

# Microplastics and Port Phillip Bay

Citizen science study finds significant amount of microplastics on Port Phillip Bay beaches – Summary report



## Acknowledgements

This report was prepared by Cressida Bradley and Dr Slobodanka Stojkovic of RMIT University, Melbourne, Australia for Sustainability Victoria. Supporting Sustainability Victoria, EPA Victoria, and Melbourne Water to deliver this project were the Port Phillip EcoCentre and Port Phillip Baykeeper, Tangaroa Blue Foundation, and RMIT University.

Sustainability Victoria acknowledges the following groups for actively participating in collecting sand samples: Werribee River Association, Werribee Riverkeeper, Port Phillip EcoCentre, Port Phillip Baykeeper, Worcester Polytechnic Institute (Massachusetts, USA), Frankston Beach Patrol, and the Rye Foreshore Advisory Group.

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ISBN 978-1-920825-53-9 (PDF)

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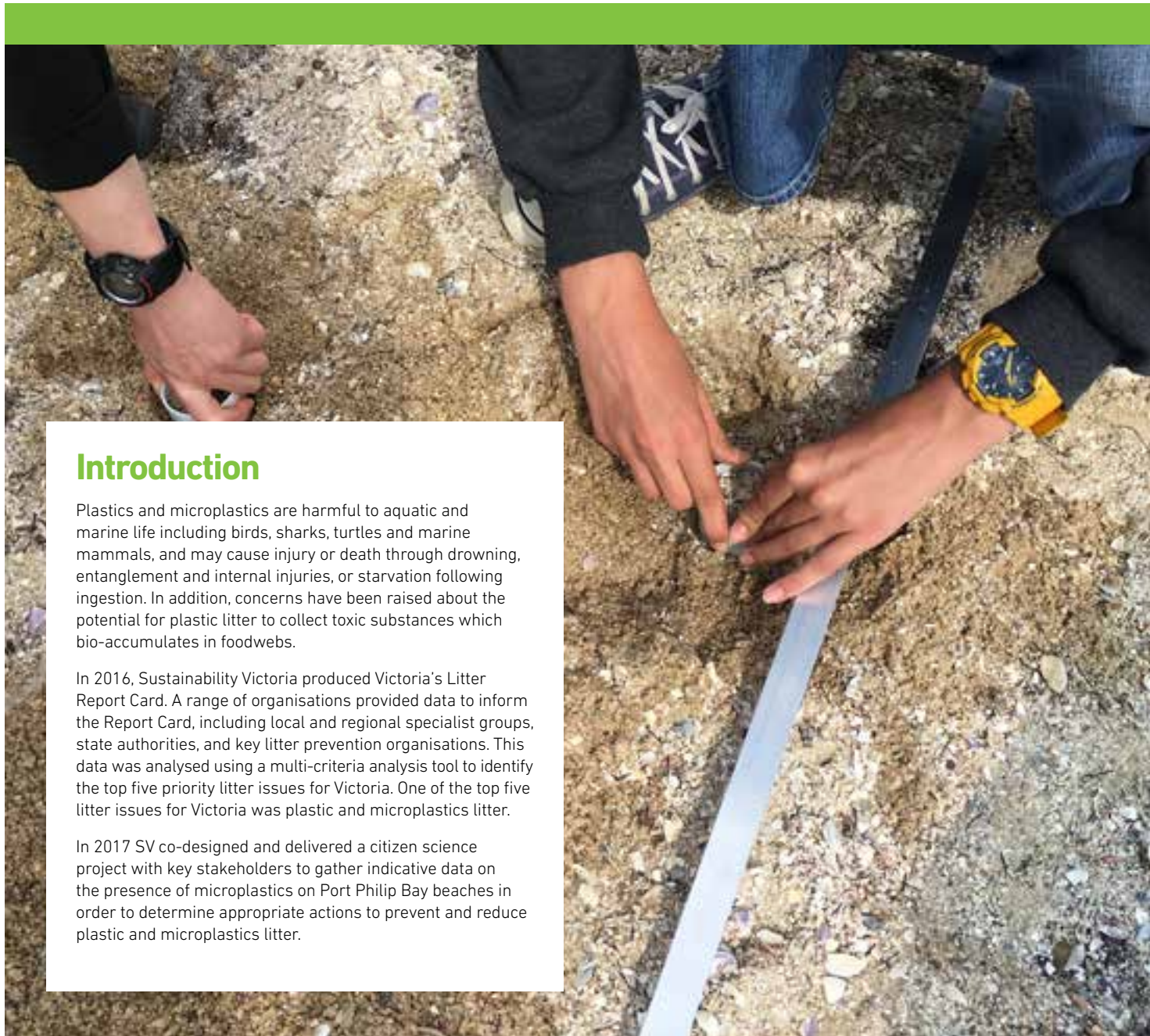
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## Introduction

Plastics and microplastics are harmful to aquatic and marine life including birds, sharks, turtles and marine mammals, and may cause injury or death through drowning, entanglement and internal injuries, or starvation following ingestion. In addition, concerns have been raised about the potential for plastic litter to collect toxic substances which bio-accumulates in foodwebs.

In 2016, Sustainability Victoria produced Victoria's Litter Report Card. A range of organisations provided data to inform the Report Card, including local and regional specialist groups, state authorities, and key litter prevention organisations. This data was analysed using a multi-criteria analysis tool to identify the top five priority litter issues for Victoria. One of the top five litter issues for Victoria was plastic and microplastics litter.

In 2017 SV co-designed and delivered a citizen science project with key stakeholders to gather indicative data on the presence of microplastics on Port Phillip Bay beaches in order to determine appropriate actions to prevent and reduce plastic and microplastics litter.

## What is microplastics?

Any plastic smaller than 5mm is defined as microplastics, including microfibrils. Microplastics comes from three main sources:

- 1 Plastic that has been weathered and broken up into smaller fragments due to exposure to the environment via UV light, ocean currents and/or physical damage, including beach cleaning.
- 2 Plastic from plastics manufacturing, such as pre-production plastic pellets that have entered our waterways. These pellets are known as nurdles.
- 3 Microfibrils, which are synthetic fibres from fabrics and clothing which enter our environment directly or through the sewage system.

### Citizen science

the collection and analysis of data relating to the natural world by members of the general public

## About the project

The Microplastics and Port Phillip Bay citizen science project led by Sustainability Victoria in partnership with EPA Victoria and Melbourne Water, engaged volunteers and scientists in a whole-of-catchment collaborative research project to better understand the presence of microplastics on Port Phillip Bay beaches.

In April 2017, citizen scientists recorded visible litter and collected sand samples at six reference sites around Port Phillip Bay. Sites were selected to provide a representation of Port Phillip Bay beaches and included beaches in Geelong, Werribee, St Kilda, Seaford, Frankston, and Rye.

Samples collected by citizen scientists were sieved and processed using an industry-accepted methodology then analysed by RMIT University, Melbourne.

RMIT scientists soaked the samples in saline solution and filtered them to extract microplastics and microfibrils, then examined them under microscope. Please refer to Appendix 1 Sand Sampling for Microplastics Methodology which outlines the sand sampling process for this project.

## Microplastics survey results

During analysis, microplastics samples were split into two categories: visible microplastics and microfibrres.

Visible microplastics included nurdles and any broken plastic fragments. Microfibrres were visible only under microscope.

### Visible microplastics

Visible microplastics was found in samples from Rye, St Kilda and Seaford. Most fragments were 1 mm or smaller. Larger visible microplastics (5mm or more) were found at St Kilda and Seaford, but not at Rye.

Seaford samples contained the largest average number of visible microplastics fragments, with 7.8 fragments per kilogram of sand.

Samples from Geelong and Werribee had no visible microplastics.

### Microfibrres

Microfibre fragments were collected in most samples across all beaches, and were found in greater proportions than visible microplastics.

The highest average number of microfibre fragments was found in Rye, where 123.2 fragments were recorded per kilogram of sand. This high number of fragments was a consequence of filaments being bundled in a knot.

The lowest average number of microfibre fragments was found in Seaford, where 17.3 fragments were recorded per kilogram of sand. Table 1 provides a summary of this data.



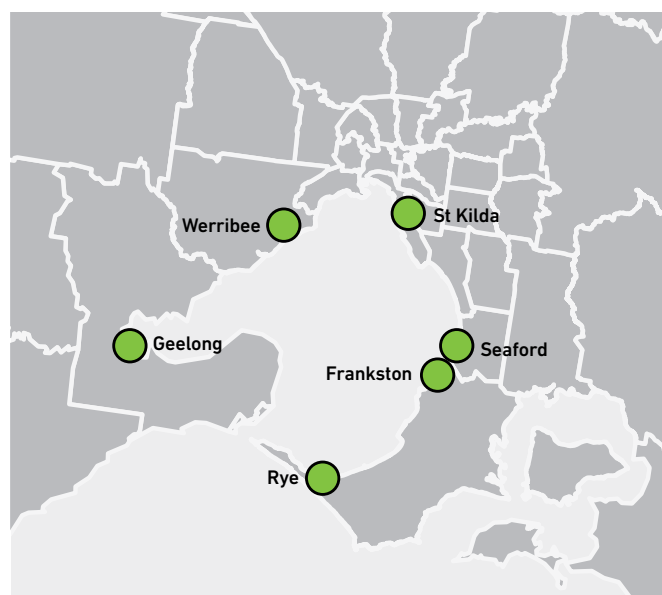


**TABLE 1 LITTER, MICROPLASTICS AND MICROFIBRE DATA SUMMARY**

Location	Litter	Visible microplastics		Microfibre	
	Average number of pieces counted	Average number of pieces counted	Average per kg of sand	Average number of pieces counted	Average per kg of sand
Frankston**	20.0	NA	NA	NA	NA
Geelong	3.0	0	0	6.3	70.7
Rye	1.1	0.5	16.7	6.3	123.2
Seaford	22.0*	1.5	43	1.7	16.7
St. Kilda	7.0	0.4	3.0	3.8	53.2
Werribee	0.2	0	0	4.8	53.4

\* The litter standard deviation in this sample is very high, due to an extremely high number of nurdles in one out of the nine sampling locations at the Seaford site (125 pieces, compared to zero at seven other sampling locations and 13 pieces at the remaining location at this site).

\*\* The Frankston beach samples were damaged in the drying process so the microplastics within these samples could not be counted in the results.



## The impact of microplastics

Port Phillip Bay is the largest marine bay in Victoria, and plastic pollution can remain for years, posing a threat to the marine ecosystem. Much of the litter found on Port Phillip Bay beaches comes from waste we produce every day in our city and suburbs, not from beachgoers. Up to 95 per cent of litter found on Port Phillip Bay beaches is deposited on land and transported through Melbourne's stormwater system (Melbourne Water, 1993).

The stormwater network carrying most of this litter into Port Phillip Bay extends from the Werribee River in the west, to the Maribyrnong River in the north, the Yarra River in the east, and down to Westernport Bay in the south of Melbourne.

Nurdles were the most common form of litter found as part of this project and pose a significant danger to wildlife. They can be ingested, and then remain in the guts of birds like penguins, gulls, and cormorants, as well as mammals like the rare Burrunan dolphin (endemic to Port Phillip Bay), and other species who mistake them for food.

Other animals like tubeworms feed upon sand sediment and therefore risk ingesting the contained microfibres. For example, the lugworm *Abarenicola pacifica* processes about 280 times its body weight of sediment in one day (Taghon, 1988). This equates to approximately 800g of sediment each day, and, using the results of this study, means it could be consuming up to approximately 250 microfibres a day from some of Port Phillip Bay's beaches and shorelines.

We do not yet know how animals' ingestion of plastic will impact our own health and social practices like recreational fishing. Individuals, business and industry all contribute to the microplastics and microfibres in our bay, so we all have a role in creating change.

## How you can help

Whether we live, work or play by the water or in a landlocked suburb, we can all make a difference to the future health of Port Phillip Bay. We can minimise the impact of litter by avoiding and reducing waste and ensuring it doesn't get into our streets and stormwater systems in the first place.

### Individuals

#### Everyday actions

- › Decrease reliance on single-use plastics like take-away coffee cups, plastic shopping bags, straws, and water bottles.
- › Pack a shopping bag, a reusable cup, and steel straw in your car-boot, beach bag or bike pannier.
- › Become a conscious consumer. Before buying something that contains plastic, consider if it's needed.
- › Look after clothes:
  - wash synthetic clothing in a wash bag to stop microfibres going down the drain
  - wear natural fibres
  - buy clothing from companies that are addressing waste and microplastics pollution
  - use a front-end loader washing machine. These are gentler on clothing, preventing excess fibre loss
  - attach a washing machine filter and clean it regularly
  - attach a filter to the water outlet pipe of the washing machine to catch more microfibres.
- › Use plant-based cleaning products that don't contain microplastics and microbeads.
- › Avoid products with plastic packaging.

#### Look after the beach

- › Anything that was brought to the beach should also be taken away.
- › Join a clean up group, such as **Beach Patrol**, who clean up local beaches on a regular basis.

#### Look after the local environment

- › Pick up litter when you see it.
- › Tell others about microplastics pollution and how they can prevent it too.
- › Join a **Love Our Street** group.
- › Get involved in **Clean up Australia Day**.
- › If you intend to smoke, bring a portable butt holder to collect your butts and take them away.
- › Contact your local council or your federal / state member to see if they have any grants to support local environment projects focused on litter prevention.
- › If you witness nurdles deposited into the environment from a business, contact EPA Victoria on 1300 372 842.

For more ideas visit: <http://www.sustainability.vic.gov.au/You-and-Your-Home/Live-sustainably>

## Business and industry

- › Sign up to **Operation Clean Sweep**, a site hygiene program to assist plastic manufacturers reduce plastic pellet loss.
- › Avoid using single-use plastics in production and products.
- › Don't wait for bans on plastic items, become a responsible business and help customers to become conscious consumers.

In addition, seek advice from EPA Victoria on nurdle/pellet loss from your business. Any business owner who fails to contain pellets faces heavy fines if prosecuted.

## Educational institutions

- › Schools and other citizen scientists can use Sustainability Victoria's Sand Sampling for Microplastics Methodology (contained as an appendix to this report) to implement this study on their own. It is recommended that citizen scientists focus only on finding visible microplastics, as this is a more time and cost-efficient approach.
- › Contribute data to the **Tangaroa Blue Australian Marine Debris Initiative Database** to help scientists gain a greater understanding of the presence and impact of microplastics in the Port Phillip Bay.
- › Fill knowledge gaps. The study of coastal microplastics pollution is an emerging field. This is an opportunity for tertiary institutions to conduct further research that builds a greater understanding of the impacts of, and solutions to, microplastics in Port Phillip Bay and beyond.

## Literature

Melbourne Water Corporation (1993): The tagged litter report.

Taghon, GL (1988): The benefits and costs of deposit feeding in the polychaete *Abarenicola pacifica*. *Limnology and Oceanography*. 33: 1166-1175.



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Published by Sustainability Victoria.  
Microplastics and Port Phillip Bay – Summary report  
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# Sand sampling for microplastics guide

## Purpose

To collect sand samples to analyse for the presence of microplastics so we can better understand their source and extent in Port Phillip Bay.

## What will happen to the sand samples?

Samples will be sent to a lab where they will be analysed for the presence of microplastics.

This data, as well as the litter data you collected in the quadrats, will be used to inform a report by Sustainability Victoria (SV), in collaboration with EPA Victoria and Melbourne Water, into the source and extent of microplastics in Port Phillip Bay.

This report will be published on the SV website with all participating groups to receive a copy once published. The report can be used to inform future work and establish baseline microplastics data for Port Phillip Bay.

## Equipment

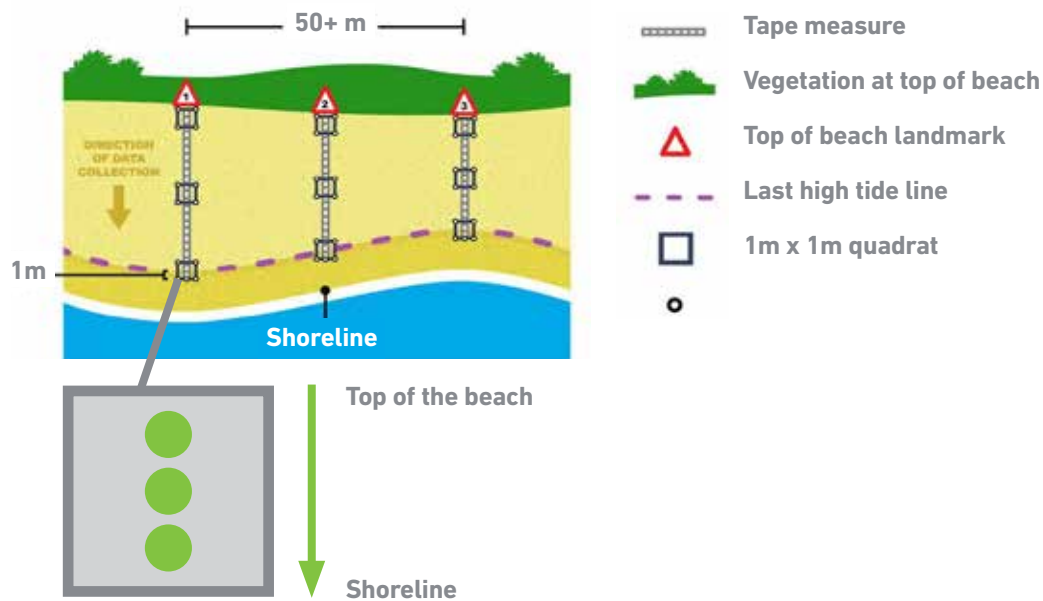
1m quadrat, 3 cylinders (50mm deep, 55mm diameter), scraper, three sieves (5mm, 1mm & 0.3mm), labelled jars, tongs, spatula, squirt bottle, gloves.

# Taking your sand samples

## Where to take your samples

Take three sand samples within each quadrat after undertaking your Port Phillip Baykeeper Beach Litter Audit.

Take one sample from at the top end of the quadrat, one from the middle, and the last from the lower end of the quadrat:



## How to take your samples

1

Stack the three sieves in the following order: 5mm on top, 1mm in middle, 0.3mm on bottom and place aside.



2

Push the cylinder into the sand until you reach the top. If there is seaweed present, move this aside.



3

Using the scraper, scrape sand away from the outside of the cylinder, then slide the scraper under the cylinder and carefully lift it out.



4

Wipe excess sand off the scraper, retaining only what is in the cylinder – this is your sand sample.



5

Empty this sand sample into the top of the stacked sieves then repeat steps 2 to 5 until you have all three sand samples in the stacked sieves.

Shake sieves until the sand has passed through the top sieve.



6

Remove the 5mm sieve and record any plastic pieces, or other litter, on the Port Phillip Baykeeper Beach Litter Audit Datasheet, and place each piece in into the jar labelled 5mm. Complete the other fields on the label.

7

Take the remaining two sieves, held tightly stacked, to the water's edge and immerse in the water. Be careful not to let water spill over the top into the top sieve. Shake gently to allow the sand to pull through into the lower sieve. Use a spatula or your hand (use gloves provided to do this) to work the sand through if needed.

8

Remove stacked sieves from the water and place on an even surface. Scrape all the contents of the 1mm sieve into the jar labelled 1mm. Complete the other fields on the label.

9

Scrape all the contents of the 0.3mm sieve into a jar labelled 0.3mm. Complete the other fields on the label.



## Common things that look like litter but aren't!

Plastic (above) sea lettuce (below)



Nurdles (left) sand grains (right)

