycled back into its original polymer a limited number of times, so ultimately it will become non-recyclable over time. Although plastic does not biodegrade (decompose into a natural substance like soil) it will degrade (break up) into tiny particles after many years. Our ability to cope with plastic waste is already overwhelmed.

On land plastic waste causes a wide range of problems when it leaks into the environment. Plastic bags can block waterways and exacerbate natural disasters. By clogging sewers and storm water drains and providing breeding grounds for mosquitoes and pests, plastic bags can increase the transmission of vector-borne diseases like malaria.



What are microplastics?

Microplastics are pieces of plastic that are smaller than 5mm. Microplastics originate from a variety of sources, including microbeads from personal care products, fibres from synthetic clothing, pre-production pellets and powders, rubber fibres from tyres, and fragments degraded from larger plastic products.

A story from Durban

A study on mullet in the Durban Harbour in KwaZulu-Natal found that, of 70 mullet, 73% had plastic particles in their guts. White and clear plastic fibres were ingested most commonly.

Source: Naidoo, Smit, Glassom 2016 Plastic ingestion by estuarine mullet *Mugil cephalus* (Mugilidae) in an urban harbour, KwaZulu-Natal, African J. Marine Science, Volume 38, 2016 - Issue 1

What are nurdles?

Nurdles are tiny plastic pellets. Each small 'nurdle' pellet is half-moon shaped. These tiny pieces of plastic are the raw material for many other plastic products. They are re-melted and moulded in factories to make a wide range of plastic products. In themselves, they are not harmful to humans. However, the bad news is that if lost at sea these plastic pellets or nurdles absorb pollutants such as PCBs and organochlorine pesticides, which are extremely harmful to both marine life and humans if consumed. Nurdles never disintegrate but merely break down into smaller and smaller fragments. Because of their small size they can be eaten by filter feeders, or other animals that eat fish eggs. Both the nurdles and the toxins they have absorbed can enter then enter the food chain, as they are eaten by fish and other marine animals.



Nurdles on the uMdloti beach in KwaZulu-Natal. ©Judy Mann

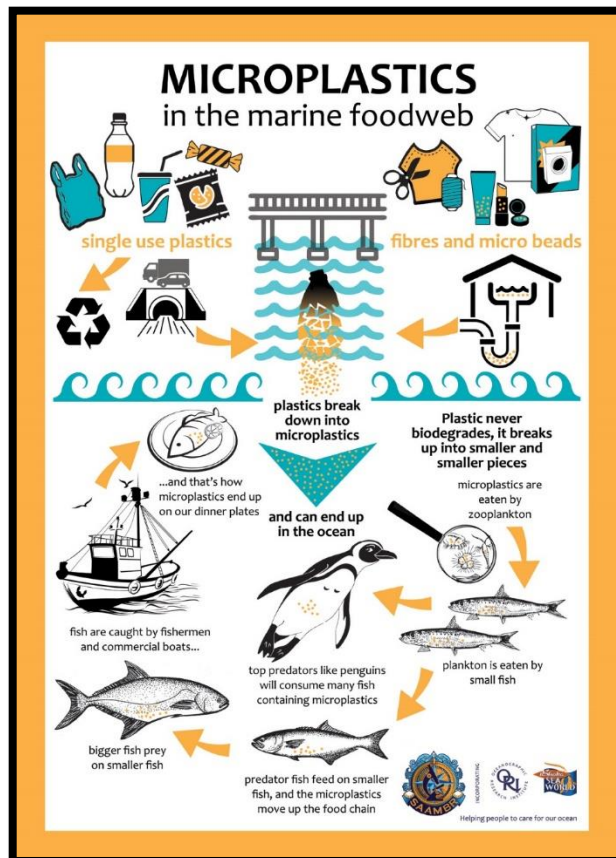
A story from Durban

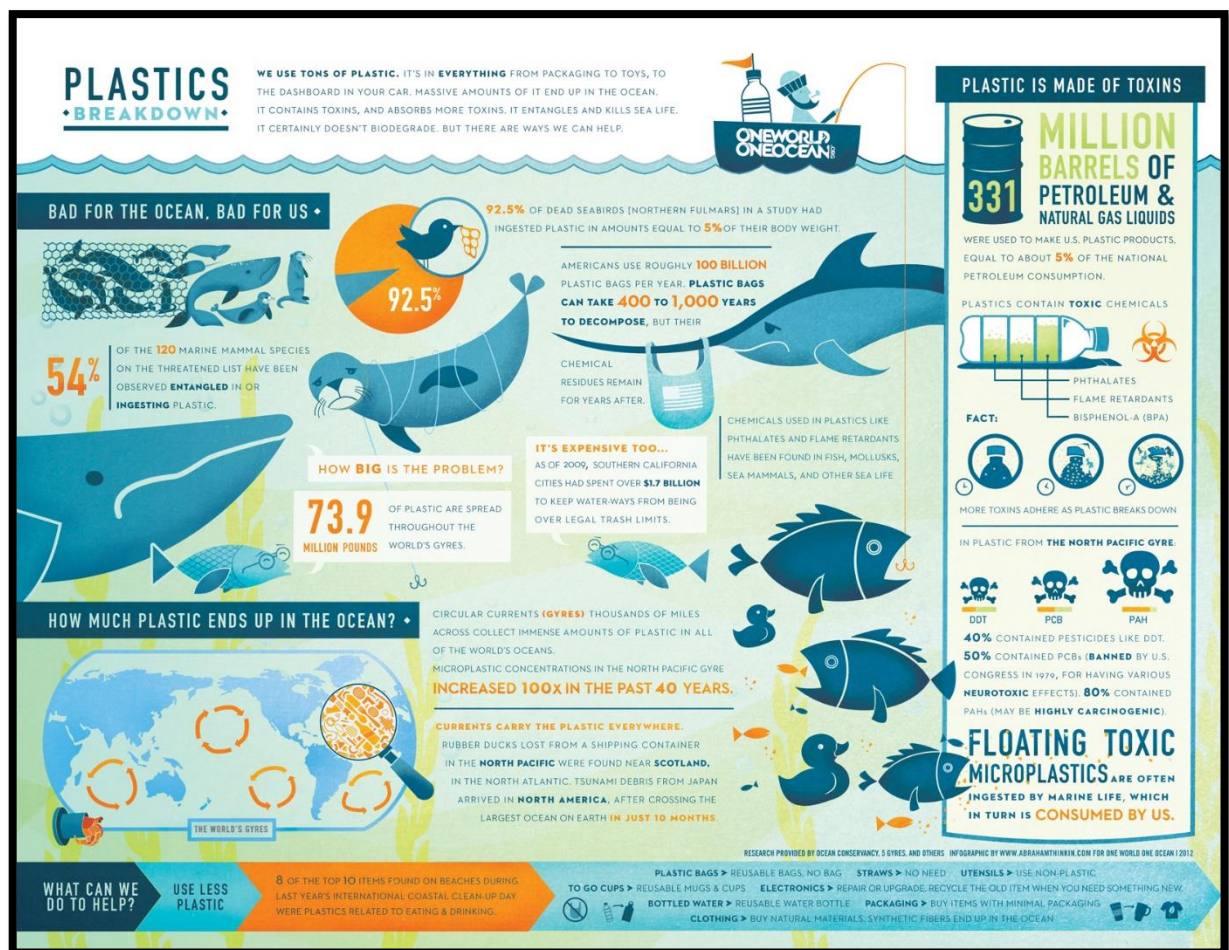
On the 10 October 2017 an estimated 49 tons of nurdles - about 2 billion microplastic nurdles - spilt out of a number of shipping containers in the Durban harbour after an extremely strong storm. These nurdles started to wash up on Durban's beaches on the 18 October. A call to clean the KZN beaches was initiated by SAAMBR and the people of KZN responded with enthusiasm. Thousands of people flocked to the beaches to collect nurdles. However, less than 25% have been recovered. The ocean currents carried the nurdles around the 3000km South African coast over a period of 8 weeks.

Food Webs and Microplastic

Because of their small size many marine species can ingest microplastics. Tiny animals such as zooplankton have been found to eat these microscopic pieces of plastic. Microplastics also enter the food web via filter feeders. There is evidence that microplastics and the toxic chemicals added during the manufacture of plastic, transfer

to animal tissue, eventually entering the human food chain. So once these plastics enter the food chain it is likely that they may land up on your plate after fish and shellfish have ingested them. Some of these compounds, which include Bisphenol-A (BPA) and Phthalates, have been found to alter hormones or have other potential human health effects such as reproductive abnormalities, higher child obesity levels and changes to foetal brain development.





Some Solutions

What should we do if we catch litter in our nets?

- Don't throw it back overboard! Bring it to shore, find an appropriate bin and dispose of it. This requires some effort, but it is well worth the trouble, both for the environment and for you (remember that fish can get caught in litter).
- Work with other fishers facing the same problem. Let your company owner, local authority (DEFF or municipal) or a local NGO know about the litter problem and together identify some solutions.
- Initiate a marine litter collection campaign or call for the creation of free waste disposal points in your local harbour.
- Work with the harbour authorities to create stations where plastic can be collected for recycling.

As a fishing company owner, what can I do?

- Produce Standard Operating Procedures for the correct handling of waste at sea. Ensure that these procedures are effectively communicated and implemented.

- Ensure that your company has appropriate waste disposal on land and on fishing vessels. Compactors reduce the volume of waste and these should be used on larger vessels.
- Ask your company to join the South African Plastic Pact and then hold them accountable to it
- Work together with the relevant industries to develop packaging and fishing gear that poses fewer threats to the environment.
- Have a look at your harbour. Are the waste disposal bins easy to access? Together with other company owners, perhaps you could approach the manager of the site (local authority or fisheries authority) and discuss ideas for improved waste management with them.

We smoke at sea. What can we do?

- Don't throw your cigarette butts overboard. Put them in a tin can and bring them back to dispose safely on shore.

A story

Story of the fishers who changed their cigarette butt disposal methods...

WWF-SA has been training local small scale fishers along the coast on the ecosystem effects of fishing one such community was Hondeklipbaai. During this training, the issue of marine pollution was addressed and the trainer mentioned that cigarette butts are the most prevalent plastic item found in the oceans and often trapped in whales and birds.

During a follow up training session with the Hondeklipbaai community, fishers proudly told WWF-SA trainers that they no longer throw their cigarette butts overboard but collect them in a tin can and bring them back to shore and dispose of them on land.

KEY POINTS FROM MODULE 5:

At the end of this module 5, I have:

- **Learnt about the sources of marine litter**
- **The impact of marine litter on fisheries and marine life**
- **How we can decrease the amount of litter entering the ocean.**

Prepared by: Dr Judy Mann-Lang, South African Association for Marine Biological Research

Appendix ii. Large scale industrial fishing industry – land-based processing

Module 5

Marine Litter

Contents

Marine Litter

- What is marine litter?

- Where does marine litter come from?

- What is the impact on fishers and fisheries?

- What is the impact on marine life?

- How does marine litter move around the ocean?

- Why is plastic such a problem?

Some Solutions

- What can we do to solve this issue?

- At sea

- On land

In the previous modules we learnt about South Africa's fisheries and their management. In this module we are going to learn about marine litter, where it comes from and its impact on our fisheries and marine life. We will also learn how we can help to solve the problem.

Marine Litter

What is marine litter?

Marine litter is simply man-made waste in the ocean or coastal environment. It includes items made of plastic, glass, paper, metal and other man-made materials, as well as organic items such as discarded food and sewage. It includes lost or discarded fishing gear, lost cargo and waste items.

Marine litter enters the ocean in three ways - i) indirectly via rivers, storm water drains, or sewage lines that open into the ocean, ii) items deliberately discarded at sea, or by people on the coastline on beaches or alongside rivers or iii) fishing gear and cargo accidentally lost or discarded at sea, including the ropes and strapping used to secure the cargo.

The litter either sinks to the bottom of the ocean or floats in the water column or at the surface. Currents in the ocean move the litter around the ocean – from pole to pole. And currents gather floating litter to create giant 'garbage patches'. Plastic has been found in the deepest parts of the ocean, at depths of 11km!

Some marine litter decomposes – breaks down until there is nothing left. Organic waste will decompose completely, although it can take a long time. Some man-made litter does break down, but it takes a very long time – cotton items, paper, cardboard, etc. Sunlight, weathering and water action degrade plastic, metal and glass. Degrade means that they break down into smaller and smaller pieces – but they remain in the environment. Glass and metal break down into tiny pieces, but these never disappear completely and remain in the ocean. Plastic breaks down into smaller and smaller pieces until it eventually becomes microplastics.

Box on the side:

Did you know: Key facts about plastic

- The raw material production of plastics in SA is still primarily derived from fossil-fuels (coal), and the industry ownership is highly sophisticated and concentrated.

- South Africa ranks in the top 20 plastic polluting nations globally due to our relatively high per capita plastic consumption coupled with 56% of waste which is mismanaged.
- Of the waste materials found on beaches 94% is plastics and 80% of that is plastic packaging.

So, most of what we have deposited in the ocean is still there, accumulating more and more, and slowly destroying the environment that sustains our fisheries and livelihoods.





© WWF-SASSI

Where does marine litter come from?

Around 80% of marine litter comes from land-based sources. About 10% comes from abandoned, lost or discarded fishing gear and 10 % comes from other fishing and shipping activities. Around 8 million tonnes of plastic enters the oceans each year from land-based sources (the equivalent to a dump truck per minute). Uncollected waste is responsible for 75% of plastic leakage into the ocean.

The land-based litter enters the ocean because of:



- Poorly managed landfill sites
- Poorly maintained sewage treatment plants and sewer overflows
- People using beaches for recreation or shore fishing
- Factories, plastic processing and transport
- Shore-based dump sites and processing facilities
- Inadequately covered waste containers and waste-container vehicles
- Street litter that is washed by rain or blown by the wind into rivers or storm water drains that enter the ocean.
- Just over half the households in South Africa have some form of waste collection.

Sea-based sources of litter include:

- Vessels that dump waste at sea
- People on vessels who throw their litter overboard. This is either deliberate or accidental when litter is blown off a vessel or washed overboard.
- Lost or discarded fishing gear
- Waste from offshore oil and gas platforms

What is the impact on fishers and fisheries?

- Marine litter has negative social and economic impacts. These can be direct, e.g. damaged equipment, lost catches, or indirect, e.g. cost of clean-ups and disposal. The cost of the damage to the marine environment is estimated to be around \$13 billion globally.

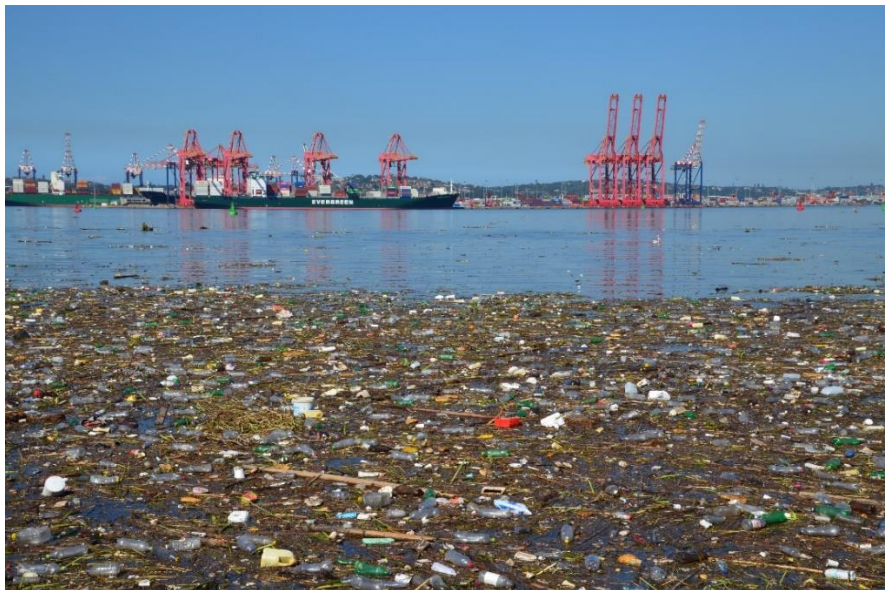
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Vessel and harbour impacts

Marine litter often becomes stuck or entangled in vessel equipment. A fouled propeller or blocked water-cooling system costs time and money to repair. Harbours have been known to become so choked with litter that it is impossible for vessels to move.

Small inshore vessels are more susceptible to the impact of marine litter than larger offshore vessels.



The Durban Harbour after a flood event in 2018. ©Judy Mann

A story from Korea

In October 1993, the Seohae Ferry was returning to port due to bad weather but became entangled in derelict rope, which got caught in the propeller. This reduced the speed of the engine; then a huge wave caused the vessel to capsize and sink, claiming 292 lives.

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Catch impacts

When nets are hauled in filled with marine litter, the litter displaces fish, meaning that fishers catch less fish. Nets can also snag on junk on the seabed. Removing the litter and repairing nets and fishing gear wastes time and money.



Plastic removed from a Durban Bay seine net. ©Judy Mann

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It is estimated that as much as 80 kg of fish per trap are progressively captured by each of the 15,000 lost fishing traps along the shores of Oman every year resulting in a loss of USD 2.6 million to the fishing industry every year. This is an example of 'ghost fishing'.

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Source: NOWPAP MERRAC 2013: Negative Impacts of Marine Litter in the NOWPAP Region: Case Studies

Negative impacts of marine litter on humans

Sectors	Impacts
Fishing and aquaculture	<ul style="list-style-type: none"> Damage to fishing gear Damage to aquaculture facilities Interruption of fishing operation Human casualties (death, injury, disease, etc.)
Marine ecosystems	<ul style="list-style-type: none"> Ghost fishing Destruction of marine species habitats Decrease of fishery resources
Shipping and navigation	<ul style="list-style-type: none"> Entanglement Sailing delay Breakdown/repair of vessel Collision, sinking and other deadly accidents
Tourism and recreational activities divers	<ul style="list-style-type: none"> Hazards to beach goers, swimmers and divers

Destruction of aesthetic value / Costs for removal

Source: NOWPAP MERRAC 2013: Negative Impacts of Marine Litter in the NOWPAP Region: Case Studies



Clean-up events are essential, although costly and time-consuming. ©Judy Mann

What is the impact on marine life?

Marine litter has many impacts on marine life. The impacts can be divided into three main groups.

Entanglement / entrapment

Entanglement occurs when an animal becomes trapped by marine litter, leading to difficulty in moving, finding food and escaping predators, which could result in death. Animals are attracted to litter items due to their natural curiosity or while in search of food or shelter. Entanglement / entrapment may not necessarily cause death but torturous pain, as the litter becomes embedded in the animal's flesh as it grows around it. Thousands of marine animals become entangled in litter each year, and many of them die because of the entanglement. Entanglement affects turtles, seals, whales and dolphins and seabirds. Fish and invertebrates also become victims of entanglement.

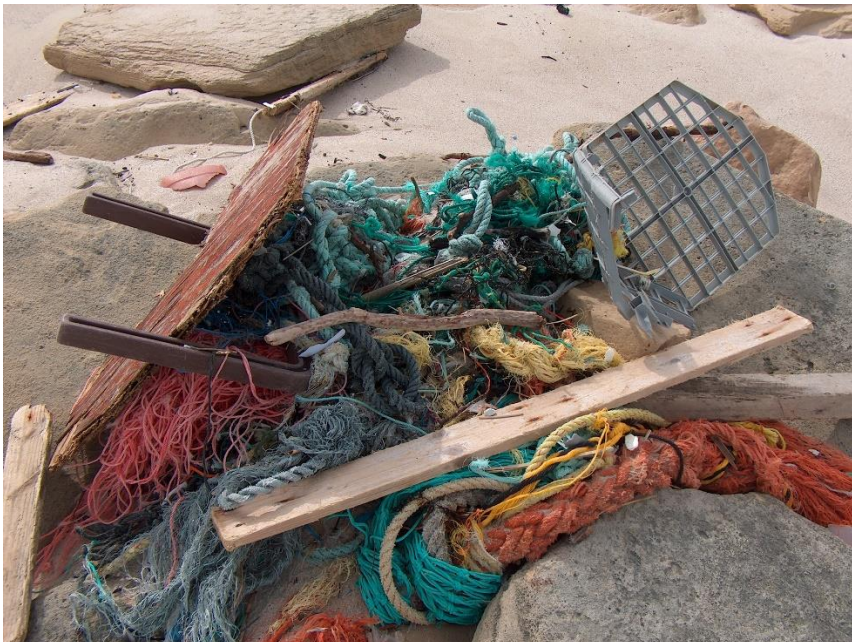
Discarded fishing gear is most often responsible for entanglements – fishing line, rope and netting and other abandoned fishing gear. Research suggests that, compared to other consumer items discarded in the ocean, fishing gear poses the greatest ecological threat. Buoys, traps, monofilament line and fishing nets are the most dangerous items for entanglement.



A seal entangled in rope. ©Two Oceans Aquarium

A story from Cape Town

The Two Oceans Aquarium disentangled almost 1 000 seals in the Western Cape between 2010 and 2018. The seals are mostly entangled in fishing gear including fishing line, box bands and various kinds of ropes. And the number of animals entangled is increasing.



On the De Hoop beach in Western Cape - fishing gear discarded off vessels ©Judy Mann



Turtle on a beach in Gabon entangled in a fishing net. ©Ewan Kyle

Ingestion

Ingestion of litter occurs unintentionally, intentionally, or indirectly through the ingestion of prey species containing litter. Plastic has now been documented in many different marine species, including marine turtles, seals, whales and seabirds. Fish, birds, turtles and mammals may swallow plastic accidentally or because it resembles their prey. For example, turtles eat plastic bags mistaking them for jellyfish; birds feed on or feed their chicks with plastic pellets or bottle tops, mistaking them for fish eggs or crabs, etc. Ingestion can lead to starvation or malnutrition if the ingested items fill up their stomach. The animal feels full and does not eat, and slowly starves to death. Plastic bags, balloons and plastic utensils are amongst the most often ingested items.



© WWF International

Sharp objects, e.g. fish hooks, metal and broken glass, can wound the digestive tract and cause infection and pain, and ultimately death. Plastic materials, particularly plastic bags, have been found blocking the airways and stomachs of many terrestrial and aquatic animal species.



An X-ray of fishing hooks inside a Cape Gannet. This bird was treated by the uShaka Sea World vet team but unfortunately died. ©SAAMBR

Microplastics can be taken up by filter feeding animals such as oysters and mussels, or small fish such as sardines. Microplastics attract toxins, which, when ingested, can harm the animals. The size of the animal determines the size of the litter ingested.

Interaction

Interaction includes contact with debris (with the exception of entanglement) including collisions, obstructions or abrasions. There are many ways that this can happen. Fishing gear, for example lobster traps, cause abrasion and damage to reefs. Discarded fishing line or nets cover and interact with mussel beds or redbait pods or smother sponges and corals. Algae growing on discarded fishing gear can kill corals and other reef animals.

What is 'Ghost Fishing'?

Lost (accidentally or deliberately) fishing gear including nets, fishing lines, anchors, ropes and traps, may continue to catch marine life long after they have been abandoned. Ghost fishing occurs when marine animals get caught, entangled and or trapped in lost gear. This gear continue to catch fish, turtles, mammals or birds, as they keep on drifting in the sea or along the bottom, often for very long periods. Their "catch" may attract other fish, sharks, mammals or seabirds searching for food, causing these predators to also become entangled. When the nets become too heavy, filled with dead animals, they sink, the animals decompose, and the nets get lighter. The nets then float again and start killing animals in a lethal never-ending cycle. The loss of these fish to the commercial catch means less fish for fishers to catch.

Rankings of marine debris items by their expected impact on marine animals.
1 highest, 20 lowest.

Item name	Rank of expected impact			
	Mean	Bird	Turtle	Mammal
Buoys/traps/pots	1	1	1	1
Monofilament line	2.3	3	2	2
Fishing nets	2.7	2	3	3
Plastic bags	5.7	4	9	4
Plastic utensils	5.7	7	4	6
Balloons	6.7	8	5	7
Cigarette butts	7.3	5	12	5
Bottle caps	7.7	9	6	8
Food packaging	8.7	10	7	9
Other packaging	9.7	11	8	10

Item name	Rank of expected impact			
	Mean	Bird	Turtle	Mammal
Hard plastic containers	11.3	6	13	15
Plastic food lids	11.3	13	10	11
Straws/Stirrers	12.3	14	11	12
Takeout containers	15.3	15	18	13
Cans	15.7	17	14	16
Beverage bottles	16	12	17	19
Unidentified plastic fragments	16.3	16	19	14
Cups & plates	16.7	18	15	17
Glass bottles	17.7	19	16	18
Paper bags	20	20	20	20

Source: C Wilcox, N J. Mallos, G H. Leonard, A Rodriguez, B D Hardesty. 2016. Using expert elicitation to estimate the impacts of plastic pollution on marine wildlife, Marine Policy, Volume 65

A story from Cape Town

Professor Peter Ryan from Cape Town is one of the world's leading researchers in marine litter. His research indicates that at least 147 seabird species, as well as 69 freshwater birds and 49 landbirds from 53 families have been entangled in plastic or other synthetic materials. Fishing gear is responsible for entangling most species (83%), although it is often difficult to differentiate entanglement from bycatch (animals caught accidentally) on active gear. He suggests that we could address the problem by banning high-risk items where there are alternatives (e.g. six-pack rings), discouraging the use of high-risk items (e.g. balloons on strings) and encouraging fishers not to discard waste fishing gear by providing bins and associated educational signage in fishing areas.

Source: Ryan, P. 2018. Entanglement of birds in plastics and other synthetic materials. Marine Pollution Bulletin. 135:159-164

A story from KwaZulu-Natal

Over 23 years, 53 sharks caught by the KZN Sharks Board had polypropylene strapping bands around the body. The dusky shark was the most frequently entangled species. The number of sharks entangled in this

way is increasing. A total of 60 sharks had ingested plastic debris, over half of these were tiger sharks. The most common items were packets or sheets.

Source: Cliff, Dudley, Ryan & Singleton 2002 Large sharks and plastic debris in KwaZulu-Natal, South Africa Marine and Freshwater Research 53(2) 575 - 581

How does marine litter move around the ocean?

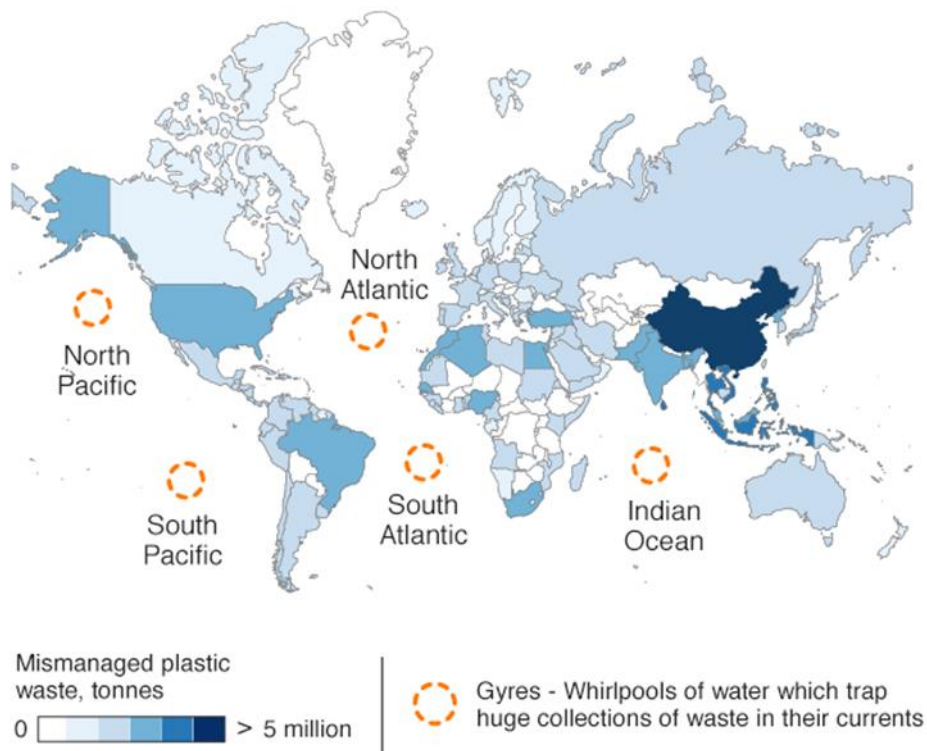
The 'garbage patches' mentioned earlier are formed when plastic waste accumulates in the centres of ocean basins, areas where winds create swirling circular currents, known as gyres.

Isolated oceanic islands, many thousands of kilometres from land, can become catch points for marine litter waste when they are near a gyre. Their shores collect a disproportionate amount of pollution, despite being far from the major plastic waste sources. Our waste knows no borders – the waste we discard here could impact animals or people thousands of kilometres away.



Uninhabited islands far from any cities are littered with plastic items. ©Pam Lenoury

Ocean plastic



Source: Jambeck et al, Science Feb 2015, UNEP, NCEAS

BBC

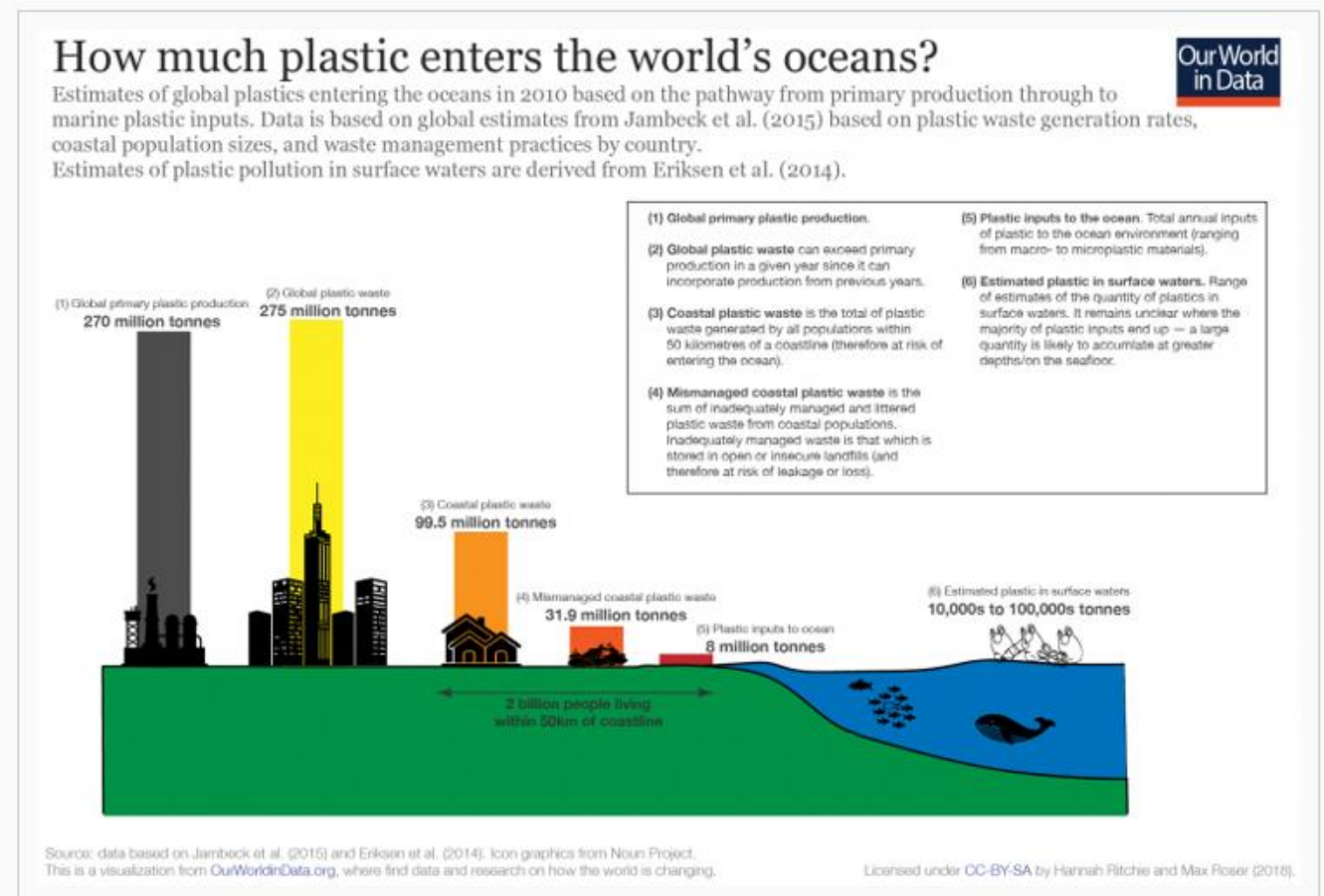
Gyres in the ocean where plastic accumulates.

Why is plastic such a problem?

We have produced over 8 billion tons of plastic since the 1950s. The production of plastic has outpaced that of almost every other material. Of this, less than 10% has been recycled. Over 275 million tonnes are produced each year. It is estimated that over 8 million tons of plastic enter the ocean each year – that is the same as 22 000 tons of plastic every DAY!

Single-use plastic, or disposable plastic, are plastic items that are only used once before they are thrown away into landfill or recycled (although many of them are not recycled or are difficult to recycle). These items include plastic bags, straws, cooldrink and water bottles, take-away coffee cup lids and most food packaging. Plastic can only be recycled back into its original polymer a limited number of times, so ultimately it will become non-recyclable over time. Although plastic does not biodegrade (decompose into a natural substance like soil) it will degrade (break up) into tiny particles after many years. Our ability to cope with plastic waste is already overwhelmed.

On land plastic waste causes a wide range of problems when it leaks into the environment. Plastic bags can block waterways and exacerbate natural disasters. By clogging sewers and storm water drains and providing breeding grounds for mosquitoes and pests, plastic bags can increase the transmission of vector-borne diseases like malaria.



What are microplastics?

Microplastics are pieces of plastic that are smaller than 5mm. Microplastics originate from a variety of sources, including microbeads from personal care products, fibres from synthetic clothing, pre-production pellets and powders, rubber fibres from tyres, and fragments degraded from larger plastic products.

A story from Durban

A study on mullet in the Durban Harbour in KwaZulu-Natal found that, of 70 mullet, 73% had plastic particles in their guts. White and clear plastic fibres were ingested most commonly.

Source: Naidoo, Smit, Glassom 2016 Plastic ingestion by estuarine mullet *Mugil cephalus* (Mugilidae) in an urban harbour, KwaZulu-Natal, African J. Marine Science, Volume 38, 2016 - Issue 1

What are nurdles?

Nurdles are tiny plastic pellets. Each small 'nurdle' pellet is half-moon shaped. These tiny pieces of plastic are the raw material for many other plastic products. They are re-melted and moulded in factories to make a wide range of plastic products. In themselves, they are not harmful to humans. However, the bad news is that if lost at sea these plastic pellets or nurdles absorb pollutants such as PCBs and organochlorine pesticides, which are extremely harmful to both marine life and humans if consumed. Nurdles never disintegrate but merely break down into smaller and smaller fragments. Because of their small size they can be eaten by filter feeders, or other animals that eat fish eggs. Both the nurdles and the toxins they have absorbed can enter then enter the food chain, as they are eaten by fish and other marine animals.



Nurdles on the uMdloti beach in KwaZulu-Natal. ©Judy Mann

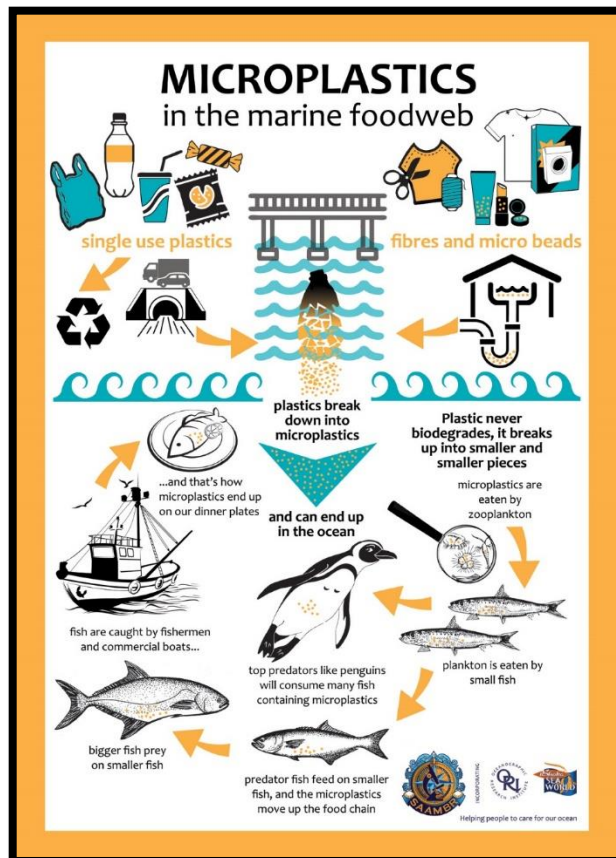
A story from Durban

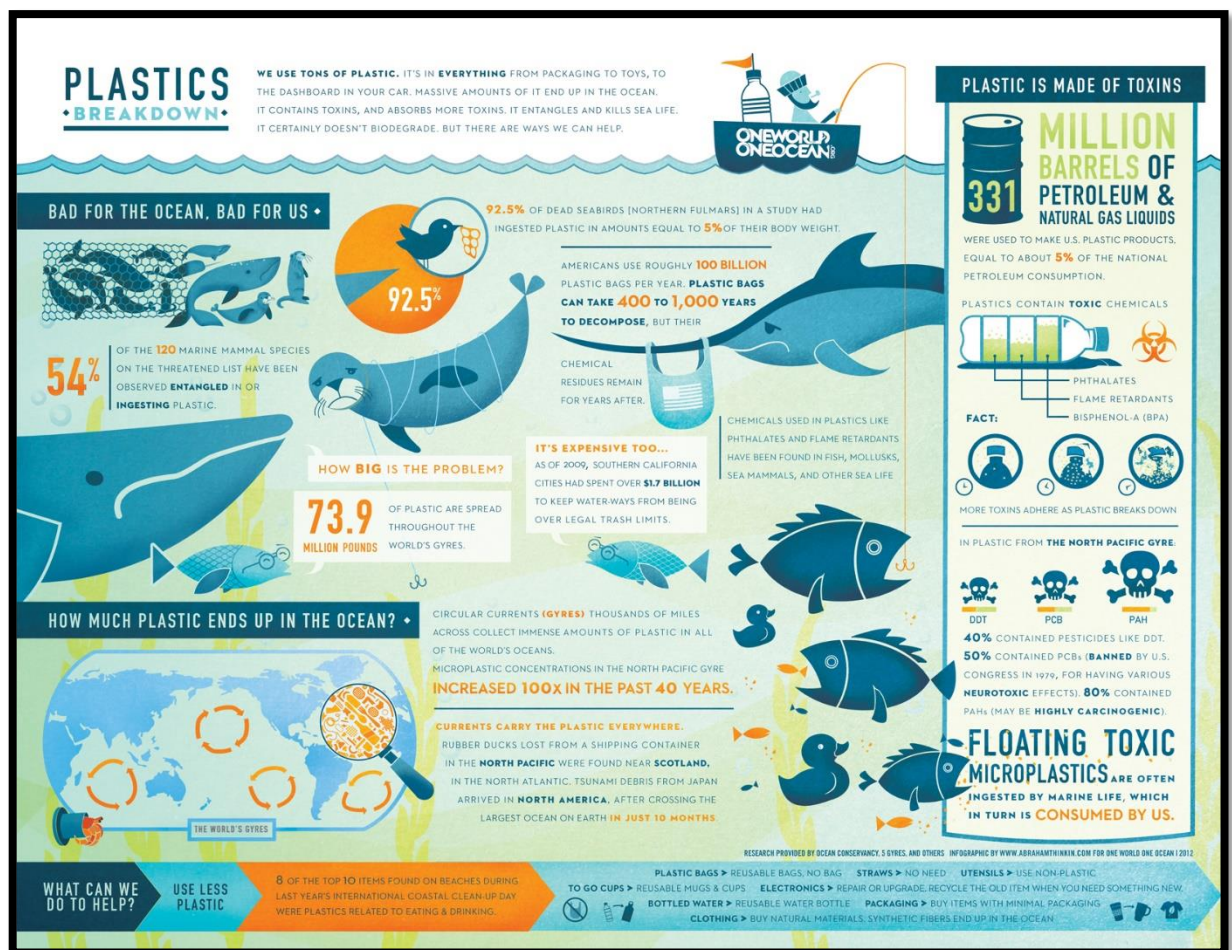
On the 10 October 2017 an estimated 49 tons of nurdles - about 2 billion microplastic nurdles - spilt out of a number of shipping containers in the Durban harbour after an extremely strong storm. These nurdles started to wash up on Durban's beaches on the 18 October. A call to clean the KZN beaches was initiated by SAAMBR and the people of KZN responded with enthusiasm. Thousands of people flocked to the beaches to collect nurdles. However, less than 25% have been recovered. The ocean currents carried the nurdles around the 3000km South African coast over a period of 8 weeks.

Food Webs and Microplastic

Because of their small size many marine species can ingest microplastics. Tiny animals such as zooplankton have been found to eat these microscopic pieces of plastic. Microplastics also enter the food web via filter feeders. There is evidence that microplastics and the toxic chemicals added during the manufacture of plastic, transfer

to animal tissue, eventually entering the human food chain. So once these plastics enter the food chain it is likely that they may land up on your plate after fish and shellfish have ingested them. Some of these compounds, which include Bisphenol-A (BPA) and Phthalates, have been found to alter hormones or have other potential human health effects such as reproductive abnormalities, higher child obesity levels and changes to foetal brain development.





Some Solutions

What we can do at sea

What should we do if we catch litter in our nets?

- Don't throw it back overboard! Bring it to shore, find an appropriate bin and dispose of it. This requires some effort, but it is well worth the trouble, both for the environment and for you (remember that fish can get caught in litter).
- Work with other fishers facing the same problem. Let your local authority (DEFF or municipal) or a local NGO know about the litter problem and together identify some solutions.
- Initiate a marine litter collection campaign or call for the creation of free waste disposal points in your local harbour.
- Work with the harbour authorities and other fishermen and owners to create stations where plastic can be collected for recycling.

We smoke at sea. What can we do?

- Don't throw your cigarette butts overboard. Put them in a tin can and bring them back to dispose safely on shore.

A story

Story of the fishers who changed their cigarette butt disposal methods...

WWF-SA has been training local small scale fishers along the coast on the ecosystem effects of fishing one such community was Hondeklipbaai. During this training, the issue of marine pollution was addressed and the trainer mentioned that cigarette butts are the most prevalent plastic item found in the oceans and often trapped in whales and birds.

During a follow up training session with the Hondeklipbaai community, fishers proudly told WWF-SA trainers that they no longer throw their cigarette butts overboard but collect them in a tin can and bring them back to shore and dispose of them on land.

What we can do on land



Plastic bottles amongst a catch of fish off the Durban beachfront. ©Judy Mann

As a fishing company owner, what can I do?

- Fully audit all processes within your supply chain and operations that use plastics and quantify the amount of plastics use
- Assess what types of plastics are used, how these plastic items are used and disposed off

- Produce Standard Operating Procedures for the correct handling of waste at sea and within processes and operations.
- Ensure that these procedures are effectively communicated and implemented.
- Train factory staff on how to correctly dispose of plastic and ensure that provide relevant tools and equipment for correct disposal
- Ensure that your company has appropriate waste disposal on land and on fishing vessels. Compactors reduce the volume of waste and these should be used on larger vessels.
- Work together with the relevant industries to develop packaging and fishing gear that poses fewer threats to the environment. Any easy way to ensure minimise threats to the ecosystem is to retrieve and where possible reuse “lost” fishing gear. If the fishing gear cannot be reused, dispose of it on land.
- Have a look at your harbour. Are the waste disposal bins easy to access? Together with other company owners, approach the manager of the site (local authority or fisheries authority) and discuss ideas for improved waste management with them.
- Ask your company to join the South African Plastic Pact and then hold them accountable to it.

As a fisherman, what can I do?

The information in the infographic below will help you to reduce your use of plastic products as they provide alternatives to single-use plastic items.

Reduce Your		
PLASTICS		
Product	Commonly Recyclable in South Africa?	Alternative
Bottled water/ cooldrink	Yes	Re-usable bottle
Polystyrene coffee cup	No	Re-usable cup
Plastic straw	No	Re-usable straw
Plastic bread bag	Yes	Paper bag or cloth bag
Plastic carrier bag	Yes	Re-usable shopping bag
Cling wrap	No	Wax wrap
Heat sealed packaging	No	Currently no alternative
Trays, code 2	Yes	Loose items, mesh bags
Plastic toothbrush	No	Bamboo toothbrush
Polystyrene take-aways	No	Take your own container
Chip packets	No	Currently no alternative
Sweets individually wrapped	No	Currently no alternative
Earbuds - plastic sticks	No	Earbuds - paper sticks
Suckers - plastic sticks	No	Suckers - paper sticks
Thin plastic produce bags	No	Re-usable bags
Plastic cutlery	No	Take your own

The infographic below contains useful information about plastic items that can be recycled in South Africa.



KEY POINTS FROM MODULE 5:

At the end of this module 5, I have:

- Learnt about the sources of marine litter
- The impact of marine litter on fisheries and marine life
- How we can decrease the amount of litter entering the ocean.

Prepared by: Dr Judy Mann-Lang, South African Association for Marine Biological Research and Pavs Pillay – WWF-SA

Appendix iii. Small scale fisheries

Module 5

Marine Litter

Contents

Marine Litter

- What is marine litter?

- Where does marine litter come from?

- What is the impact on fishers and fisheries?

- What is the impact on marine life?

- How does marine litter move around the ocean?

- Why is plastic such a problem?

Some Solutions

- What can we do to solve this issue?

- At sea

- On land

In the previous modules we learnt about South Africa's fisheries and their management. In this module we are going to learn about marine litter, where it comes from and its impact on our fisheries and marine life. We will also learn how we can help to solve the problem.

Marine Litter

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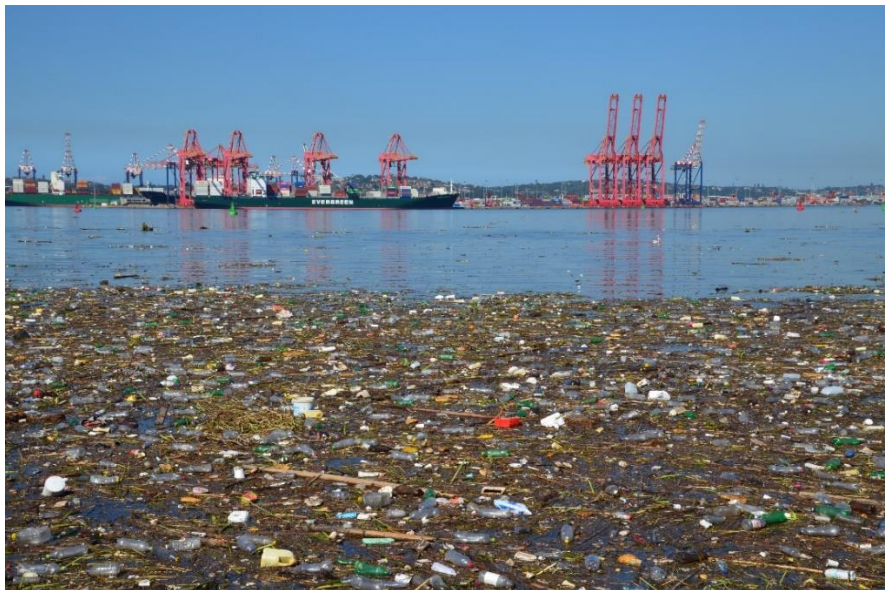
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Negative impacts of marine litter on humans

Sectors

Fishing and aquaculture

Marine ecosystems

Shipping and navigation

Tourism and recreational activities
divers

Impacts

Damage to fishing gear

Damage to aquaculture facilities

Interruption of fishing operation

Human casualties (death, injury, disease, etc.)

Ghost fishing

Destruction of marine species habitats

Decrease of fishery resources

Entanglement

Sailing delay

Breakdown/repair of vessel

Collision, sinking and other deadly accidents

Hazards to beach goers, swimmers and

Destruction of aesthetic value / Costs for removal

Source: NOWPAP MERRAC 2013: Negative Impacts of Marine Litter in the NOWPAP Region: Case Studies



Clean-up events are essential, although costly and time-consuming. ©Judy Mann

What is the impact on marine life?

Marine litter has many impacts on marine life. The impacts can be divided into three main groups.

Entanglement / entrapment

Entanglement occurs when an animal becomes trapped by marine litter, leading to difficulty in moving, finding food and escaping predators, which could result in death. Animals are attracted to litter items due to their natural curiosity or while in search of food or shelter. Entanglement / entrapment may not necessarily cause death but torturous pain, as the litter becomes embedded in the animal's flesh as it grows around it. Thousands of marine animals become entangled in litter each year, and many of them die because of the entanglement. Entanglement affects turtles, seals, whales and dolphins and seabirds. Fish and invertebrates also become victims of entanglement.

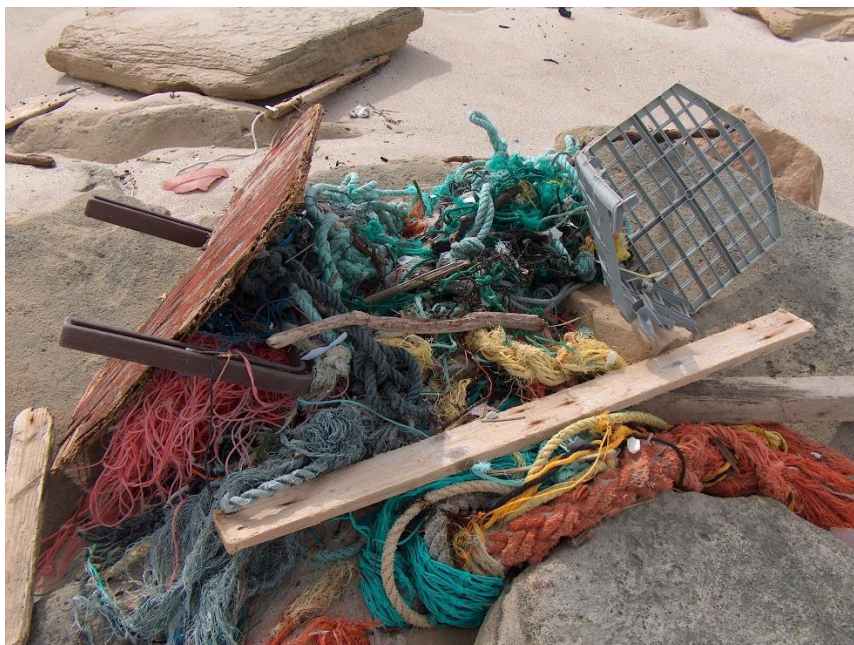
Discarded fishing gear is most often responsible for entanglements – fishing line, rope and netting and other abandoned fishing gear. Research suggests that, compared to other consumer items discarded in the ocean, fishing gear poses the greatest ecological threat. Buoys, traps, monofilament line and fishing nets are the most dangerous items for entanglement.



A seal entangled in rope. ©Two Oceans Aquarium

A story from Cape Town

The Two Oceans Aquarium disentangled almost 1 000 seals in the Western Cape between 2010 and 2018. The seals are mostly entangled in fishing gear including fishing line, box bands and various kinds of ropes. And the number of animals entangled is increasing.



On the De Hoop beach in Western Cape - fishing gear discarded off vessels ©Judy Mann



Turtle on a beach in Gabon entangled in a fishing net. ©Ewan Kyle

Ingestion

Ingestion of litter occurs unintentionally, intentionally, or indirectly through the ingestion of prey species containing litter. Plastic has now been documented in many different marine species, including marine turtles, seals, whales and seabirds. Fish, birds, turtles and mammals may swallow plastic accidentally or because it resembles their prey. For example, turtles eat plastic bags mistaking them for jellyfish; birds feed on or feed their chicks with plastic pellets or bottle tops, mistaking them for fish eggs or crabs, etc. Ingestion can lead to starvation or malnutrition if the ingested items fill up their stomach. The animal feels full and does not eat, and slowly starves to death. Plastic bags, balloons and plastic utensils are amongst the most often ingested items.



© WWF International

Sharp objects, e.g. fish hooks, metal and broken glass, can wound the digestive tract and cause infection and pain, and ultimately death. Plastic materials, particularly plastic bags, have been found blocking the airways and stomachs of many terrestrial and aquatic animal species.



An X-ray of fishing hooks inside a Cape Gannet. This bird was treated by the uShaka Sea World vet team but unfortunately died. ©SAAMBR

Microplastics can be taken up by filter feeding animals such as oysters and mussels, or small fish such as sardines. Microplastics attract toxins, which, when ingested, can harm the animals. The size of the animal determines the size of the litter ingested.

Interaction

Interaction includes contact with debris (with the exception of entanglement) including collisions, obstructions or abrasions. There are many ways that this can happen. Fishing gear, for example lobster traps, cause abrasion and damage to reefs. Discarded fishing line or nets cover and interact with mussel beds or redbait pods, or smother sponges and corals. Algae growing on discarded fishing gear can kill corals and other reef animals.

What is 'Ghost Fishing'?

Lost (accidentally or deliberately) fishing gear including nets, fishing lines, anchors, ropes and traps, may continue to catch marine life long after they have been abandoned. Ghost fishing occurs when marine animals get caught, entangled and or trapped in lost gear. This gear continue to catch fish, turtles, mammals or birds, as they keep on drifting in the sea or along the bottom, often for very long periods. Their "catch" may attract other fish, sharks, mammals or seabirds searching for food, causing these predators to also become entangled. When the nets become too heavy, filled with dead animals, they sink, the animals decompose, and the nets get lighter. The nets then float again and start killing animals in a lethal never-ending cycle. The loss of these fish to the commercial catch means less fish for fishers to catch.

Rankings of marine debris items by their expected impact on marine animals.
1 highest, 20 lowest.

Item name	Rank of expected impact			
	Mean	Bird	Turtle	Mammal
Buoys/traps/pots	1	1	1	1
Monofilament line	2.3	3	2	2
Fishing nets	2.7	2	3	3
Plastic bags	5.7	4	9	4
Plastic utensils	5.7	7	4	6
Balloons	6.7	8	5	7
Cigarette butts	7.3	5	12	5
Bottle caps	7.7	9	6	8
Food packaging	8.7	10	7	9

Item name	Rank of expected impact			
	Mean	Bird	Turtle	Mammal
Other packaging	9.7	11	8	10
Hard plastic containers	11.3	6	13	15
Plastic food lids	11.3	13	10	11
Straws/Stirrers	12.3	14	11	12
Takeout containers	15.3	15	18	13
Cans	15.7	17	14	16
Beverage bottles	16	12	17	19
Unidentified plastic fragments	16.3	16	19	14
Cups & plates	16.7	18	15	17
Glass bottles	17.7	19	16	18
Paper bags	20	20	20	20

Source: C Wilcox, N J. Mallos, G H. Leonard, A Rodriguez, B D Hardesty. 2016. Using expert elicitation to estimate the impacts of plastic pollution on marine wildlife, Marine Policy, Volume 65

A story from Cape Town

Professor Peter Ryan from Cape Town is one of the world's leading researchers in marine litter. His research indicates that at least 147 seabird species, as well as 69 freshwater birds and 49 landbirds from 53 families have been entangled in plastic or other synthetic materials. Fishing gear is responsible for entangling most species (83%), although it is often difficult to differentiate entanglement from bycatch (animals caught accidentally) on active gear. He suggests that we could address the problem by banning high-risk items where there are alternatives (e.g. six-pack rings), discouraging the use of high-risk items (e.g. balloons on strings) and encouraging fishers not to discard

waste fishing gear by providing bins and associated educational signage in fishing areas.

Source: Ryan, P. 2018. Entanglement of birds in plastics and other synthetic materials. Marine Pollution Bulletin. 135:159-164

A story from KwaZulu-Natal

Over 23 years, 53 sharks caught by the KZN Sharks Board had polypropylene strapping bands around the body. The dusky shark was the most frequently entangled species. The number of sharks entangled in this

way is increasing. A total of 60 sharks had ingested plastic debris, over half of these were tiger sharks. The most common items were packets or sheets.

Source: Cliff, Dudley, Ryan & Singleton 2002 Large sharks and plastic debris in KwaZulu-Natal, South Africa Marine and Freshwater Research 53(2) 575 - 581

How does marine litter move around the ocean?

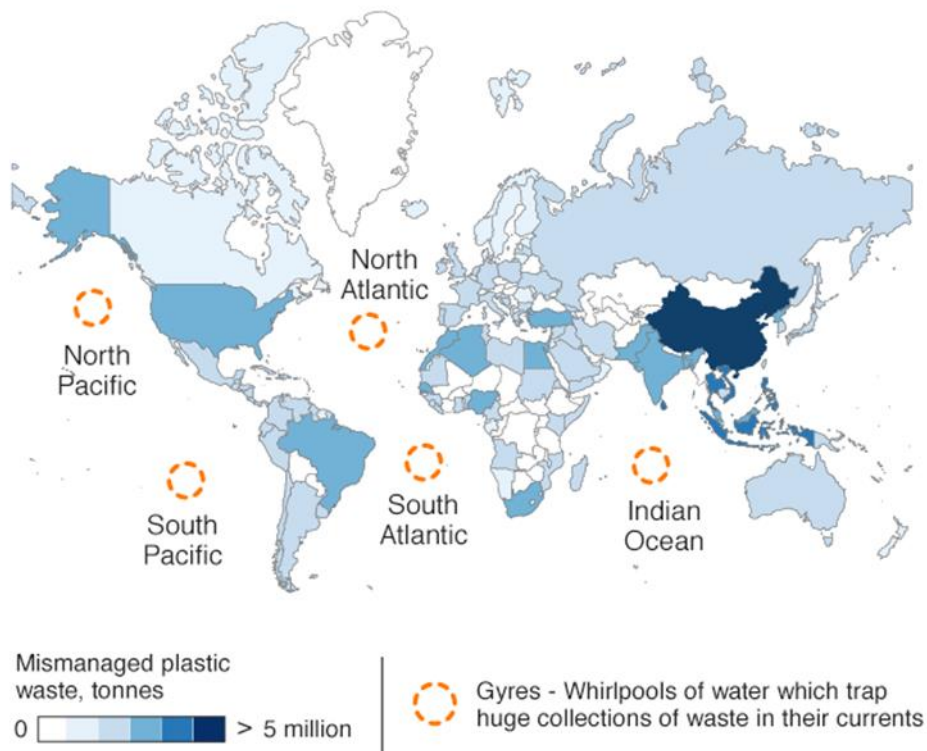
The 'garbage patches' mentioned earlier are formed when plastic waste accumulates in the centres of ocean basins, areas where winds create swirling circular currents, known as gyres.

Isolated oceanic islands, many thousands of kilometres from land, can become catch points for marine litter waste when they are near a gyre. Their shores collect a disproportionate amount of pollution, despite being far from the major plastic waste sources. Our waste knows no borders – the waste we discard here could impact animals or people thousands of kilometres away.



Uninhabited islands far from any cities are littered with plastic items. ©Pam Lenoury

Ocean plastic



Source: Jambeck et al, Science Feb 2015, UNEP, NCEAS

BBC

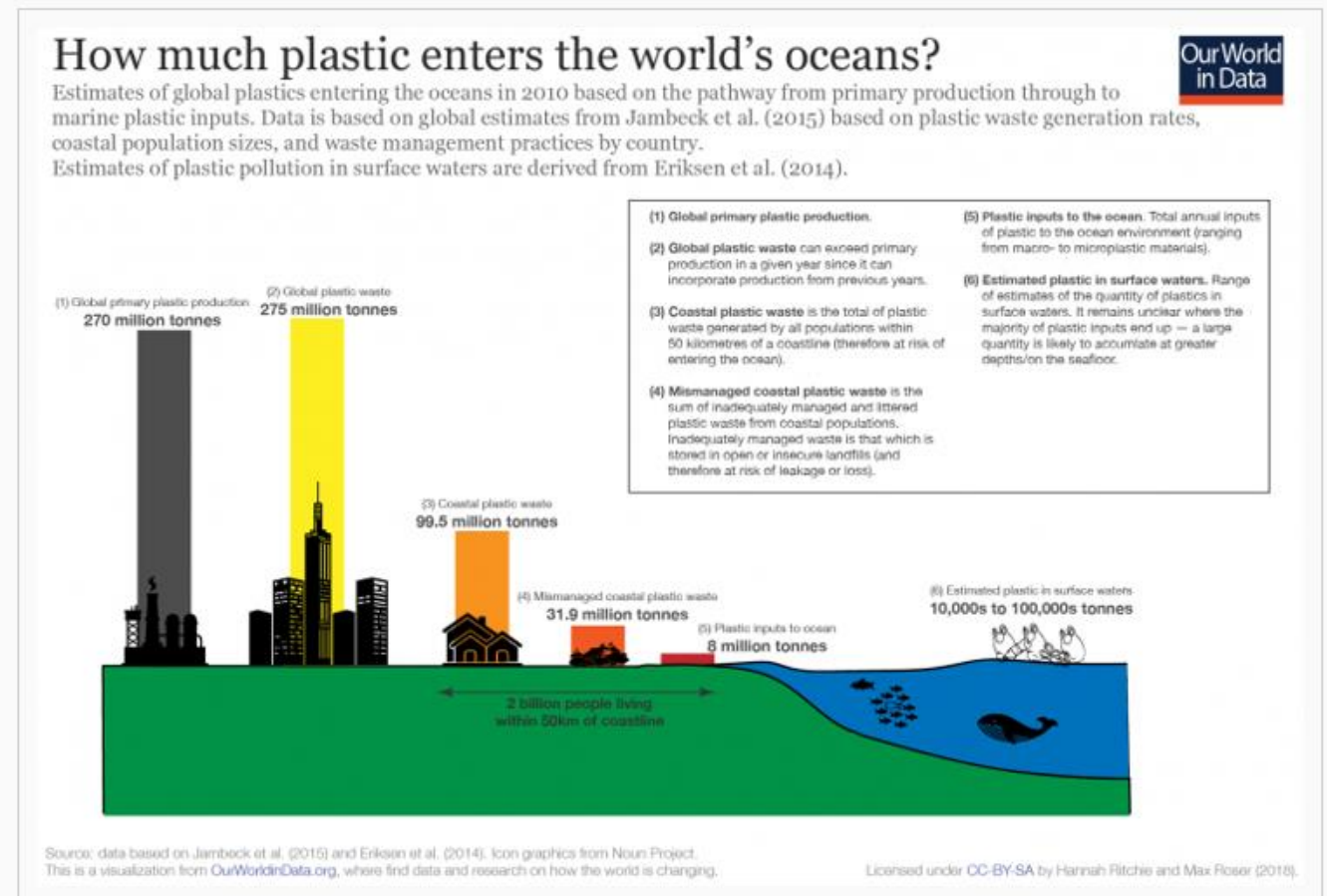
Gyres in the ocean where plastic accumulates.

Why is plastic such a problem?

We have produced over 8 billion tons of plastic since the 1950s. The production of plastic has outpaced that of almost every other material. Of this, less than 10% has been recycled. Over 275 million tonnes are produced each year. It is estimated that over 8 million tons of plastic enter the ocean each year – that is the same as 22 000 tons of plastic every DAY!

Single-use plastic, or disposable plastic, are plastic items that are only used once before they are thrown away into landfill or recycled (although many of them are not recycled or are difficult to recycle). These items include plastic bags, straws, cooldrink and water bottles, take-away coffee cup lids and most food packaging. Plastic can only be recycled back into its original polymer a limited number of times, so ultimately it will become non-recyclable over time. Although plastic does not biodegrade (decompose into a natural substance like soil) it will degrade (break up) into tiny particles after many years. Our ability to cope with plastic waste is already overwhelmed.

On land plastic waste causes a wide range of problems when it leaks into the environment. Plastic bags can block waterways and exacerbate natural disasters. By clogging sewers and storm water drains and providing breeding grounds for mosquitoes and pests, plastic bags can increase the transmission of vector-borne diseases like malaria.



What are microplastics?

Microplastics are pieces of plastic that are smaller than 5mm. Microplastics originate from a variety of sources, including microbeads from personal care products, fibres from synthetic clothing, pre-production pellets and powders, rubber fibres from tyres, and fragments degraded from larger plastic products.

A story from Durban

A study on mullet in the Durban Harbour in KwaZulu-Natal found that, of 70 mullet, 73% had plastic particles in their guts. White and clear plastic fibres were ingested most commonly.

Source: Naidoo, Smit, Glassom 2016 Plastic ingestion by estuarine mullet *Mugil cephalus* (Mugilidae) in an urban harbour, KwaZulu-Natal, African J. Marine Science, Volume 38, 2016 - Issue 1

What are nurdles?

Nurdles are tiny plastic pellets. Each small 'nurdle' pellet is half-moon shaped. These tiny pieces of plastic are the raw material for many other plastic products. They are re-melted and moulded in factories to make a wide range of plastic products. In themselves, they are not harmful to humans. However, the bad news is that if lost at sea these plastic pellets or nurdles absorb pollutants such as PCBs and organochlorine pesticides, which are extremely harmful to both marine life and humans if consumed. Nurdles never disintegrate but merely break down into smaller and smaller fragments. Because of their small size they can be eaten by filter feeders, or other animals that eat fish eggs. Both the nurdles and the toxins they have absorbed can enter then enter the food chain, as they are eaten by fish and other marine animals.



Nurdles on the uMdloti beach in KwaZulu-Natal. ©Judy Mann

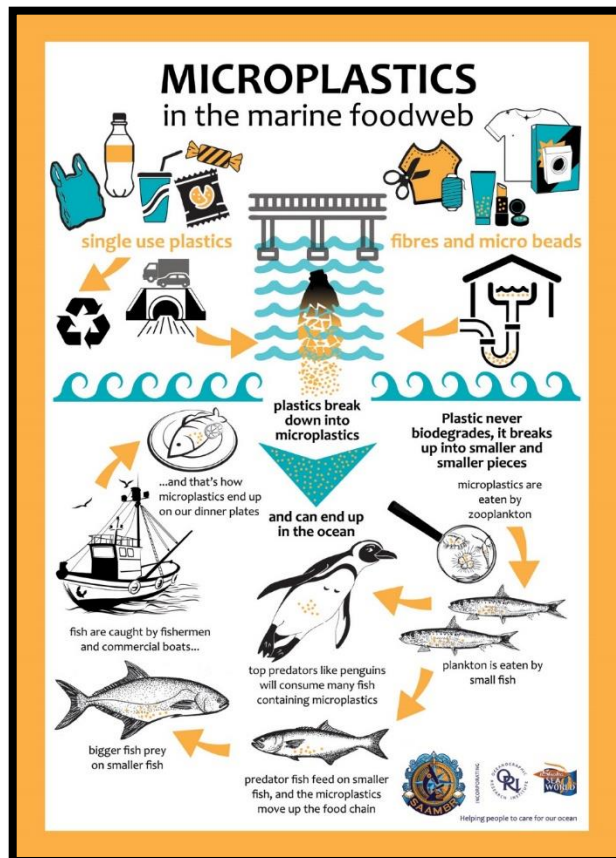
A story from Durban

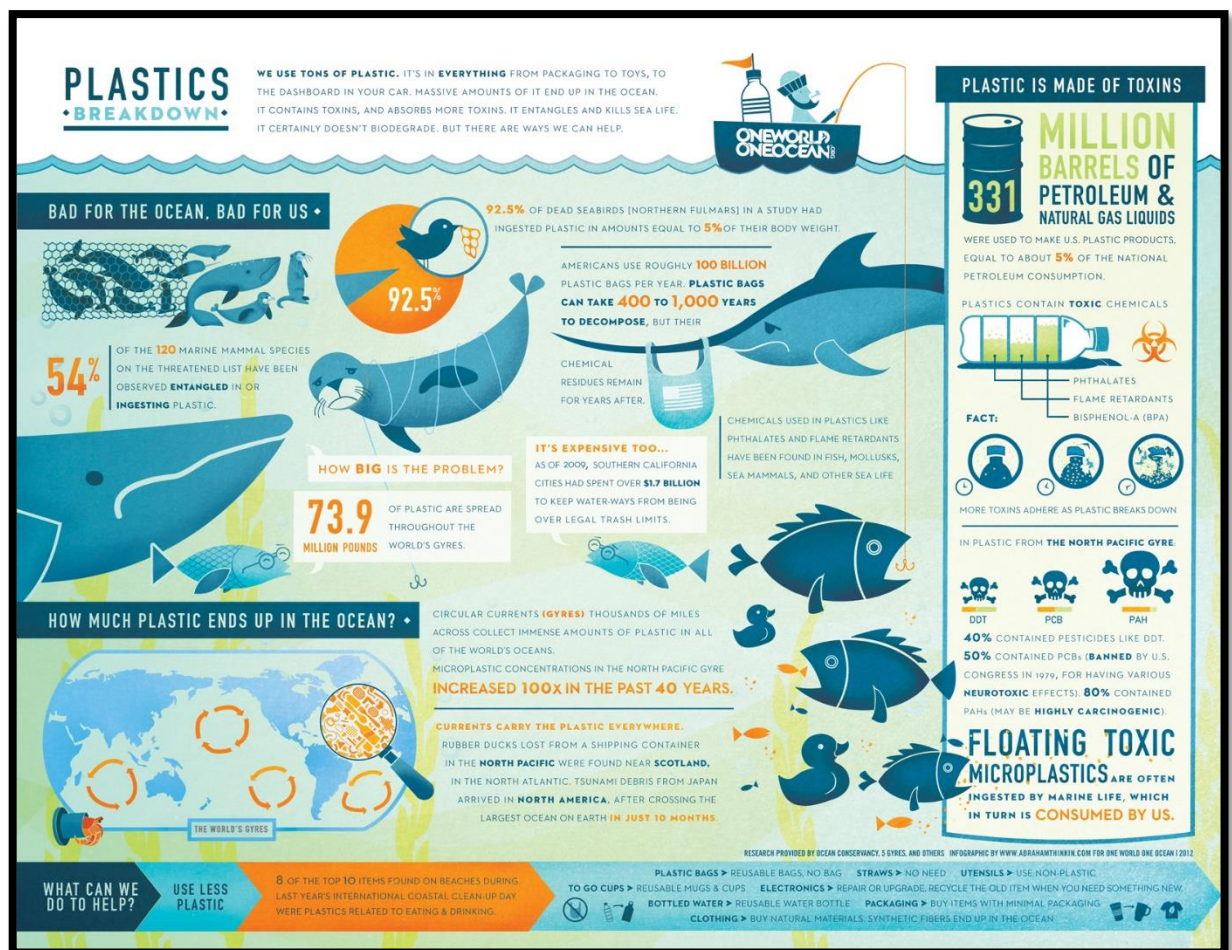
On the 10 October 2017 an estimated 49 tons of nurdles - about 2 billion microplastic nurdles - spilt out of a number of shipping containers in the Durban harbour after an extremely strong storm. These nurdles started to wash up on Durban's beaches on the 18 October. A call to clean the KZN beaches was initiated by SAAMBR and the people of KZN responded with enthusiasm. Thousands of people flocked to the beaches to collect nurdles. However, less than 25% have been recovered. The ocean currents carried the nurdles around the 3000km South African coast over a period of 8 weeks.

Food Webs and Microplastic

Because of their small size many marine species can ingest microplastics. Tiny animals such as zooplankton have been found to eat these microscopic pieces of plastic. Microplastics also enter the food web via filter feeders. There is evidence that microplastics and the toxic chemicals added during the manufacture of plastic, transfer

to animal tissue, eventually entering the human food chain. So once these plastics enter the food chain it is likely that they may land up on your plate after fish and shellfish have ingested them. Some of these compounds, which include Bisphenol-A (BPA) and Phthalates, have been found to alter hormones or have other potential human health effects such as reproductive abnormalities, higher child obesity levels and changes to foetal brain development.





Some Solutions

What we can do at sea

What should I do if I catch litter in my nets?

- Don't throw it back overboard! Bring it to shore, find an appropriate bin and dispose of it. This requires some effort, but it is well worth the trouble, both for the environment and for you (remember that fish can get caught in litter).
- If you are fishing from the beach, collect the litter and place it in the appropriate bins. Never leave cut line on the beach or on the rocks
- Work with other fishers facing the same problem. Let your local authority (DEFF or municipal) or a local NGO know about the litter problem and together identify some solutions.
- Initiate a marine litter collection campaign or call for the creation of free waste disposal points in your local harbour.

- Work with the harbour authorities and other small scale fishers to create stations where plastic can be collected for recycling.

As a small fishing boat owner, what can I do?

- Make sure that you do not throw away any waste from your boat into the sea,
- including old fishing line, rope and nets. Take it back to the shore and dispose of it in the appropriate bins.
- Do the same for any waste that gets caught in your line or nets during your normal fishing operations.
- Initiate longer-term practices for reducing marine litter – think about how you will dispose of an item before you take it aboard.
- Make sure that you retrieve all your fishing gear before returning to port.
- Be especially aware of bait packaging – cut any plastic box loops before you stow them on board.



Plastic box strapping discarded on a beach – this strapping was not cut and poses a serious risk to marine life. ©Judy Mann

What can I do as a recreational boat owner or Charter boat operator?

- Make sure that no litter on board enters the sea (this includes cigarette butts!).
- Place signs on the boats that you rent out to inform your customers that they should bring any waste that they create back to harbour.
- Provide rubbish bins on the boat to discourage boat users from throwing litter and discarded fishing tackle overboard.

We smoke at sea. What can we do?

- Don't throw your cigarette butts overboard. Put them in a tin can and bring them back to dispose safely on shore.

A story

Story of the fishers who changed their cigarette butt disposal methods...

WWF-SA has been training local small scale fishers along the coast on the ecosystem effects of fishing one such community was Hondeklipbaai. During this training, the issue of marine pollution was addressed, and the trainer mentioned that cigarette butts are the most prevalent plastic item found in the oceans and often trapped in whales and birds.

During a follow up training session with the Hondeklipbaai community, fishers proudly told WWF-SA trainers that they no longer throw their cigarette butts overboard but collect them in a tin can and bring them back to shore and dispose of them on land.

What we can do on land



Plastic bottles amongst a catch of fish off the Durban beachfront. ©Judy Mann

- Have a look at your landing site. Are the waste disposal bins easy to access? Together with other fishers in the site approach the manager of the site (local authority or fisheries authority) and discuss ideas for improved waste management with them.
- Perhaps a local community member or group could be contracted to sort the waste and then sell it to a recycler in the area.

- Be aware of excess packaging before you go out to sea - what can you remove and safely dispose of before you launch?

The information in the infographic below will help you to reduce your use of plastic products as they provide alternatives to single-use plastic items.

Reduce Your		
PLASTICS		
Product	Commonly Recyclable in South Africa?	Alternative
Bottled water/ cooldrink	Yes	Re-usable bottle
Polystyrene coffee cup	No	Re-usable cup
Plastic straw	No	Re-usable straw
Plastic bread bag	Yes	Paper bag or cloth bag
Plastic carrier bag	Yes	Re-usable shopping bag
Cling wrap	No	Wax wrap
Heat sealed packaging	No	Currently no alternative
Trays, code 2	Yes	Loose items, mesh bags
Plastic toothbrush	No	Bamboo toothbrush
Polystyrene take-aways	No	Take your own container
Chip packets	No	Currently no alternative
Sweets individually wrapped	No	Currently no alternative
Earbuds - plastic sticks	No	Earbuds - paper sticks
Suckers - plastic sticks	No	Suckers - paper sticks
Thin plastic produce bags	No	Re-usable bags
Plastic cutlery	No	Take your own

The infographic below contains useful information about plastic items that can be recycled in South Africa.



KEY POINTS FROM MODULE 5:

At the end of this module 5, I have:

- Learnt about the sources of marine litter
- The impact of marine litter on fisheries and marine life
- How we can decrease the amount of litter entering the ocean.

Prepared by: Dr Judy Mann-Lang, South African Association for Marine Biological Research and Pavs Pillay at WWF -SA

Appendix iv. Monitoring and Evaluation forms (A & B)

A

MODULE 5 MARINE LITTER

FRONT-END EVALUATION

Please complete this evaluation as honestly as possible and feel free to comment. It is only through accurate feedback that we will be able to improve our training.

Why are you attending this training?

What are the three things that you would like to achieve during this workshop?

What is Marine Litter?

What two things can you do to reduce marine litter?

Why is marine litter a problem?

THANK YOU FOR YOUR HONESTY

B

MODULE 5 MARINE LITTER

SUMMATIVE EVALUATION - PROCESS

Please complete this evaluation as honestly as possible and feel free to comment. It is only through accurate feedback that we will be able to improve our training.

A. Why is marine litter a problem in the ocean?

B. What can you do to reduce marine litter in the ocean?

C. What was the most important thing that you learnt?

On a scale of 1 to 7 please rate (circle) your:-

1 Overall assessment of the workshop

1	2	3	4	5	6	7
---	---	---	---	---	---	---

No use or relevance

Highly useful and relevant

2 Workshop content, information and ideas presented

1	2	3	4	5	6	7
---	---	---	---	---	---	---

No use or relevance

Useful and relevant

3 The presentation/facilitation style was

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Not helpful
Disenabling

Very helpful
Enabling

4 The likely usefulness of the workshop content in the future

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Not useful

Very useful

5 Recommendation of this workshop to others at a similar level

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Not recommended

Recommended

6 What did you like most about the workshop?

7 Is there anything you would change?

8 Do you think that the workshop will help you working in your workplace? YES NO

If YES, how will it help you? If NO, why will it not help you?

9 Any other comments? _____

THANK YOU FOR YOUR HONESTY

DATE: _____

VENUE: _____

Appendix v. Photos of the training event





Centre for Environment
Fisheries & Aquaculture
Science

About us

The Centre for Environment, Fisheries and Aquaculture Science is the UK's leading and most diverse centre for applied marine and freshwater science.

We advise UK government and private sector customers on the environmental impact of their policies, programmes and activities through our scientific evidence and impartial expert advice.

Our environmental monitoring and assessment programmes are fundamental to the sustainable development of marine and freshwater industries.

Through the application of our science and technology, we play a major role in growing the marine and freshwater economy, creating jobs, and safeguarding public health and the health of our seas and aquatic resources

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Our customer base and partnerships are broad, spanning Government, public and private sectors, academia, non-governmental organisations (NGOs), at home and internationally.

We work with:

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- industries across a range of sectors including offshore renewable energy, oil and gas emergency response, marine surveying, fishing and aquaculture.
- other scientists from research councils, universities and EU research programmes.
- NGOs interested in marine and freshwater.
- local communities and voluntary groups, active in protecting the coastal, marine and freshwater environments.

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