

# MARINE LITTER IN SYDNEY HARBOUR

Data Monitoring, Prevention, Community & Cleanup

In July 2020, clean tech startup Seabin Project, backed by thousands of community members and local businesses, self-funded a world first city pilot to monitor the health of the waterways, and clean up the plastic pollution in Sydney Harbour, Australia.

These are the findings from July 2020 - June 2021.

Photo: Will Turner

## Acknowledgement Of Country

*"We acknowledge the Gadigal people of the Eora Nation as the Traditional Custodians of The Country we have been operating within for the past 12 months and more.*

*We recognise their continuing connection to the land and waters, and thank them for protecting this coastline and its ecosystems since time immemorial.*

*We pay our respects to Elders past and present, and extend that respect to all First Nations people present today."*

## About Sydney

Sydney's geographical setting is perfect for a tourist destination. The city is built on one of the most beautiful harbours in the world; throughout its suburbs and outlying areas are pockets of virgin bushland which not only means Sydney doesn't have the 'concrete jungle' feel of most big cities, you don't have to drive great distances to see its natural attractions because they are right there outside your window.

Sydney has top-class beaches right on its doorstep, it is home to important national historic sites (both European and Aboriginal), it has no extremes in climate, and it is strategically located midway between Australia's second and third biggest cities (Melbourne and Brisbane - Sydney is the largest) and is just a few hours drive from the nation's capital.



Sydney Harbour covers an area of 5,500 hectares with an average depth of 9 metres.

I love the ocean, I surf, swim, paddle, been a surf lifesaver since the age of 8, won championships, we take our kids to the beach daily and the ocean has even provided me with a source of income for nearly 2 decades now, yet strangely enough the ocean is not my driver.

My driver is my family, helping others and having "purpose" in my life. So when the ocean became my platform to rise up, take action and make a measurable difference, I was pretty happy about that.

Running a startup means you're lean, agile and make informed risk-based decisions often. Our major milestone is our #100 Cities campaign, it's also our biggest risk and yet has the potential to be the biggest reward we can share with everyone, from our 3000 strong shareholders to anyone just generally enjoying cleaner oceans and beaches with your family, friends and loved ones.

The biggest challenge we face at Seabin isn't plastic pollution, lack of governance on our waterways or the glacial speed of decision-making from local, state and federal government. The biggest challenge we face is behavioural change and taking accountability for our own actions.

The #100 Smarter Cities For Cleaner Oceans campaign addresses both cleanup in the water and behavioural change on land. In short, we are both turning off the tap and cleaning up the mess at the same time.

I want to thank everyone who supports our mission and also to the epic team of rockstars at Seabin Project, because without you all, we wouldn't be making a difference today, or in the future.

Thanks again from myself and the team at Seabin Project.



Pete Ceglinski  
CEO & Co Founder  
Seabin Project



For as long as I can remember, I have been fascinated by the ocean and water in general. First, it was snow, rivers and lakes, but quickly, the oceans became a driving force. For me, looking at the ocean is a reminder of what it means to love unconditionally. It's expansive, wide open, ever changing, adaptive and incredibly beautiful. Water gives me life. This alone makes me want to care for it in a devoted way.

My work with the Seabin Foundation fulfils this passion. It is about getting myself and others excited to cleanup pollution, but even more so, it is about finding solutions to stop pollution.

The Sydney City Pilot has been an exciting, bold adventure, and a great learning journey. It has allowed the Seabin Foundation to understand how best to coordinate and support a growing number of dedicated volunteers, improve our data protocols, manage consistent data entries, and report on key findings. There is a world of opportunities that has now opened up from the knowledge we gained. Thank you, Sydney community, for showing us how much can be achieved when we stand up together for what we love!

Alongside a Seabin dream team, I will continue to act for litter prevention with a focus on major cities, through a joint effort between Seabin tech, people and institutions. Cities often face similar challenges when it comes to polluting waterways. I whole-heartedly dream of connecting communities around the world through our campaign, implementing the successes of one to another, and accelerating positive change for a healthier planet for all.

Simply because water is one of the most beautiful elements that unites us.

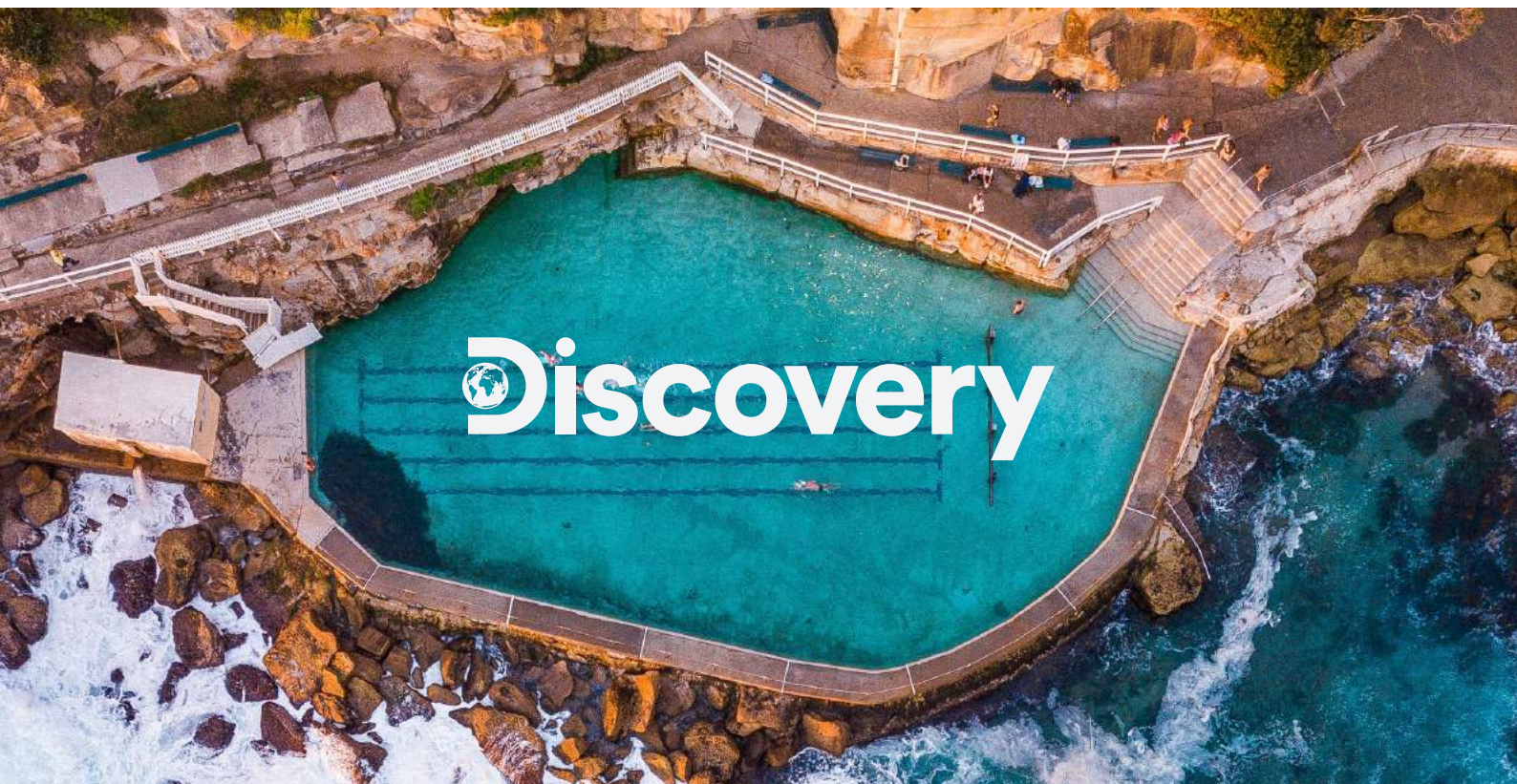


Mahi Paquette  
CEO & Director  
Seabin Foundation

***“Discovery has a deep commitment to making a difference across the globe, it's core to who we are.***

***We're proud to financially support Seabin as Principal Sponsor of the Sydney City Pilot, and use our platforms and talent to educate and encourage our audience to Reduce, Reuse & Recycle to help cleanup our oceans.”***

- Shannon Most - Discovery Senior Director, CSR & Marketing



- **3.2 Billion** Litres of water filtered for microplastics, plastic fibres, oil and more
- **16.5 Tonnes** of marine litter captured for the months of July 2020 to June 2021
- This is the equivalent of covering **351** football fields with plastic shopping bags
- **70,965** plastic items, including microplastics & microfibres were catalogued
- An estimated **441,228\*** plastic items have been captured since July 2020
- **780% increase** in plastic items recorded during data collections from the **16** units in Sydney Harbour over the pilot period

\*Calculated using the total count of plastic items catalogued from the total data collections to provide an average plastic item count per data collection. This figure (average plastic count) was then multiplied by the total number of Seabin empties (the maximum potential number of data collections; that is, if one data collection was conducted per Seabin site visit/empty)

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- 16 Seabin units in 8 locations were serviced Monday to Friday<sup>1</sup>
- **3.2 billion** litres of water<sup>2</sup> were filtered for marine litter<sup>3</sup>
- **16,525.8kgs** of marine litter physically removed by the Seabin Enviro Technician with 3,008 empties<sup>4</sup> in total
- Each Seabin unit captured an average of **3kg of marine litter** per day
- **70,965 items of plastic** were captured and counted from **426 detailed** “data collections” conducted across all sites
- The Seabin Enviro Technician (SET) engaged in meaningful conversations with **710 members of the local community.**

<sup>1</sup> Seabins operated for a total of 345 days.

<sup>2</sup> Seabins operated at 97% run rate for the total operational days in the year.

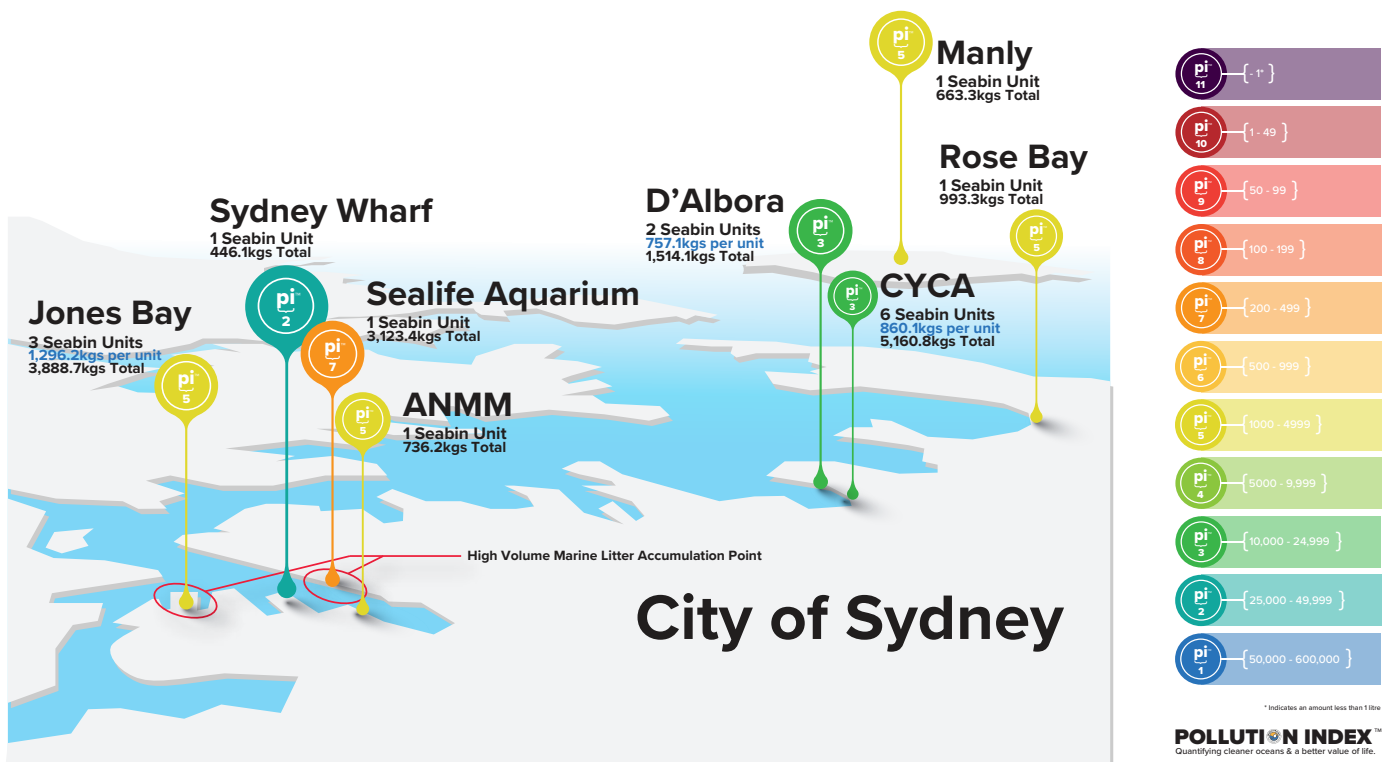
<sup>3</sup> Marine litter: any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment (UN Environment Program, 2009). Marine debris, microplastics and microfibres are captured by floating organic matter which is collected in Seabins.

<sup>4</sup> Unless on certain rare occasions when a SET visit is not possible, and a volunteer does the data collection without a scale.





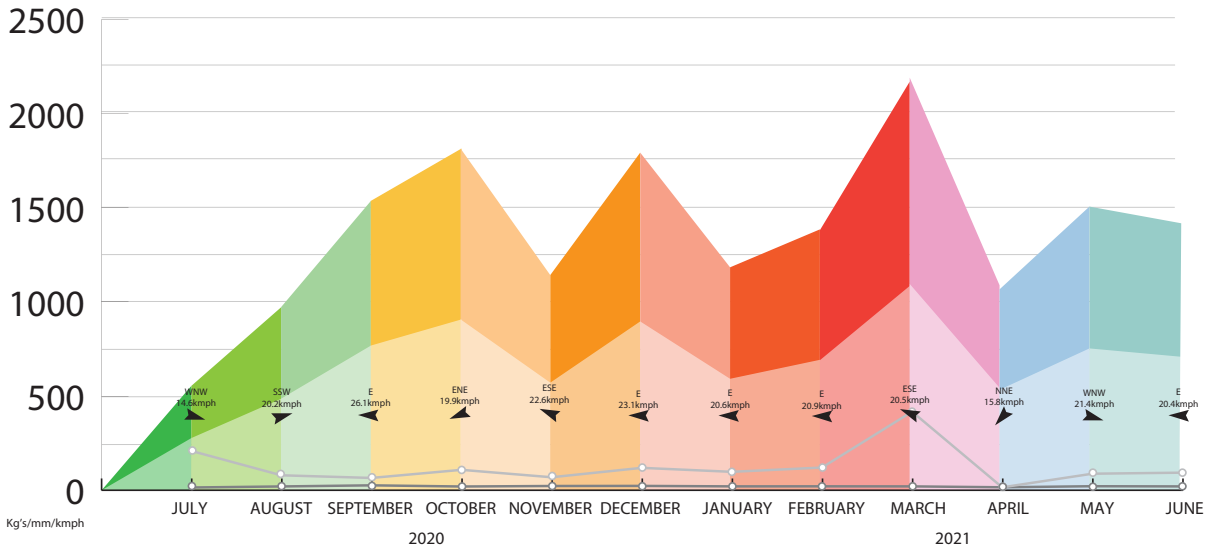
# Route 1 Sydney, Australia. July 2020 > June 2021



More information on the Pollution Index™ ratings and how it is calculated can be found on page 24

**SEABIN PROJECT™** | **SYDNEY CITY PILOT**  
Data Driven Solutions To Change The World  
July 2020 - July 2021

**16,525.8kgs marine litter captured**  
**Sydney Harbour. July 2020 - June 2021 - Monthly Statistics**

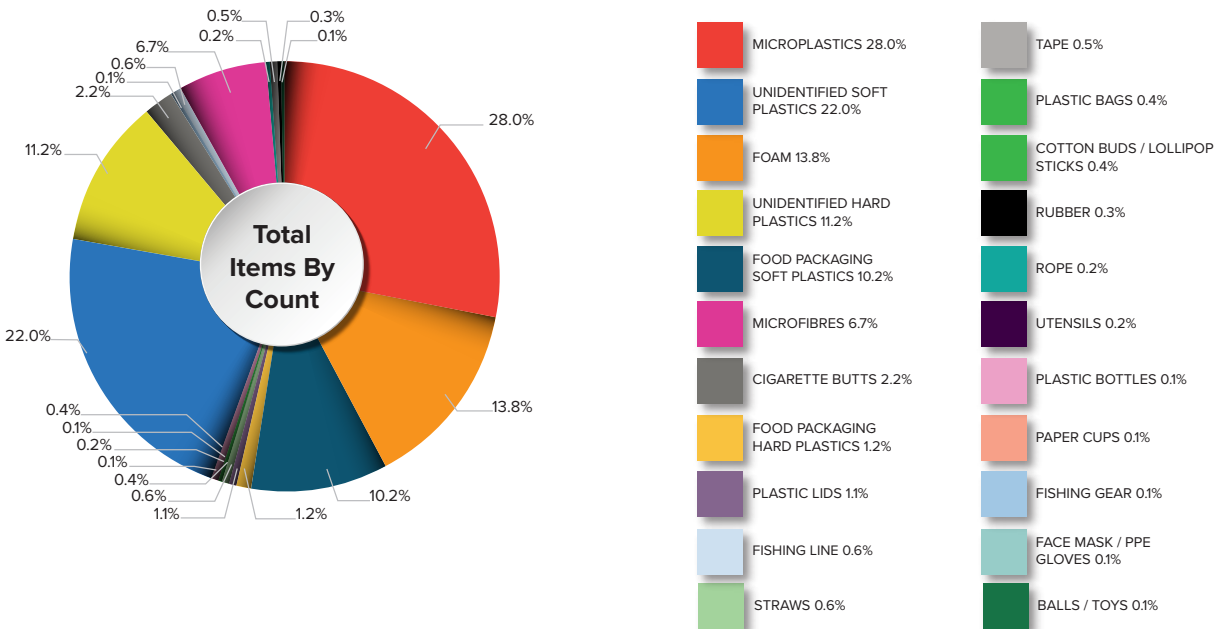


**pi™ Pollution Index™** by Seabin Project  
 Quantifying cleaner oceans & a better value of life.

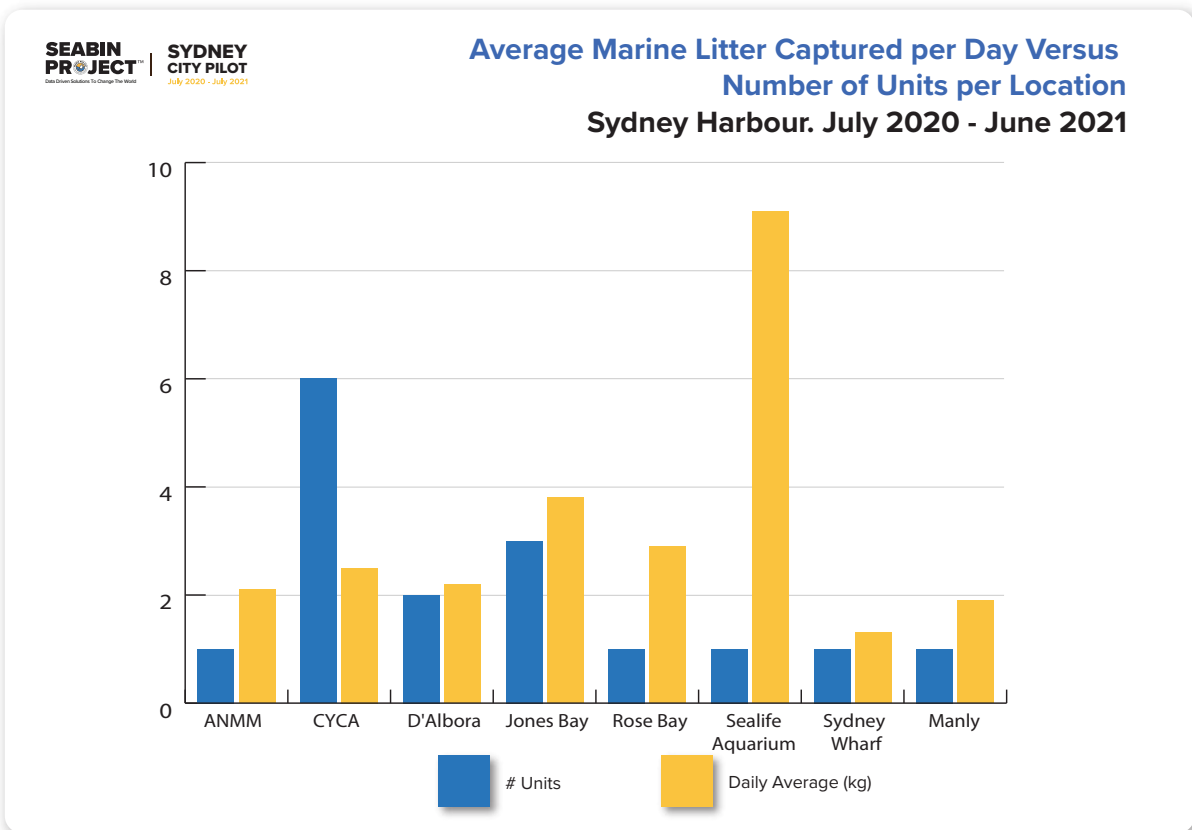
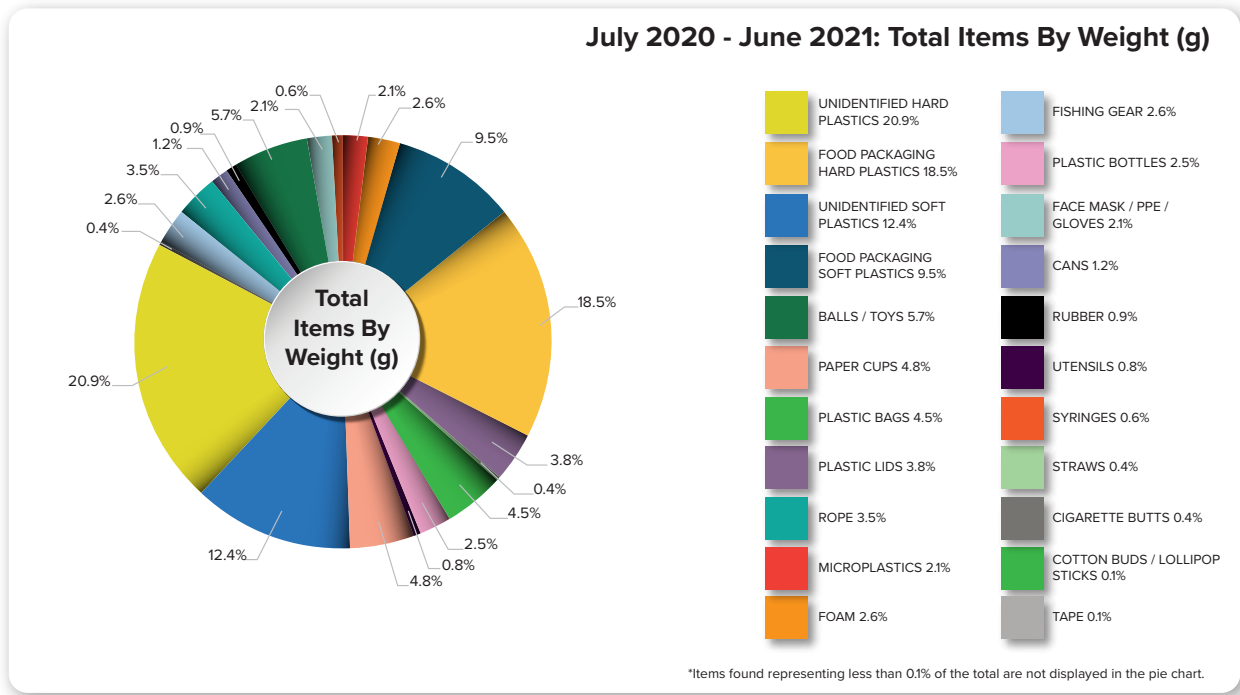
Rainfall (mm)    
 Wind (Kmph)    
 Litter Captured (Kg's)

Observation: Heavy rainfall in March appears to be related with the increase in marine litter captured by the Seabin units.

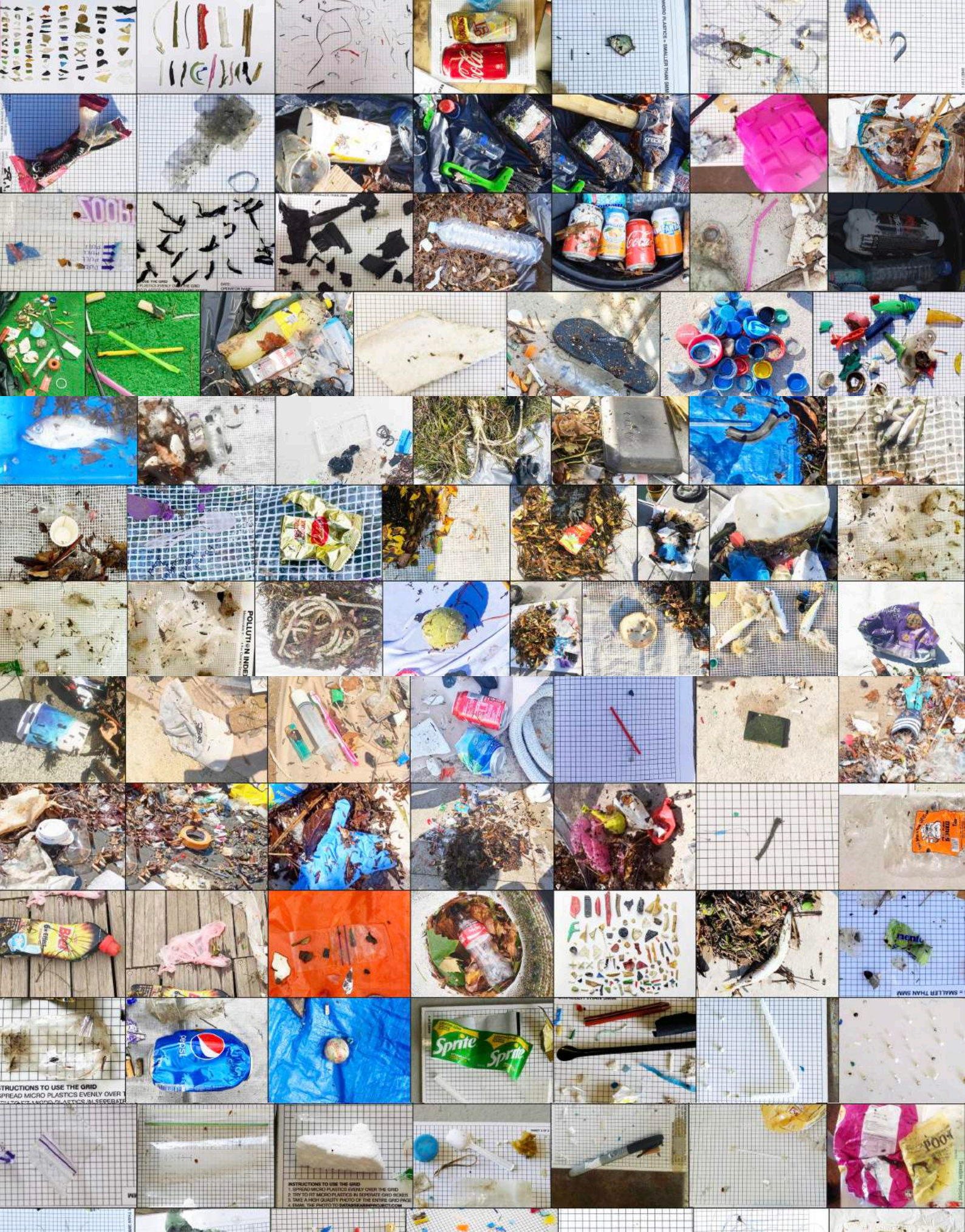
**July 2020 - June 2021: Total Items By Count**



\*Items found representing less than 0.1% of the total are not displayed in the pie chart.



Despite hosting a single Seabin unit, Sealife Aquarium has the highest capture rate. More information can be found on p. 32



A collage of some of the data samples and plastic items catalogued by our amazing data volunteer network in Sydney, Australia.

## Data:

A total of 30 citizen science volunteers contributed their time and efforts to collect valuable, frequent data at all locations throughout the Sydney City Pilot. The establishment of our vast and diverse volunteer cohort has delivered consistent and accurate baseline data on the prevalence of marine litter in Sydney Harbour.

## Prevention:

The presence and visual impact achieved at Seabin host sites/marinas throughout Sydney Harbour during the 12-month Sydney City Pilot has emphasised the need for behavioural and policy change to reduce littering.

Cleanup, citizen science, volunteer outreach and social media messaging, combined with community engagement by the Enviro Technicians, are all examples of Seabin Project targeting behavioural change to reduce the prevalence of marine litter within and around Sydney Harbour.

In addition to volunteer and Seabin corporate data days, a total of 710 people engaged in meaningful conversations with the Enviro Technicians, which is at least 3 people per working day.

## Cleanup:

Since July 2020, there has been a 780% increase in plastic items recorded during data collections from the 16 units in Sydney Harbour.

The majority of the litter captured by all Seabins, at all the host sites, was microplastics, soft and hard plastics, and foam. A large proportion of the identifiable plastics were land-based, as seen per the low degradation state of items.

## Community:

Community engagement and support has increased exponentially throughout the Sydney City Pilot. Seabin Project successfully hosted various community engagement, STEM workshops and corporate engagement data sessions (COVID permitting).

Community advocates have engaged and supported the Sydney City Pilot via sharing and resharing social media posts, and our surveys have shown genuine interest in creating cleaner oceans through innovative solutions at a base level.



**Scott**  
**Marina Manager**

Scope Marine - Sydney, Australia

*“The Seabin City Pilot has been a game changer and an incredible journey to be involved in. We now have tangible data showing the desperate need to clean up our harbour waterways. More importantly than that the visibility of the City Pilot has created a huge amount of community engagement. Every conversation we have about the Seabin Project helps inform and educate our community about the problem and the way that they can be part of the solution.”*



**Tom**  
**Head Enviro Technician**

Global - Sydney, Australia

*“The most rewarding aspect has been seeing the data story grow and develop with our team and tech and having consistent evidence showing the huge impact Seabin is having. My one key takeaway from a year on the water with Seabin is that bins on land are not the solution. So much of what is placed responsibly in rubbish bins still ends up in our waterways and our goal at Seabin has always been to use data to work with the community, big business and Government to address the problem at the source.”*



**Julia**  
Data Volunteer  
Manly - Sydney, Australia

*“It was truly shocking to see the amount of rubbish being captured by the Seabin each week. Some weeks, the Seabin net would be so full, I would struggle to retrieve it from the water, weighing up to 20 kg.*

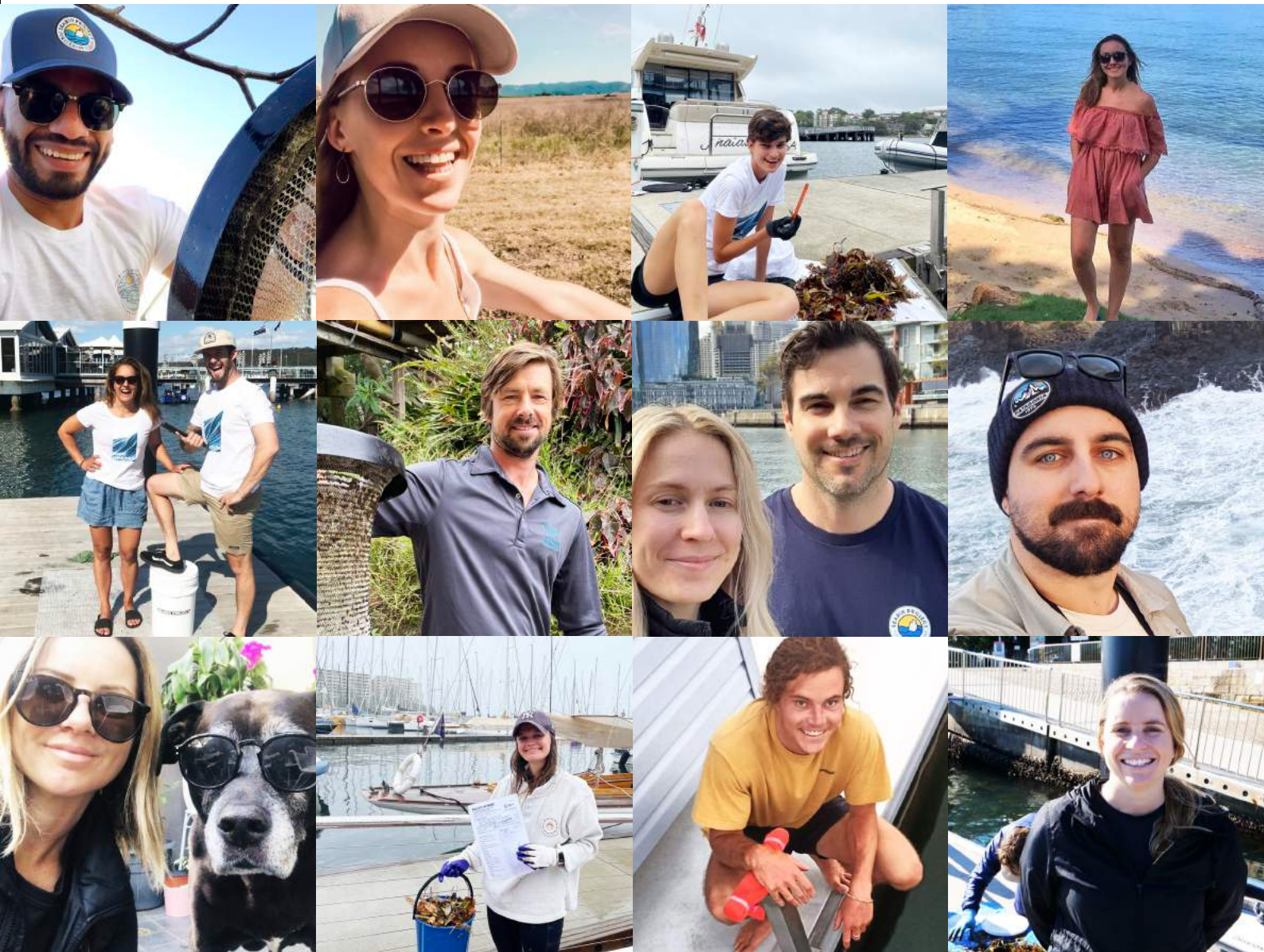
*When sorting through the catch as part of the data collection, each handful would have multiple pieces of plastics of all sizes. Some weeks it could take more than an hour to sort through. However, sifting through the catch was so rewarding, to count each piece and think that it’s one more piece we are preventing from being swallowed by sea life or transported out to the marine environment.*

*I truly love being part of the Seabin community and can’t wait to see how the company will grow and expand their technology.”*



**Jack**  
Enviro Technician &  
Data Analyst  
Sydney, Australia

*“No one is immune to the impacts of marine litter and the diversity of our volunteer program reflects that. It has given individuals an opportunity to become connected to the issue firsthand, creating hope for themselves and their community towards cleaner oceans.”*



Edward Midgley  
 Georgia Corrie  
 Mario Ara  
 Wade Cameron  
 Anne Keyvar  
 Astrid Holler  
 Alicia Corsar  
 Dave Corsar  
 Jono Cousins  
 Julia Nicholson

Luciana Santos  
 Sarah Hill  
 Toby Pati  
 Katrina MacDonald  
 Greta Quealy  
 Rhiann Foster  
 Tia Bool  
 Tiffany Holz  
 Joseph Scopas  
 Sarah Colquhoun

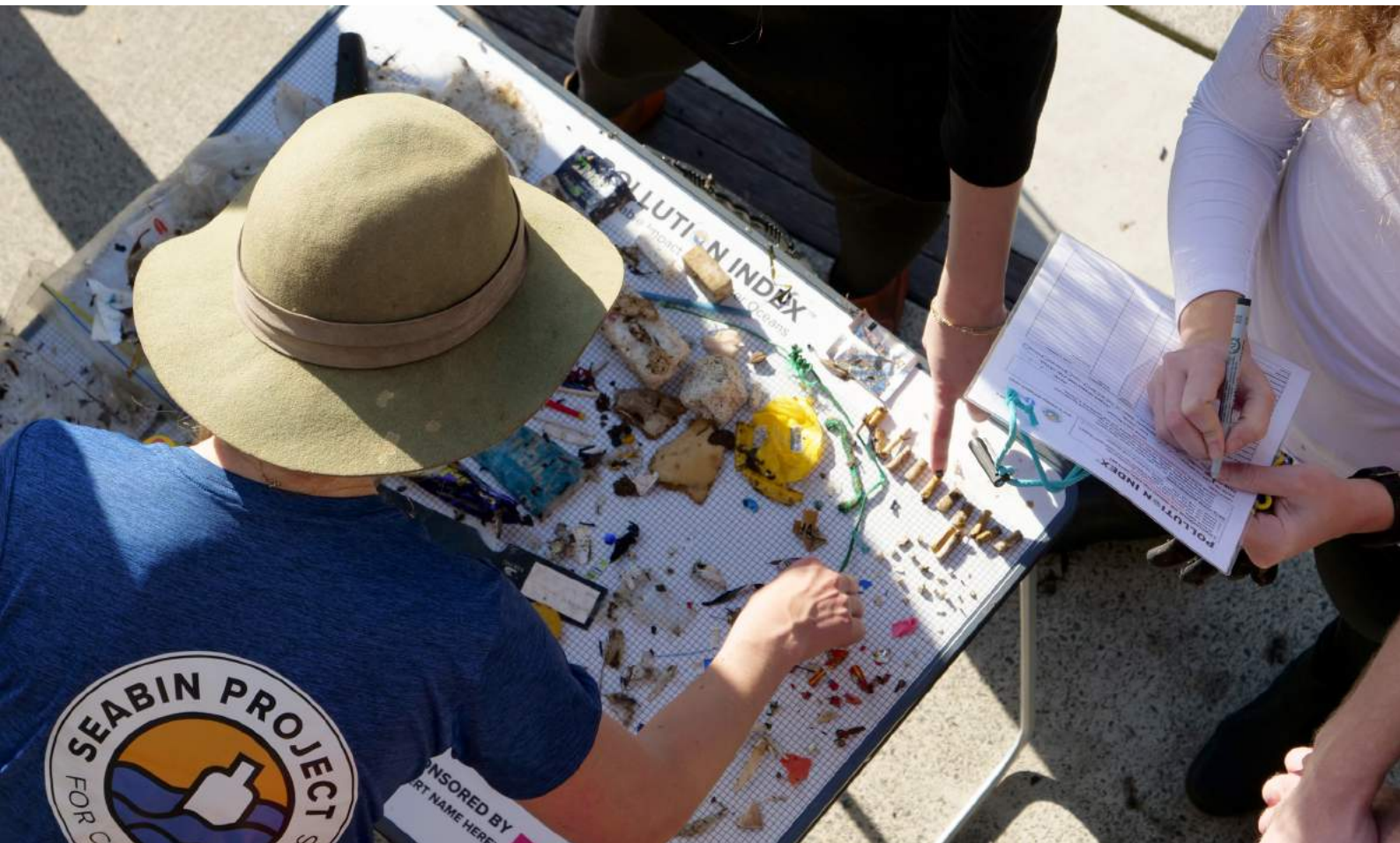
Tara Lloyd  
 Emma Shearman  
 James Plasto  
 Jenni Ellard  
 Mark Lawson  
 Meredith Epp  
 Olivia Eastwood  
 Mandy Meyerowitz  
 Matthias Muller  
 Phil Merillo



# The Nitty Gritty Details

Diving deeper into the 100 Smarter Cities For Cleaner Oceans campaign, Seabin Smart Tech and the Sydney annual impact report.

1. Seabin Project are a young and dynamic startup making a global impact in the blue tech innovation and ocean data sector.
2. Seabin has 14 employees with offices in Australia, the USA and Spain.
3. Seabin believes that both Prevention & Cleanup are needed to turn off the tap to ocean plastics.
4. Seabin is embarking on an ambitious and important mission to save our oceans via the rollout of the 100 Smarter Cities for Cleaner Oceans program. Seabin has achieved proof of concept through 5 years of technical research and development, 3 years of global data monitoring + reporting, and successful proof of concept for a sustainable and commercial business model, via the Sydney City Pilot, July 2020 > June 2021.
5. Seabin are seeking to engage with ambitious, genuine, well-aligned partners, for long term, high impact global partnerships, to clean and protect our oceans.
6. Our focus points are Data Monitoring & Reporting, 100 Cities Goal, Next Tech R&D, Connectivity, Citizen Science, Prevention, Community Activation and Clean up.



In July 2020 Seabin Project launched a self-funded 12-month city pilot program in Sydney Harbour aiming to create employment in the environmental sector post COVID19, and ultimately, to reduce the prevalence of marine litter in Sydney's waterways.

Five months into the pilot Discovery were inspired by the project, and came onboard as principal sponsor, allowing more Seabins to be added, more support staff to be hired and for the Seabin message to be shared more broadly on-air.

With the goal of installing 20 Seabin units in strategic locations throughout Sydney Harbour, Seabin Project anticipated approximately 28 tonnes of marine litter would be captured, and 4.3 billion litres of water filtered over the 12-months of operation.

The 12-month city pilot program was the first step in Seabin Project's model for scaling up operations towards rolling out of the 100 Smarter Cities, For Cleaner Oceans (SCFCO) campaign.

Seabin Project plans to replicate this service around the world, with the goal to deliver the SCFCO campaign to 100 cities by 2050.

This impact report presents the findings from 12 months of operation from 16 Seabin units installed at 8 locations throughout Sydney Harbour.



**2021** United Nations Decade  
of Ocean Science  
**2030** for Sustainable Development

**2021 marks the start of the Decade of Ocean Science for Sustainable Development.**

**Seabin Project is doing its part to fill critical knowledge gaps and develop science-based solutions.**

Marine litter, including all forms of plastic pollution in our oceans and waterways is a global problem that will transcend generations. Since 2015, approximately 9 million tonnes (MT) of land-based plastic pollution enters the marine environment annually and is estimated to increase to 250MT per annum by 2025 (Jambeck et al, 2015; Meijer et al., 2021<sup>5</sup>).






Our collective responsibility is to act immediately to ensure a cleaner and safer environment for future generations. The Sydney City Pilot program was the first of its kind.

Marine litter data was collected daily and compared with localised environmental parameters such as wind, rain and tides. The data collected from the city pilot has been used to develop the Pollution Index™ (PI), a platform that can quantify the health of our waterways and report on the localised prevalence of marine litter.

Seabin Project developed the PI™ to provide key decision and policymakers with valuable baseline data to address the issue of marine litter entering our ocean through metropolitan waterways.

<sup>5</sup>Jambeck, J.R., Geyer, R., Wilcox, C., Siegler, T.R., Perryman, M., Andrady, A., Narayan, R. and Law, K.L., 2015. Plastic waste inputs from land into the ocean. *Science*, 347(6223), pp.768-771.; and Meijer, L.J., van Emmerik, T., van der Ent, R., Schmidt, C. and Lebreton, L., 2021. More than 1000 rivers account for 80% of global riverine plastic emissions into the ocean. *Science Advances*, 7(18), p. 5803.

## The “100 Smarter Cities For Cleaner Oceans” pilot program comprises of 5 key initiatives:

1.	2.	3.	4.	5.
				
<b>Data Monitoring.</b>	<b>Data &amp; Impact Reporting.</b>	<b>Identifying The Causes.</b>	<b>Community Programs.</b>	<b>Marine Debris Removal.</b>
Measuring & monitoring marine health and debris/pollution.	Detailed reporting to inform policy and drive pollution prevention.	Who's accountable? Analysis of land based pollution origination.	STEM education & public engagement for behavioural change.	Intercepting pollution in the water before it reaches the ocean.

The Seabin Smart Technology (SST) merges the concept of a pool skimmer and a garbage bin to create a litter capture system for the marine environment.

Seabins can filter up to 600,000 litres of water per day (L/day) to capture marine litter. A catch net is housed within the Seabin unit and is capable of holding up to 20kg of matter. The average catch (globally) over a typical 24hour cycle is approximately 4kg.

Seabins operate 24/7 – 365 days per year. SST filters the top 20mm of the water column for marine litter, as well as surface pollutants including microplastics, plastic fibres, oils and fuels. Seabins use surface tension to capture floating marine litter in the catch net. The force of the surface tension is enhanced by a submersible pump that drives water through the unit at a rate of 25,000L/hour (600,000L/day) and up to 6 metres (m) from the unit<sup>6</sup>.

The location of a Seabin is dictated by the observed marine litter and plastic pollution problem of an area (Figure 1). SST has the greatest impact on reducing marine plastic pollution in calm environments such as waterways, marinas, ports and harbours (Figure 2). A significant proportion of litter captured by Seabins originated on land and is transported into the marine setting by physical environmental factors such as rain or wind.

Therefore, Seabins have the most significant impact in metropolitan areas with large, built-up catchment areas. The data collected, however, can be used to influence decision-makers and policy, and reduce the prevalence of land-based litter upstream.

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<sup>6</sup> Site specific pressures and environmental factor may alter this measurement. The measure regarding a radius of 6 metres was tested in a controlled environment.



Figure 1: Typical accumulation of marine litter including plastic pollution captured within a harbour



Figure 2: Marine litter captured using the Seabin smart technology in Sydney Harbour.

Seabin catches vary significantly. Catches are often made up of organic material including terrestrial organics such as leaves branches and grasses as well as marine organics such as seaweeds and kelp (Figure 3).

Captured within the organic material are micro and macro plastics (Figure 4). All the material captured in Seabins is therefore classified as marine litter and is disposed of accordingly.

An oil pad is also attached to the bottom of the catch net and absorbs pollutants such as oils, liquid fuel and other contaminants whilst the water is filtered through the Seabin (Figure 5&6).



Figure 3: An example of marine litter intermingled with organic matter.



Figure 4: A sample of plastic items found within the organic matter.



Figure 5: An example of surface pollutants in a marina before turning on a Seabin.



Figure 6: Surface pollutants filtered by the Seabin V5 after 45 minutes, using an oil pad.

Seabins are regularly emptied, most commonly on a daily basis. Marina staff and volunteers collect data on the weight and content of the catch as often as possible. The data is filled out in the PI™ data form.

The catch is first weighed in kilograms, then spread out on a 1000mm x 1000mm surface (1mx1m). Spreading the Seabin catch is the first step in the ‘detailed data collection’ process. Data collections indicate the composition and diversity of the types of plastics that are captured in Seabins.

Organic matter is separated first, then plastic items are sorted and displayed in like-groups according to the ‘PI™’ datasheet. Plastic items are counted and recorded to supply location-specific data about plastic pollution streams and weights.

Seabin Enviro Technicians  
Tom Batrouney & Jack Vitnell going over  
the daily data sets in Sydney, Australia.



The Pollution Index™ (PI) by Seabin Project quantifies the impact of Seabin units for cleaner oceans and a better value of life.

The Pollution Index™ is a ranking scale that quantifies the litres of water filtered by a Seabin unit to capture a single item of marine plastic. A Seabins filters up to 600,000 litres of water per day. The scale summarises Seabin data collections in a ranking, ranging from 1 to 11 (least polluted to most polluted).

Within each numbered item on the Pollution Index™ scale (PI 1 – PI 11), there is a number range that depicts the number of litres filtered to capture 1 item of marine plastic (Figure 8).

Developed over 4 years of manual data collections, cataloguing captured marine litter & water quality information from the global Seabin fleet, the Pollution Index™ platform has the capacity to monitor and measure the health of waterways.

Consistent, reliable data can be used to highlight marine plastic knowledge gaps and appropriately inform communities and governing bodies.

The Pollution Index™ goal is to provide data-driven solutions through education and thereby progress humanities behaviour towards cleaner oceans, helping support the world's biodiversity.

Seabin Project is working towards being recognised by the United Nations Development Program through the Pollution Index data as key indicators for their life Below Water Goal (SDG14).



\* Indicates an amount less than 1 litre

**POLLUTION INDEX™**  
Quantifying cleaner oceans & a better value of life.

Figure 8: The Pollution Index rating scale for measuring marine litter prevalence.



Figure 9: The Pollution Index™ is designed to be an indicator of SDG14 Life Below Water, helping cities and governments reach their target SDG's globally.



# PLASTIC PER LITRE (PPL)

## PPL ratio explained



## How PPL is calculated

Seabin Flow = 600,000 Litres Per Day  
 Plastic Item Count Over 24 Hour Period = 560 Plastic Items  
 600,000 / 560 = 1 Plastic Item Per 1071 Litres Filtered

## How PPL is used

- Each location is marked by a PPL colour grade, referenced by the PPL scale on the right.
- Each colour grade shows a pollution level.
- Each location has a PPL rating for reference to how polluted the water is for plastic particles.
- The PPL may also assist in measuring the plastic count or volume of a location's surface area.

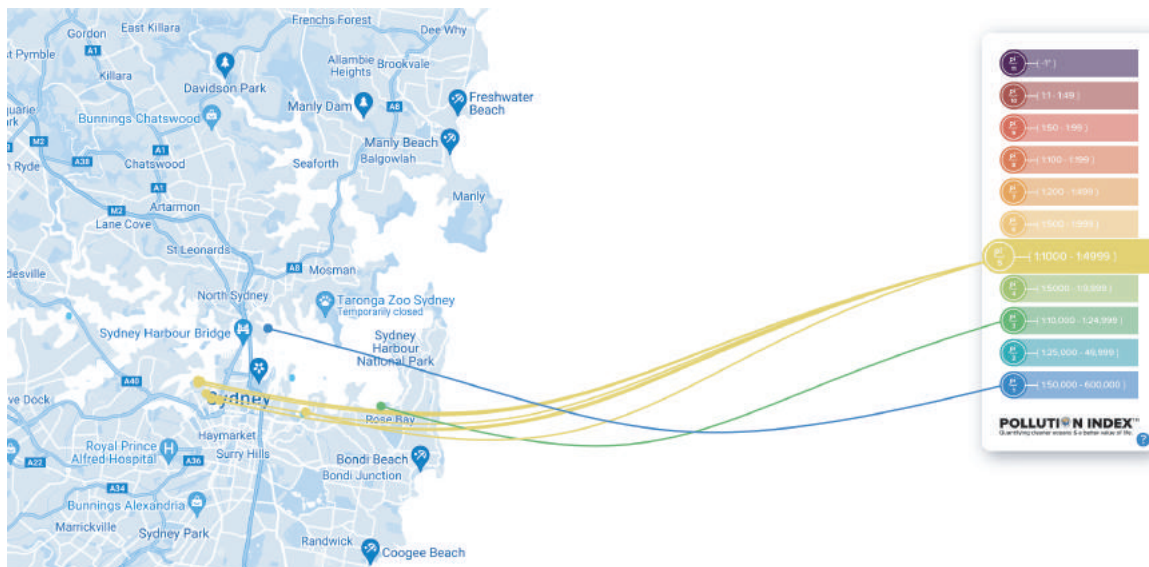
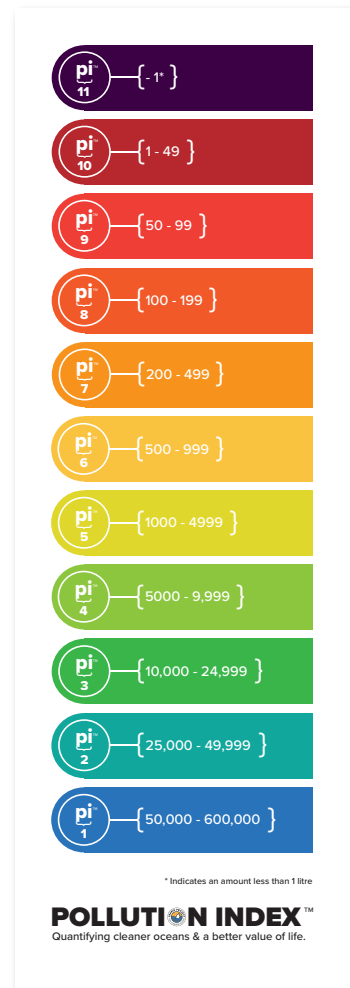


Figure 10: Screenshot (fictitious - for purpose and example only) from the Pollution Index™ dashboard showing locations and their PPL ratings.

**Brunswick Heads Marina**

Brunswick Heads Marina is located on the Far North Coast of NSW, Australia. Surrounded by pristine waterways, bush and pastoral land with minimal urban sprawl, this location presents a unique data set with low pollution. A total 612 items of marine litter were catalogued from 48 data collections (on 72hr catches) and 86 million litres of water were filtered. This equates to one item of marine litter captured for every 141,176 litres of water filtered.

Therefore, the **PI™** rating for Brunswick Heads Marina is: **PI 1**

**The top 3 prevalent items were:**

Microplastic, Fishing Line, Foam Pieces.



**Batavia Marina Sunda Kelapa, Jakarta, Indonesia**

Batavia Marina is a historical marina located in the heart of Jakarta City, the capital city of Indonesia, and among the most polluted water in the world. The Seabin hosted in Batavia Marina provides invaluable data on the prevalence of marine litter in a large South East Asian city. A total 5,405,319 items of marine litter were catalogued from 70 data collections (on 24hr catches) and a total 42 million litres of water were filtered. This equates to one item of marine litter captured for every 8 litres of water filtered.

Therefore, the **PI™** rating for Batavia Marina is: **PI 10**

**The top 3 prevalent items were:**

Foam Pieces, Microplastic, Microfibres.



**Sydney Harbour – City Pilot (overall)**

In a first of its kind study, Seabin Project sampled the prevalence of marine litter daily in Sydney Harbour for 12 months. A total 70,965 items of marine litter were catalogued from 426 data collections (on 24hr catches) and 255.6 million litres of water were filtered. This equates to one item of marine litter captured for every 3,602 litres of water filtered.

Therefore, the **PI™** rating for Sydney Harbour is: **PI 5**

**The top 3 prevalent items were:**

Microplastic, Unidentified Plastic Items - Soft & Foam Pieces.



The performance of a Seabin is directly related to how the daily empties are conducted and the consistency of servicing. Being submerged in a marine environment 24/7, Seabins require daily visual assessments and servicing every 2-3 months.

Servicing is an essential component to maintaining the consistent operation of Seabins and prolonged capture of marine litter. To service a Seabin, the unit must be switched off and removed from the water. Servicing generally includes pressure washing the unit to remove any marine fouling such as the accumulation of barnacles and marine fauna or flora. Operational checks are conducted to test the functionality of the pump, catch net and plunger mechanism.

A Seabin service takes approximately 1 hour and once the service is completed, the unit is returned to the water and is switched on, ready to capture marine litter. The 16 Seabin units were operational for 345 days.

The Seabin Enviro Techs performed 68 Seabin services along with their daily responsibility to check and empty the units. Of the 345 operational days, the Seabins units operated at 97% runtime capacity. This equates to a total downtime of 10 days spread among the 16 units.

A common problem that influences the operation of a Seabin is pump failure resulting from debris blocking the impeller. To mitigate this issue, it is essential to follow the correct procedure when conducting daily empties. The Seabins must be turned off before the catch net is removed to prevent debris from being sucked into the impeller, resulting in the pump causing failure.

Other issues that can be encountered are electrical related. Power supply to the units may be cut off and Seabin Project are not informed. Additionally, catch nets may require replacement.



The Sydney City Pilot directly created 3 full-time jobs\*

## 1. Head Environmental Technician

The role of the Enviro Technician is to both address the servicing and maintenance of the Seabin hardware Monday - Friday, and also to act as a community ambassador using prevention and education as a platform.



Tom Batrouney

## 2. Data Analyst / Environmental Technician

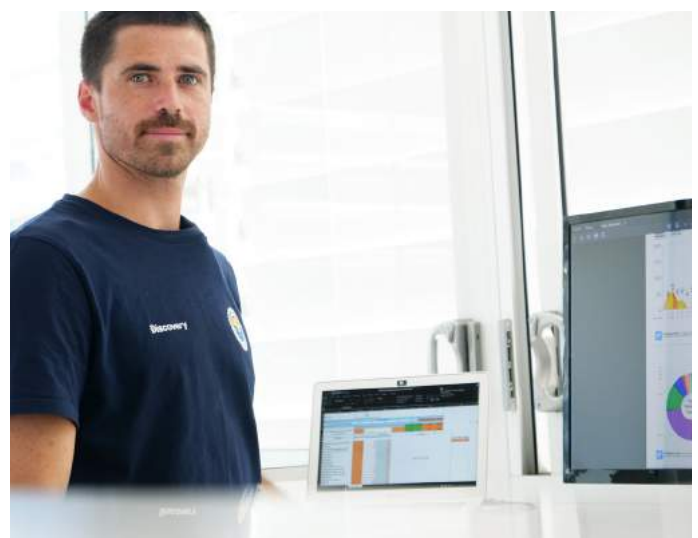
The role of the Data Analyst / Enviro Technician is to conduct daily data samples, weekly detailed data samples, help manage the data volunteer network and assist with the servicing and maintenance of the Seabin hardware, also to act as a community ambassador.



Jack Vitnell

## 3. Campaign & Data Coordinator

The role of the Campaign & Data Coordinator is to manage the incoming data, build monthly impact reports and coordinate the volunteer network in collaboration with the Enviro Technicians.



Solomon Wadani

\* Seabin wish to disclose that whilst these three guys are strikingly handsome and predominantly male, we have a strict non biased, gender equal HR policy. Anyone hired for a position is based on merit, empathy and the ability to work as a team.

## Community Engagement

Part of the enviro Technician's role is to engage with local communities. Over the 12-month period, our Enviro Technicians engaged in meaningful conversation with 710 people on the ground.

## Corporate/Employee Days

Due to Covid 19 restrictions, our community engagement is down from previous years, however, we still managed to host or attend 12 live events with 527 attendees.

## Educational Activities

Due to Covid 19 restrictions our educational program in Sydney, Australia, is also down from previous years, however, we still managed to present at a substantial event with 120 students attending.



## Digital/Media Reach

Our reach specific to the Sydney City Pilot over the 12-month period was +14 Million people not including daily social media posts across our channels.

The 3 main items were 2 x press releases and a Discovery Channel sponsored TV media package.

## Organic Reach

Our social media reach specifically to the Sydney City Pilot is +8 million across our social media channels Instagram, Facebook, Twitter, LinkedIn and Vimeo.



Through our Pollution Index™ digital platform, we can begin to identify and trace land-based pollution streams. We can establish baseline data and report on the rate at which pollution is entering our oceans to highlight the need to drive behavioural change to ‘turn off the tap’.

Baseline data will allow us to report on how this pollution may be affecting the ocean's health and natural ability to sequester carbon from our atmosphere; and in turn the ocean's ability to regulate the world's climate.

Furthermore, preventative solutions to plastic pollution also have an indirect role to play in addressing climate change, with the main driver being behavioural change to reduce the carbon footprint of single-use plastic manufacturing, whilst promoting a consumer culture of reusables.

The next few years are critical for us to turn off the tap to land-based pollution, conserve our oceans, and collaborate to foster a sustainable planet for future generations.

***The next few years are critical for us to turn off the tap to land-based pollution, conserve our oceans, and collaborate to foster a sustainable planet for future generations.***

Throughout the 12-month Sydney City Pilot, our Enviro Technicians and volunteer cohort began seeing and recording parking tickets captured among the Seabin catch marine litter. With an array of degradation, some tickets were legible enough to begin recording details. This presented Seabin Project with a unique opportunity to track the location and time of litter items to be captured in the Seabin Smart Tech (SST).

Presented below is an example of 40 parking tickets, recorded at varying times throughout the Sydney City Pilot and their corresponding point of capture (in a Seabin).

The Sealife Aquarium unit recorded the highest volume and frequency of parking tickets, predominantly from the City of Sydney Local Government Area (LGA). On average, 48 days passed between point (day and time) of origin to point of capture. Therefore, parking tickets spent on average 48 days in the environment before being captured by SST.

Figure 11: Map of Sydney showing parking ticket locations of issue and capture, including City Area 30 Catchment (See page 32)

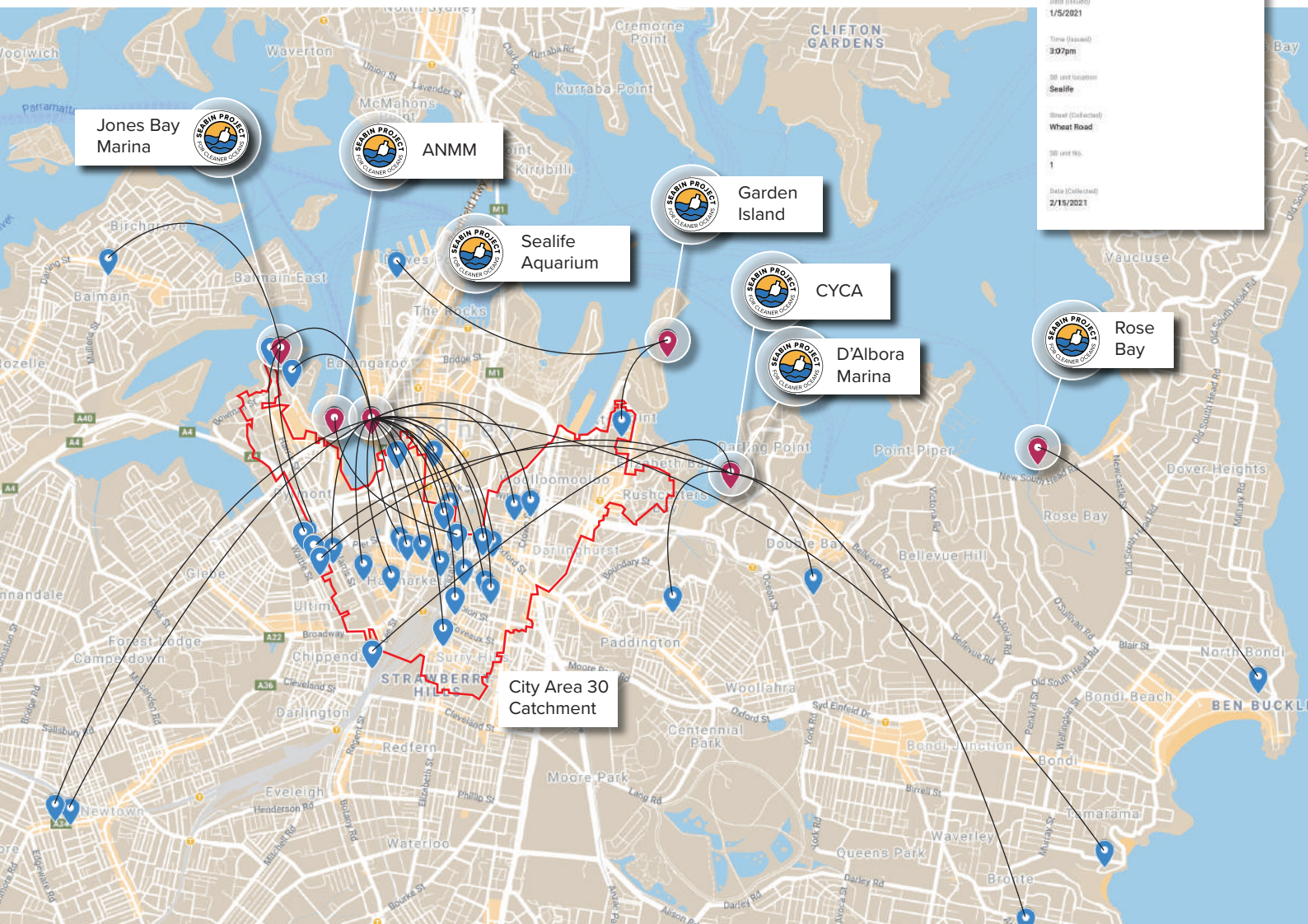
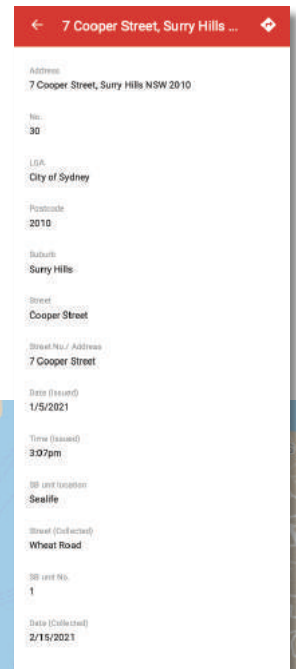


Figure 12: An example of how the parking ticket information was entered into Google maps.

Catalogued Parking Ticket On Google Maps



**Stormwater drains and Sealife Aquarium Seabin unit - observations**

In March 2021, Sydney received almost 3 times (352mm) March’s monthly average rainfall (132mm) in the 11 days from 15th to the 26th of March. The Sydney Harbour Seabin fleet reflected this with almost 3 times higher (1492kg) catches than pilot averages, with the Sealife Aquarium unit capturing approximately 697kg of this alone.

Within close proximity to the Sealife unit are two large stormwater drains of approximately 1.2m in diameter that sit partially submerged (depending on the tides). The layout of the Aquarium barges has created funnels for the stormwater, rich in litter, to be captured by the Seabin unit instead of flowing into Sydney Harbour.

In comparison, a site with minimal stormwater input such as Sydney Wharf captured 17.5 kg during this same time period. The Sealife Aquarium site is on the border between two stormwater drainage areas (See fig 13 below for map of City Area 30 Catchment and City Area 2910 Catchment).

The Seabin team has therefore identified this as an area of concern for Sydney Harbour. The March rain event likely flushed the litter accumulated in the stormwater system and surrounding areas. This is an observation derived from comparing the following month of April when the unit collected on average 6.7 kg per day, almost 4kg short of its March average of 10.5 kg.

Surry Hills and Haymarket suburbs indicated the highest recorded frequencies of parking tickets caught in Darling Harbour, suggesting catchment drains located in City Area 30 Catchment , into Darling Harbour (See Fig 11, page 31).

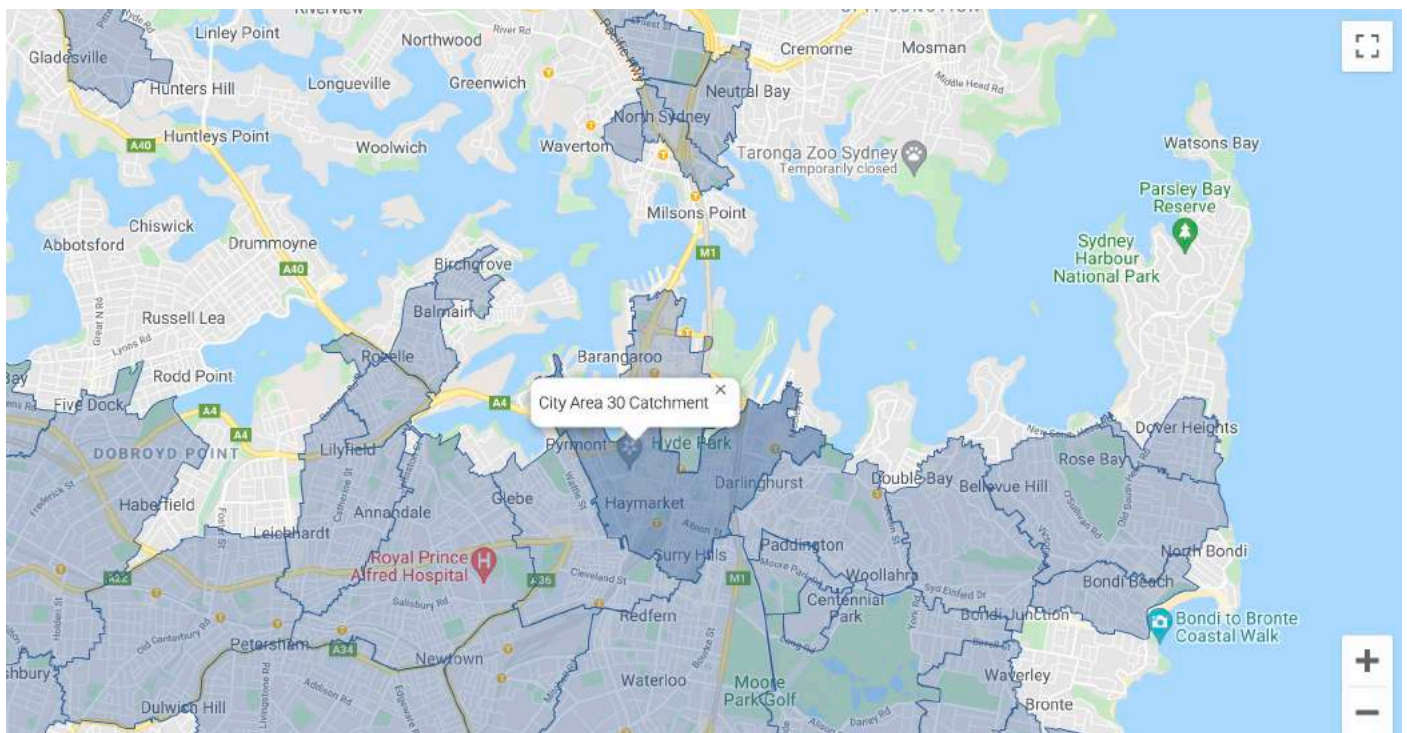


Figure 13: Screenshot of City Area 30 Catchment from <https://www.sydneywater.com.au/sw/water-the-environment/how-we-manage-sydney-s-water/stormwater-catchment-map/index.htm>



Although it is thought wind and tides control the flow of rubbish back and forth through these funnels, the marine litter generally works its way into the Harbour within a few tide cycles unless captured by the Seabin. To prevent this flow into the Harbour, we have experimented with budget style pollution traps/booms that cover the exit point of this funnel.

Refining the pollution traps to cope with high loads and varying environmental conditions has been successful in trapping a large degree of marine litter within these “raceways”. This allows the Seabin and those who service the unit, time to capture further litter from the seawater before it escapes to the Harbour. After the success of this first unit and the help of the Sealife staff who frequently empties it, funding has been secured for the second unit to help reduce the high load on the first unit.

Due to the private location of the site and restricted access to volunteers the litter specific data at this location is minimal, however the SET's have to service this unit most often due to its high prevalence of polystyrene (EPS) that can block the “snorkel” of the Seabin unit. This location reported 6.5 times more foam pieces than the Seabin unit average in Sydney Harbour.

There are a number of factors that could explain this trend. The catchment area is comparatively large and runs through a key food distribution hub around the Haymarket region. Once the EPS enters the stormwater system it is churned up, breaking into smaller EPS pieces. 80% of the EPS found at this location was <5mm.

The Seabin unit with the second highest reported frequency of EPS was opposite Sealife Sydney Aquarium at the Australian National Maritime Museum (ANMM) and the third highest nearby at Jones Bay Wharf, which receives stormwater input from the same catchment area. The small balls of polystyrene (EPS) foam mark the high tide lines around the pylons and walls around Sealife Sydney Aquarium.



Figure 14: One of the parking tickets captured by the Sealife Seabin unit in Darling Harbour.

## Wind as a contributing polluting factor

From visual observations, marine litter accumulated in certain areas after weather events or persistent environmental conditions. Wind is thought to be a one of the main drivers of litter around the Harbour however many variables come into play including rainfall, tide cycles, infrastructure and localised currents.

Seabin Enviro Technicians have observed many full and overflowing bins on land, some within metres of stormwater drains. Strong winds will blow litter from overflowing bins onto streets and into stormwater systems, therefore an increase in wind speed appears to lead to an increase of land-based litter entering the harbour.

The results showed that data collections done on days of heavy winds had the highest average catch weight (6.4kg) followed by moderate days (4.4kg), then by light winds (4.2kg). It appears periods of high wind followed by rain are environmental contributors to heavy catch totals. High wind alone is unlikely to create a large amount of litter in the Harbour, but rain followed by strong winds may be triggering this observed trend.

The Manly Seabin Unit is the northernmost unit in Sydney Harbour and litter accumulates on these shores more frequently when there is Southerly direction in the wind. Seven out of the top ten catches were on days with Southerly winds.

Figure 15: The Manly Seabin Unit is the northernmost unit in Sydney Harbour and litter accumulates on these shores more frequently when there is Southerly direction in the wind.



The Sydney City pilot program had a significant impact on the prevalence of marine litter in Sydney Harbour. The pilot program demonstrates the ability and impact of 16 Seabin units. The 16 Seabin units removed more than 16.5 tons of marine litter.

Whilst this total is less than the anticipated 28 tonnes, it represents a significant reduction of marine litter. The initial estimations were based on 20 units operational for one full year. Not all units were installed simultaneously and therefore, as the pilot accrued Seabin units, logistical challenges became present. Whenever a Seabin unit is 'offline' there is a higher risk of marine litter polluting the ocean.

Throughout the course of the city pilot, Seabin Project employed 3 full-time staff to manage the workload. Their role was ranging from Seabin servicing, data collection to managing marina requests and reporting. Servicing all 16 units presented as the key logistical challenge and was overcome by allocating more Seabin staff to service-specific work. This resulted in reducing the downtime of each Seabin unit and increasing capability to capture marine litter.

There is an exponential increase in marine litter capture with regularly serviced Seabin units. Sealife Sydney Aquarium registered the highest total catch weight for all the locations throughout Sydney. Of the 8 locations, Sealife Sydney Aquarium was the unit that was most impacted by city runoff. The site hosts two large stormwater drain outlets, which act as a significant source of pollution.

In March 2021, an East Coast Low (ECL) impacted NSW leading to significant flooding for large parts of the state, and consequently a significant amount of land-based litter runoff. This environmental event resulted in the Sealife Sydney Aquarium unit recording the highest daily catch (223kg). Seabins remove surface contaminants as well as marine litter, including the capture of significant concentrations of microfibres and other marine pollutants such as fuels and oils.

Additional studies have been conducted using the Seabin units to capture microfibres<sup>8</sup>. Seabins significantly reduce the presence and prevalence of marine litter.

The city pilot has been able to deliver critical information about the most prevalent marine litter items capture, and therefore present in Sydney Harbour. Through analysing the numerous data collections conducted by Seabin staff and our team of committed volunteers, the most prevalent marine litter items were microplastics (including plastic pellets and nurdles), polystyrene foam and soft plastics. These 3 categories represented 54% (>45,000) of the cumulative total count of plastic items recorded from data collections.

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<sup>8</sup> Masters students from Macquarie University completed and published a study on the Seabins effectiveness to capture microplastics in March 2020. The total catch data was not used in this report. This report does not reference the microplastics captured and reported on in the Macquarie University Report, as it was undertaken prior to the start of the City Pilot.

The microplastics report can be supplied on demand, with written consent from the authors.

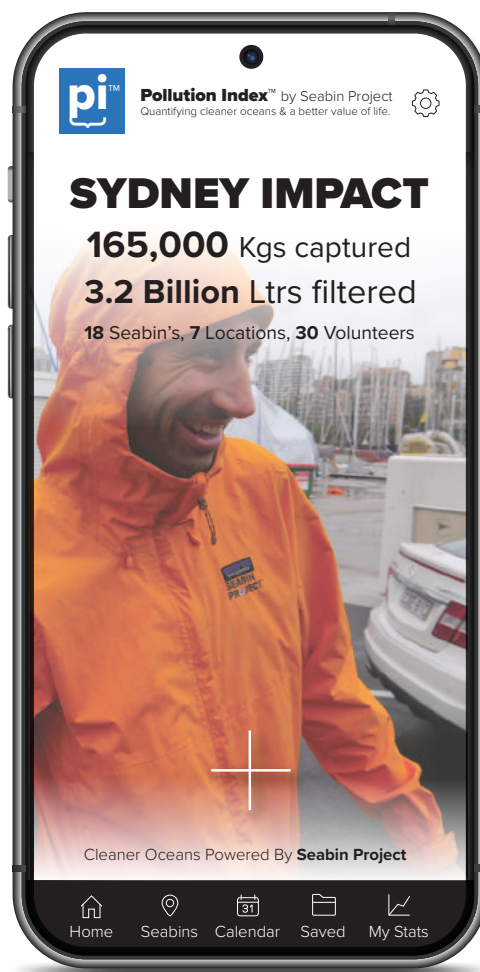
Figure 16: The Pollution Index™ dashboard with automated reporting, will be launched October 2021.



Figure 17: The Seabin 6.0//DMU is due to launch October 2021.



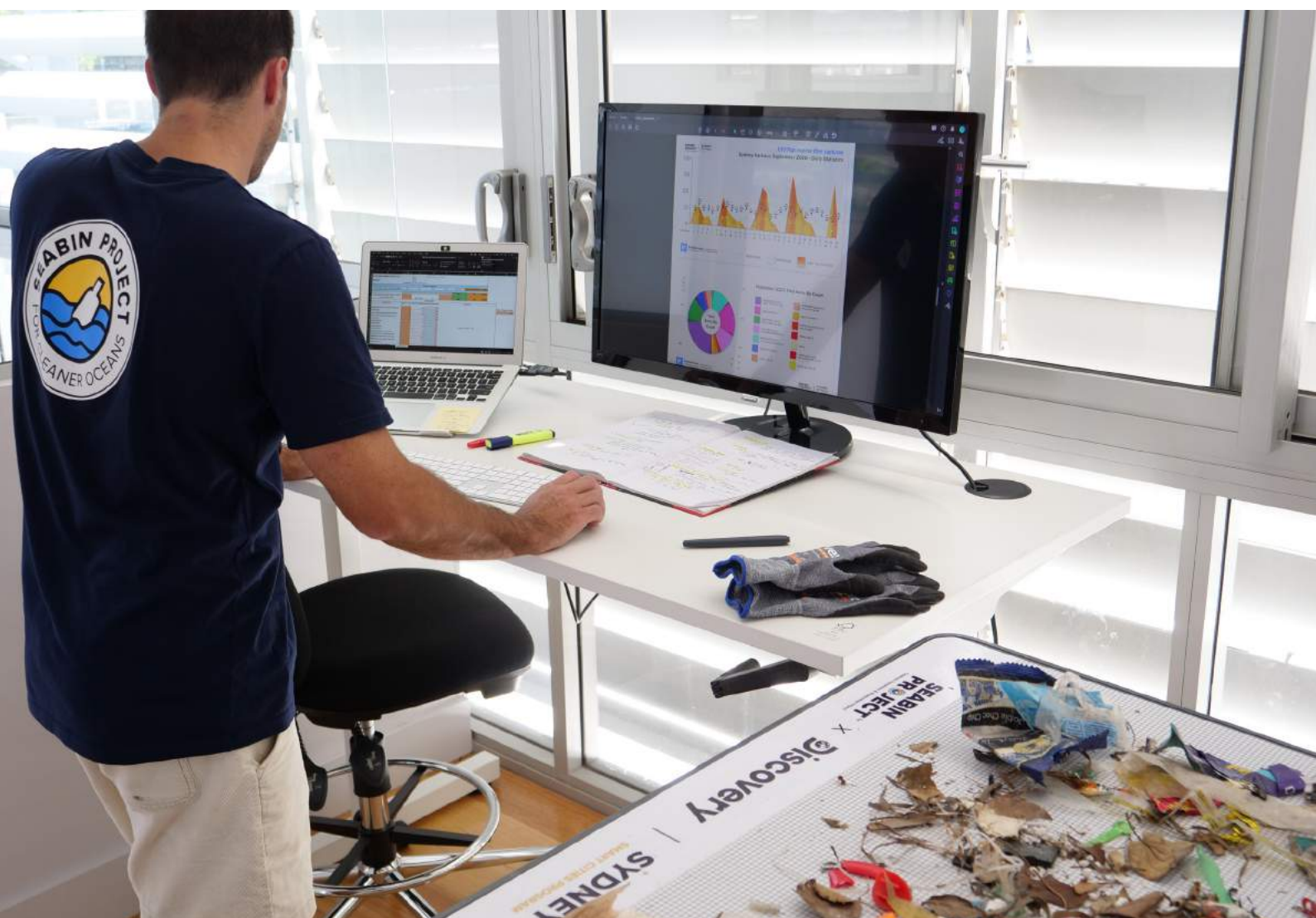
Figure 18: The Pollution Index™ mobile app, will be launched October 2021.



The city pilot data has been compiled with Seabin's global database and used to build a model by which the health of the marine environment can be quantified by referencing the prevalence of marine litter.

The PI™, is a platform consisting of over 4 years in planning and manual data collections, cataloguing captured marine litter & water quality information from the global Seabin fleet. The PI™ has the capacity to monitor and measure the health of waterways and the direct impact of Seabin units creating cleaner oceans and a better value of life.

The PI™ is available through our live dashboard and smartphone application, where a user can generate bespoke reports from up to date, open-access data.



# A huge thank you to our host location partners for your ongoing trust and support!

## Rose Bay Public Pontoon

(Managed by NSW Transport)

## D'Albora Marina, Rushcutters Bay

(Unit sponsors are Australian Ethical)

## Cruising Yacht Club Of Australia

## Sealife Aquarium, Darling Harbour

(Unit co-sponsor is Sydney By Kayak)

## Australian National Maritime Museum

### Sydney Wharf

(Managed by Scope Marine)

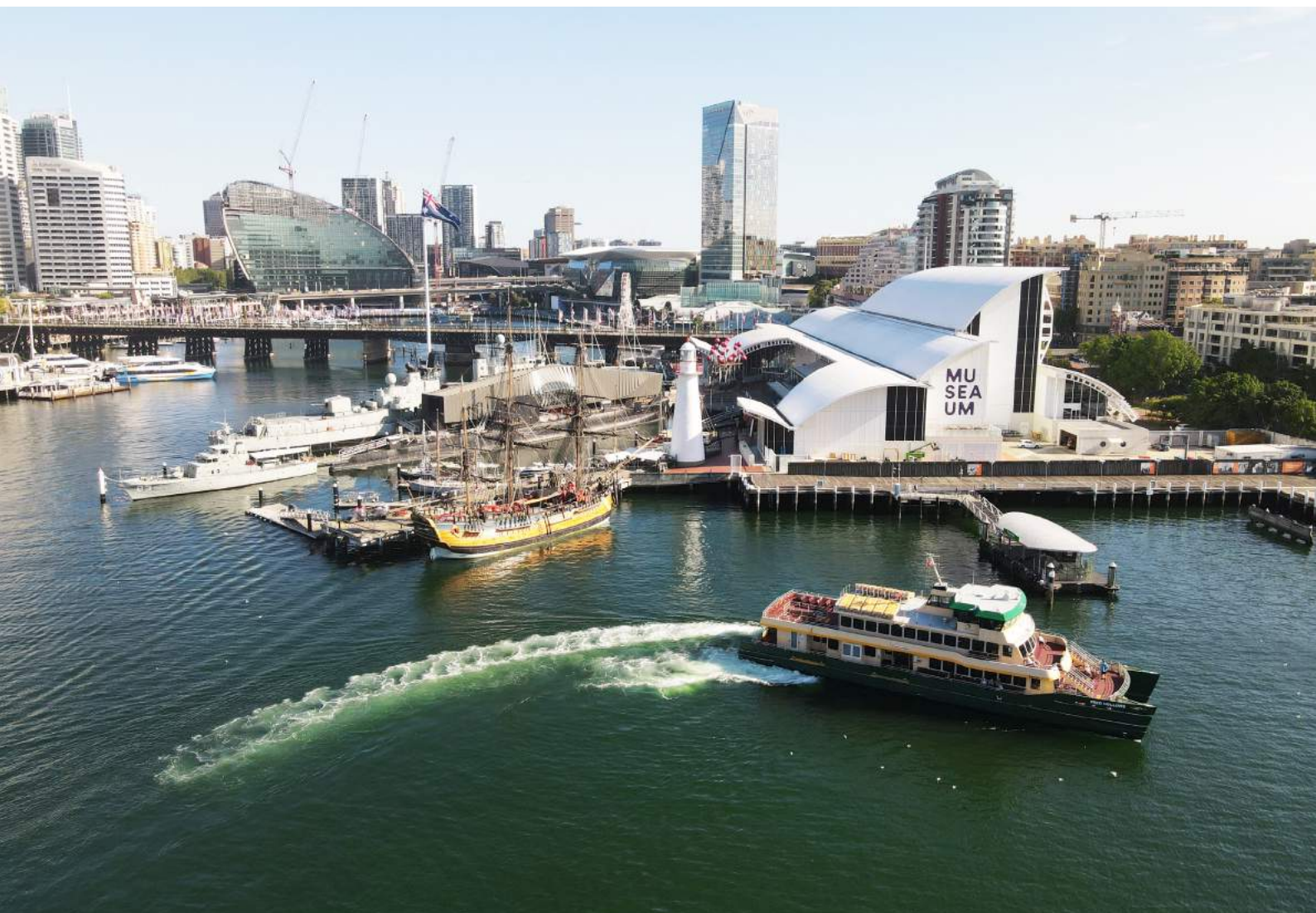
Unit sponsor is Star Entertainment)

### Jones Bay Wharf

(Managed by Scope Marine)

### Manly Yacht Club

(Unit sponsor is Patagonia)



**A huge thank you to our awesome sponsors for getting behind this world first initiative!**

We look forwards to scaling our partnerships to our next cities.





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To learn more or for enquiries to support a city pilot,  
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