



Shipwreck Coast Marine Debris Citizen Science in Action.



August 2022

Prepared by;



Executive Summary

Beach Patrol 3280-3284 (Beach Patrol), a volunteer group that collects marine debris along the Shipwreck Coast of Victoria, has built up a significant amount of data on the type and number of debris it collects.

Beach Patrol has been recognised by numerous awards in recent years and its campaigning contributed to an upgrade of the screens at Warrnambool's sewage treatment plant to better protect the environment, and also, resulted in the Victorian State Government passing legislation to ban plastic stemmed cotton buds from February 2023.

In recent years group members were becoming concerned over what appeared to be an increasing amount of debris that they suspected was coming from international shipping.

Beach Patrol engaged Tutt Environmental to review and report on the group's methods, data, information and concerns.

The recorded data spans from 2017 to the present day, and is located in various database system and excel files. In recent times a mobile app has started to be used to record patrol data, however a number of patrollers don't record their patrols or what they find.

It is estimated that 15-20 Patrols (both recorded and unrecorded patrols) occur every week and that 1 in 3 patrols collect debris that appears to be from international ships.

Collected debris that is likely linked to international shipping ranges from foreign origin water bottles, to Nescafe coffee jars filled with foreign cigarette butts, to foreign food packaging (some still with contents inside).

The Port of Portland handles many international ships. International ships' waste disposal at the Port of Portland is expensive. These high costs and COVID factors are suspected by Beach Patrol as being a factor for increased amounts of foreign debris being found.

The regions' location and features mean that significant amounts of marine debris are unlikely to have originated from urban runoff unlike the northern Australia coast with its proximity to Asian countries to the north.

Beach Patrol and the data it has generated is a good example of citizen science highlighting the issue of marine debris on south west Victoria beaches, and highlighting international shipping waste as an ongoing concern.

The data and observations made by Beach Patrol provide for further action to be taken such as increased education, inspection and enforcement and possible changes to waste management at ports.

Contents

1	Review Background.....	1
1.1	Beach Patrol 3280-3284 Synopsis.....	1
1.2	Tutt Environmental Background.....	1
1.3	Aim.....	2
2	Method.....	2
2.1	Beach Patrol 3280-3284.....	2
3	Patrol Data.....	3
3.1	Patrol Frequency.....	3
3.2	What has been found?.....	4
4	International Shipping Waste.....	6
4.1	International Waste – what has been found?.....	6
4.2	International Waste – frequency of find.....	7
5	Bottle Specific.....	8
5.1	Bottle Lid Analysis.....	9
6	Discussion.....	10
7	Conclusions.....	12

Acknowledgements.

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1 Review Background

Beach Patrol 3280-3284 (Beach Patrol) engaged Tutt Environmental (Tim Tutt) to undertake a review of marine debris data generated by Beach Patrol clean ups. Of particular interest and concern for the community group is what they perceive to be an increase in the amount of foreign-branded debris/ international shipping waste being collected and its condition, i.e., how new or recently disposed it appears to be.

1.1 Beach Patrol 3280-3284 Synopsis

Beach Patrol is a group of dedicated volunteers that operates from Warrnambool to Port Fairy on Victoria's south west coast. Its vision is a coastline and ocean that is free from plastic pollution. Beach Patrol works to achieve this vision through volunteer clean-up of local beaches, working with industry and government to prevent marine pollution and educating and engaging the wider community.

Beach Patrol volunteers have undertaken and uploaded data for over 2000 beach clean-ups since 2017. Items from each clean up are sorted, counted, identified, and photographed, and the information is loaded into a database. The data is used to lobby for change. Beach Patrol has led successful campaigns to stop pollution at source, such as their Better Buds campaign that addressed plastic-stemmed cotton bud marine pollution.

Beach Patrol has been acknowledged for their work in a number of awards including Winner of the Tidy Towns 'Prevention of Litter' Award (2021), Finalist in the Premier's sustainability Awards 2019, Finalist in Parks Victoria environmental sustainability Award (Regional Achievement and Community Awards 2019) and Tidy Towns Finalist 2019.

Beach Patrol's leader, Colleen Hughson, is an active campaigner and educator in ocean plastics. She leads from the front with hundreds of hours spent picking up rubbish from our coastline. She is highly regarded amongst her peers and her community. She won Warrnambool's Citizen of the Year (2022), Victorian Marine and Coastal Council's 'Winner - Inspiring community engagement and education' 2020, Tidy Towns Fund Prize Award 2019, GHCMA Environmental Achievers Awards Highly Commended (2019), Australia Day Local Achievers Award (2019), and Rotary Community Peace Award (2019). She is a strong advocate for citizen science and stopping marine debris at source. Colleen is a regular spokesperson on marine debris related issues in the media.

1.2 Tutt Environmental Background

Tutt Environmental is a Warrnambool district based environmental consultancy with over 20 years' experience working in the local environmental sector. Tim Tutt (the author) qualifications include a Bachelor in Environmental Engineering, a PhD in environmental remediation and 10 years lecturing part time at Deakin University in the sciences including a subject titled Water quality and ecological health. Tim Tutt is a member of the Beach Patrol Facebook group and posts photographs from his clean-ups from time to time (he is not a registered Beach Patrol member).

1.3 Aim

The report aims to document how Beach Patrol operates along the coast, including how patrols are undertaken and how the marine debris it finds is turned into data and information. The report will also present a summary of data specifically associated with international shipping waste and discuss this issue further.

2 Method

2.1 Beach Patrol 3280-3284

Beach Patrol members and the general community collect marine debris on their walks along the beaches and other foreshores i.e., rocky platforms or rocky shores in the Warrnambool region. "Patrols" may range from a 15-minute walk up to a whole day, covering both short and long distances.

There are 305 registered members and 641 Facebook group members. Patrols take place as far west as the South Australian border, and to the east as far as Cape Otway, however the majority of the patrols take place within 50km either side of Warrnambool.

Beach Patrol members and non-members, during and after they collect marine debris, do a number of different things with what they find including:

- Dispose debris with no records being made
- Photograph some or all of the items collected and share it to a friend or friends on social media
- Photograph some or all of the items collected and post on social media i.e., the Beach Patrol Facebook or Instagram
- Sort and record what was collected and where and when in online databases, previously ADMI and currently Litter Stopper app, and also separate excel databases at times.

In addition to the above, more active members of Beach Patrol may sort and record other persons' collected debris. They also record and maintain data in numerous ways, including stockpiles of specific debris, image and photo catalogues, excel database files, listing what was found, and where and when. Following on from data generation, active members also analyse and further investigate the origins of the debris.

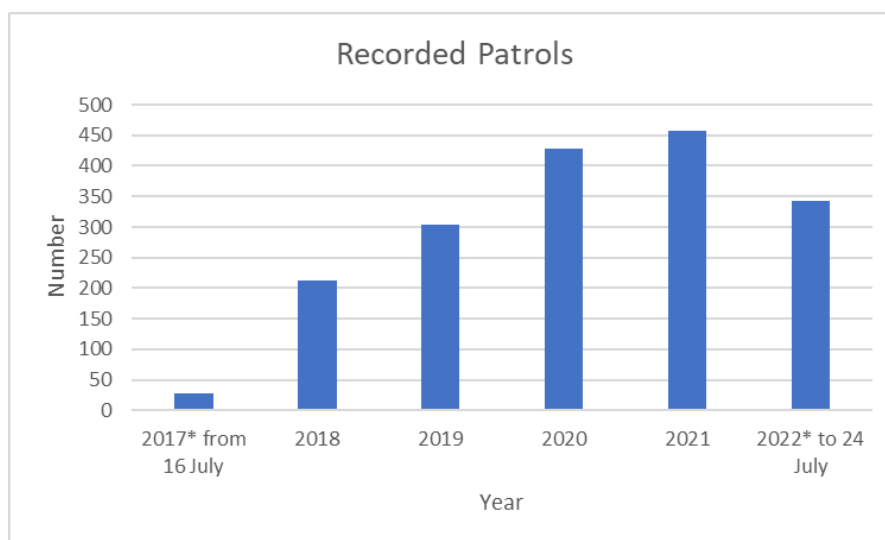
3 Patrol Data

3.1 Patrol Frequency

The first documenting of patrols, i.e., when, where and what was found, commenced in 2017 and was named Pick Up Sticks. People were concerned about the number of cotton buds washing up on beaches near the Warrnambool sewage treatment plant ocean outfall and commenced weekly patrols documenting the collections. While conducting these patrols, the large nurdle discharge from the sewerage treatment plant was noticed in November 2017. This incident created significant social interest in marine debris and also eventually resulted in the local water authority Wannon Water upgrading the plant's capacity to prevent small plastics being discharged to the ocean.

Data for the number of patrols is presented in Figure 1 and shows documented patrols counted via review of merged databases.

Figure 1 Graph showing number of recorded patrols on an annual basis from July 16th 2017 to 24th July 2022)

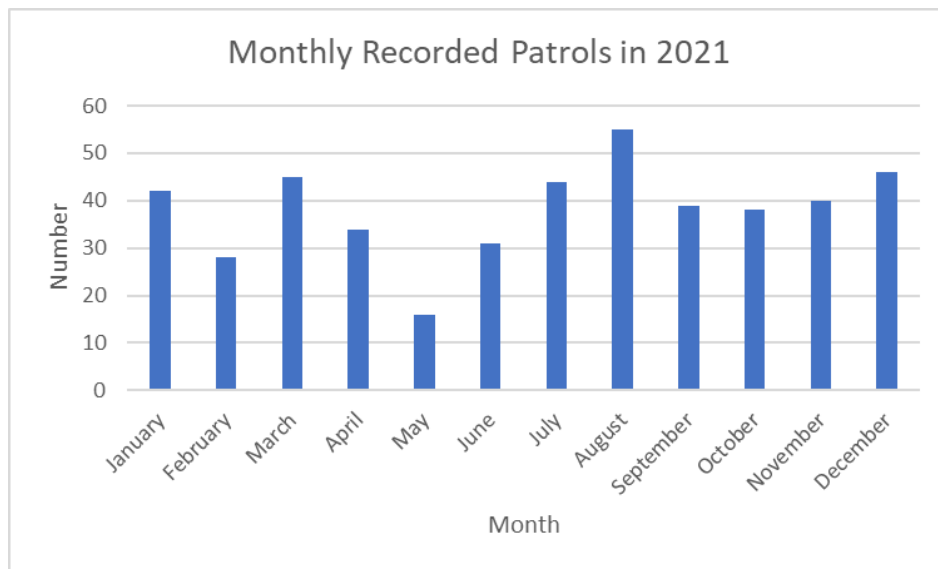


The graph shows that the number of recorded patrols has been increasing over time. This may be partly explained by the improved ease of record-keeping and by the uptake of use of a phone app. It may also be the case that more people are patrolling as the issue gains community interest.

On average the number of patrols range from approximately 4 per week in 2018, up to 9 per week in 2021.

A monthly breakdown of recorded patrols for 2021, Figure 2, shows that patrols are spread across all months and not heavily influenced by seasons i.e., patrols are still ongoing in the cold winter months.

Figure 2 Monthly breakdown of recorded Patrols in 2021 showing a relatively consistent frequency of patrols throughout the year.



It is also known (via firsthand knowledge and other deductions i.e., a Facebook post with no corresponding data upload) that many patrols are not recorded due to individual preferences. Following discussion with Colleen Hughson it is estimated that possibly an equivalent number of unrecorded patrols are occurring as to the recorded patrols on a regular basis. If this were the case it would then make the current number of average patrols per week in the range 15-20.

In summary the number of patrols seems to range from 15 to 20 per week based on the database information and discussions on the number of unrecorded patrols at the time of writing the report.

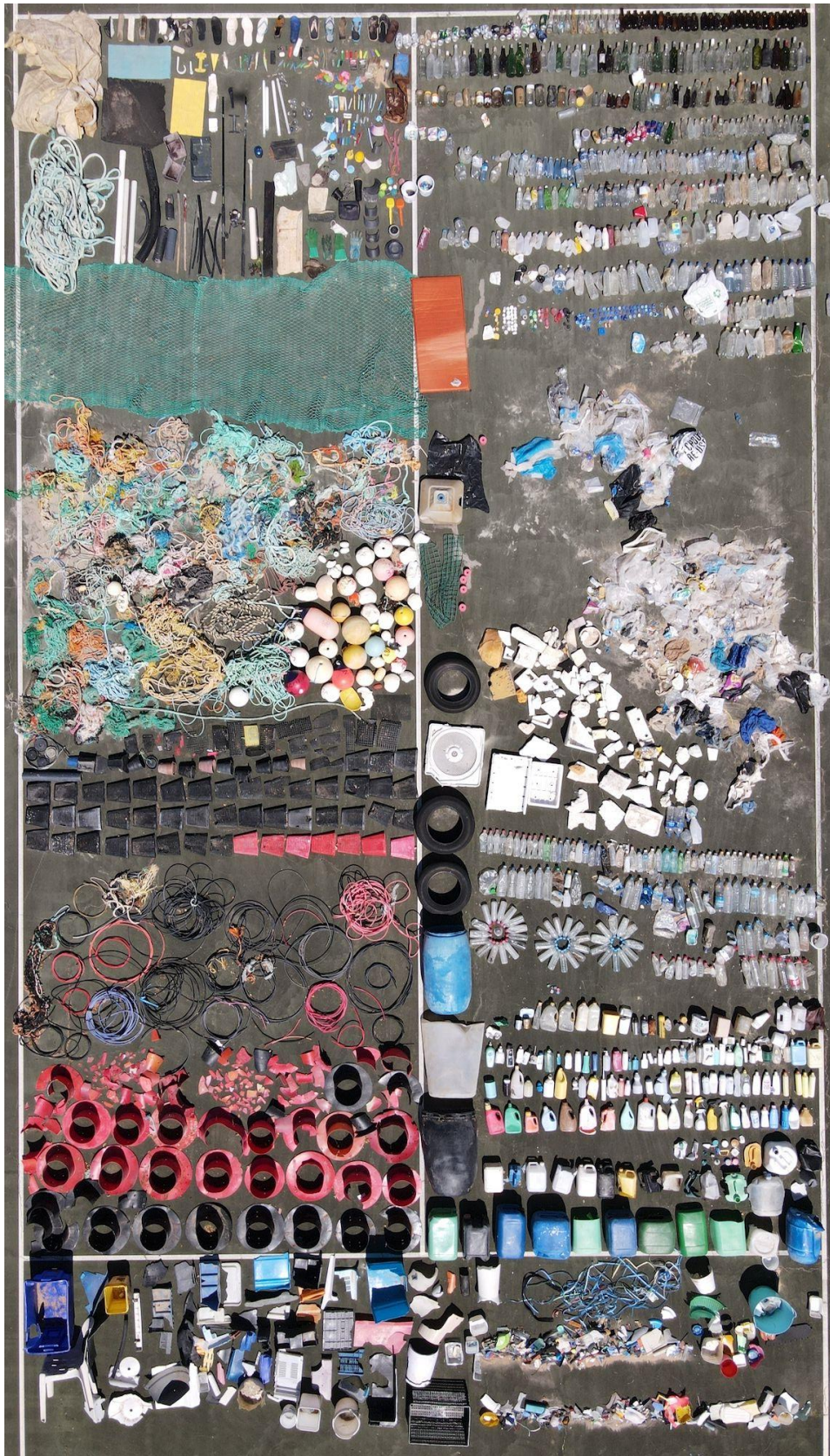
3.2 What has been found?

Beach Patrol has found and collected a wide variety of debris on its patrols ranging from small items such as nurdle and plastic remnants (the small pieces of broken down larger hard plastics) to a large space junk cylinder at Yambuk Beach and a large submarine flare at Terry's Beach.

To highlight the variety of items being found, a look at the debris collected from a 7-day patrol from Warrnambool to Portland in January 2022 by Colleen and her partner Luke provides a good picture. Following the patrol all the items collected were arranged on a tennis court to help give a sense of both the quantity and the extensive range of items that even included a male sex toy!

Approximately 430 kg of debris was collected and as can be seen in Figure 3 commercial fishing debris made up a large portion along with plastic containers and drums and drink bottles. Of the drink bottles 159 were identified as foreign, 70 were identified as brands sold in Australia and 109 had no distinguishing markings.

Figure 3 Photo of the marine debris collected on beaches from Warrnambool to Portland in January 2022 laid out over a tennis court.



4 International Shipping Waste

As outlined, the frequency of patrols gives members a good feel for trends of what they are finding on local beaches. In the last 2 years members have expressed concern about what appears to be an increasing number of foreign-branded items appearing on the beaches in the south west. Of particular concern, is the type and condition of some of the debris collected, such as foreign branded items that appear in a near-new condition.

4.1 International Waste – what has been found?

Some examples of the debris that Beach Patrol suspects originated from international ships include numerous brands of water bottles, food packaging such as expandable foam typically used on tropical fruits, cleaning products packaging, coffee jars full or cigarette butts, and other items such as fluorescent tubes and bulbs. See Figure 4.

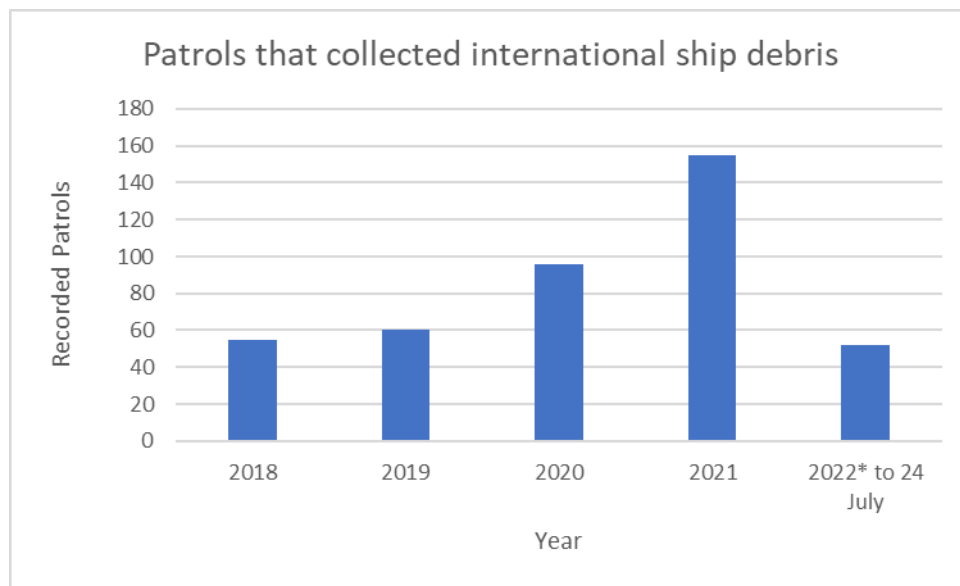
Figure 4 Images of debris found by Beach Patrol members that is likely to have come from international ships.

Foreign branded water bottle	Foreign branded package unopened with contents still present.
	
Nescafe instant coffee jar filled with cigarette butts and lolly wrappers.	Expandable foam, often used in larger tropical fruit packaging.
	

4.2 International Waste – frequency of find

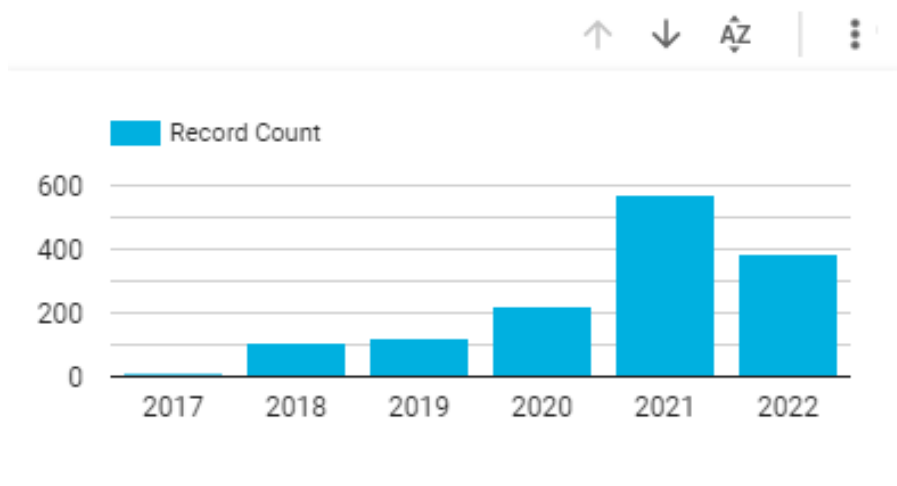
As outlined in section 3.1 the estimated average number of patrols is in the range of 15-20 per week. Of these approximately half are recorded in a database. A review of the database to 24th July 2022 counted the occasions where international debris i.e., a foreign-branded water bottle, was noted. The numbers of occasions have been increasing over the years and in 2021 of the 458 recorded patrols, 155 recorded debris, likely or certainly to have come from international ships, that is 1 in 3 patrols. An annual break down of patrols that found international branded debris is shown in Figure 5.

Figure 5 Graph of number of patrols where foreign branded debris was found. Note the increase in recent years.



In addition to finding international debris more often, the amount of debris also appears to be increasing, as shown by the count of international bottles collected and entered into the database since 2017, see Figure 7.

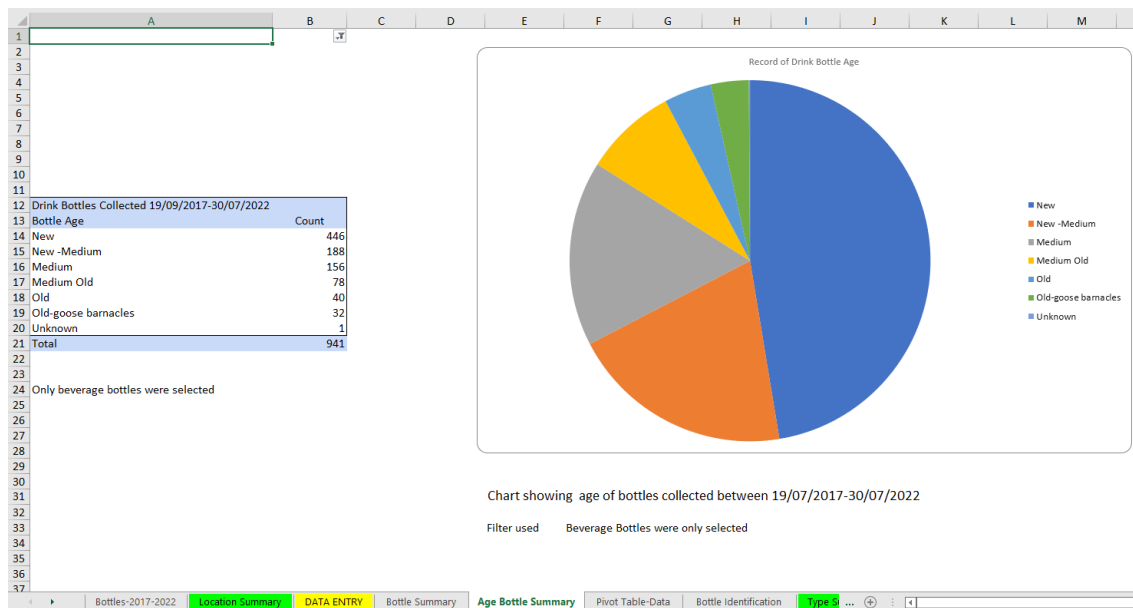
Figure 6 Graph showing the number of international bottles collected and entered into database from 2017 to July 2022.



5 Bottle Specific

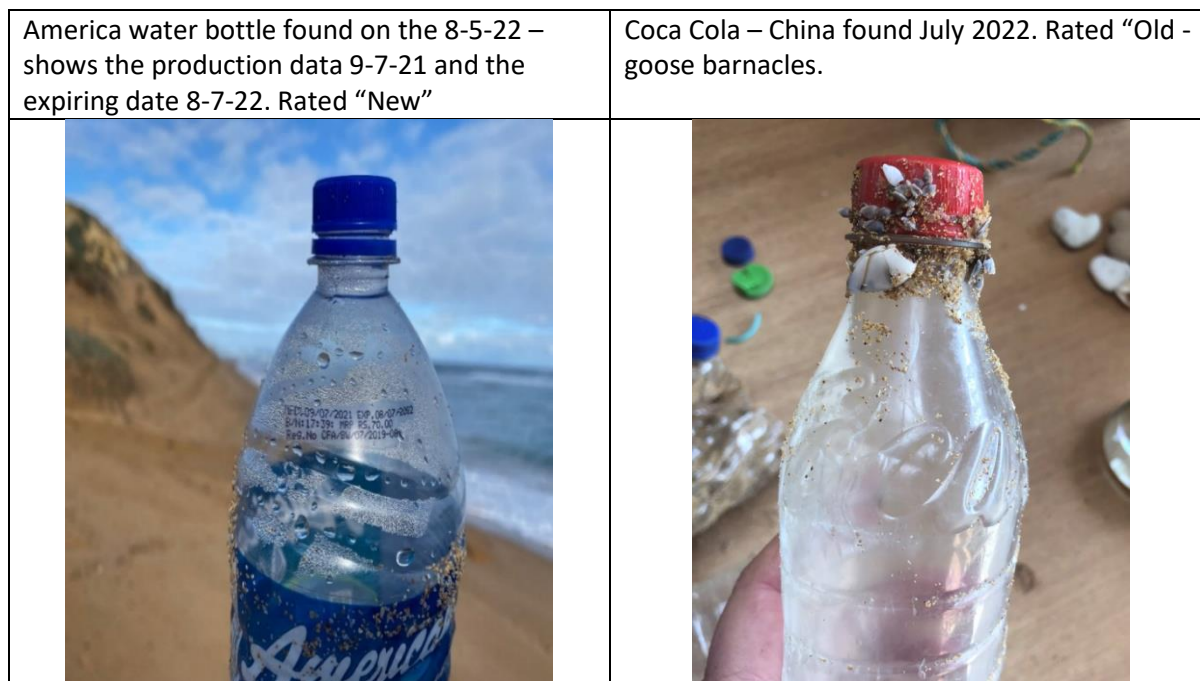
Due to their ubiquitous nature, bottles, and specifically beverage bottles, have been singled out in the Beach Patrol data. Water bottles can often be readily identified, and due to the number of bottles being found members started making an assessment of the condition of the bottles rating them from “new” to “old-goose barnacles”. In summary 941 bottles are in the dataset (at the time of review), and approximately half of these condition was rated as new, see Figure 7.

Figure 7 Image of bottle data taken from Beach Patrols database, showing approximately half of the 941 bottles has a “new condition” rating.



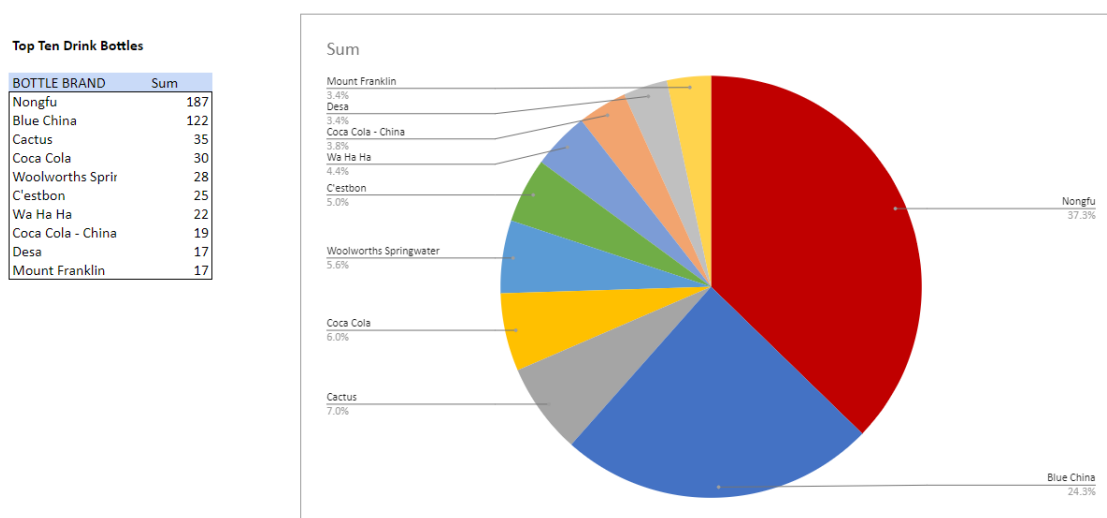
Examples of bottle “condition” and their assigned rating are show in Figure 8.

Figure 8 Assessment of the age based on condition of water bottles found by Beach Patrol



Further breakdown by Beach Patrol of the brands, and thus likely country of production / origin of the foreign bottles, found that China accounted for the majority of the bottles, see Figure 9

Figure 9 Image of the Top Ten drink bottles by brand compiled in the Beach Patrol database.



Note; China brands; Nongfu, Blue China, Coca Cola China, C'estbon, Wa Ha Ha. Malaysia brands Cactus and Desa, Australian brands Coca Cola, Woolworths Spring and Mount Franklin.

The age and brand of the bottles is significant because it clearly shows that the bottles have not drifted from their countries of production / origin. To highlight this point, in January 2022 Beach Patrol members collected 7 Master Kong/Blue China water bottles, 6 on one day from one beach near Killarney, all with the same batch number and in new condition. The find was reported to the Port of Portland and AMSA (Australian Maritime Safety Authority). Follow up investigations by the Authorities did identify the ship and did issue them with a deficiency notice- “a condition found not to be in compliance with the requirements of the relevant convention” (Source; <https://www.amsa.gov.au/deficiencies>).

5.1 Bottle Lid Analysis

Bottles lids are an abundant item collected by Beach Patrol and recorded in the Beach Patrol database. Their abundance is in part due to the plastic they are made from (typically HDPE) being more robust and hard wearing, compared to the lighter PET of the bottle itself. Given this, Beach Patrol with the help of Warrnambool East Primary School completed some further analysis on the type of lid that have been found. A sub sample of lids collected between May 2018 and May 2021, numbering 5416 were sorted and the following points were concluded:

- 30% of the lids were from water bottles
- 24% were other tetra pack beverages such as long-life milk
- 21% were from personal care items such as shampoos and toothpaste tubes
- 9.4% were from cleaner & detergent containers
- 7.3% were from chemical containers and drums
- 5.5% lids were from food bottles such as tabasco & soy sauce bottles.

Approximately 20% (1080) of the lids had identifiable branding, with the brand Aqua (462 lids) being the most common lid followed by Coca-Cola (58), then Kewpie Mayonnaise, Sinda (health drink) and Kaki Tiga (herbal drink).

The identifiable lids when sorted into probable point of sale showed that 757 were from overseas, 179 were from Australia, and the remaining lids (144) were from either Australia or overseas.

The lid information does highlight that foreign-origin marine debris makes up a significant portion of debris being found by Beach Patrol.

6 Discussion

Marine debris is a global issue, however at a local level local data of marine debris on the shipwreck coast appears to be highlighting the specific issues of international shipping waste. The Beach Patrol group, and the data it generates, is a good example of the "citizen science" phenomenon that is currently becoming more established and recognised.

Unlike other parts of Australia and overseas, southwest Victoria is not densely populated or urbanised. Nor has it any proximity to other countries, such as in north Australia. While urban/rural litter is a source of debris in marine environment, i.e., a discarded drink bottle ending up in the ocean via stormwater and river system, the regions characteristics don't lend themselves to this being a significant contributor to what it being found. As mentioned, the region is not densely populated, good waste and recycling programs are in place, Councils have street sweeping programs and litter traps on some stormwater systems, and typically Australians don't have a culture of littering. These points suggests that the south west Victoria land catchment is probably not a significant source of marine debris. Additionally, in local rivers such as the Hopkins River, the mouth is typically closed for a portion of the year, and thus cannot be a source of debris to the ocean during this period. However, debris is still found.

Beach Patrol suspect the most likely explanation for much of the internationally-branded debris being found, is that it is coming (unintentionally or otherwise i.e., being dumped) from international ships passing along this coast. These ships may also be berthing at the Port of Portland. The Port specialises in the export of bulk commodity products. Approximately 300 ships per annum use the facility, handling 45% of Victoria's dry bulk cargo (Source; <https://www.portofportland.com.au/>). Exports from the Port include sustainable forestry products and agricultural products, with much of the markets located in Asia. The connection between the vessels using the port and the brands of debris, specifically "the canary of marine debris" beverage bottles is apparent to Beach Patrol.

The number of beverage and water bottles being found may in part be associated with the ongoing phenomenon of bottled water consumption around the world. A number of factors have led to the rise of bottle water consumption including it being seen as a safer option compared to other water sources such as tap water. COVID may have also contributed to increased utilisation of single use disposable products on international ships.

Beach Patrol further investigated possible reasons why ships' rubbish may be being "lost at sea" and noted that Port of Portland waste disposal fees have a minimum charge of \$960 in 2021/22. The fee equates to \$320 per 240-litre drum, see Figure 10. Enquiring why the fees are so high (as a comparison, the disposal fee for a 240-litre drum of municipal waste at Portland landfill is \$10.40),

Beach Patrol were informed that all waste and recycling is considered a “biohazard” and requires incineration disposal.

Figure 10 Images taken from Port of Portland website, showing Quarantine Waste Disposal fees in 2021/22 and 2022/23 (<https://www.portofportland.com.au/port-operations/services-facilities/port-charges/>)

QUARANTINE WASTE DISPOSAL

PARTICULARS	CHARGE
Minimum charge (includes three 240 litre drums)	\$ 960
Each additional drum	\$ 310

QUARANTINE WASTE DISPOSAL

PARTICULARS	CHARGE
Minimum charge (includes three 240 litre drums)	\$ 980
Each additional drum	\$ 317

There are international laws that prohibit the dumping of rubbish at sea. The Annex V of the MARPOL convention and Australian Maritime Legislation requires large vessels above 100 gross tonnage to keep garbage management plans, however, foreign branded debris is being regularly found on the region's beaches.

Drawing a parallel to local waste management, the dumping of rubbish does occur even when laws exists and services are provided to accept waste for proper recycling and disposal. Contamination of municipal kerbside recycling bins with waste items is a problem, and charity bins regularly report issues of waste basically being dumped. In trying to ascertain why this occurs, factors of convenience and laziness apply, for example once the waste bin (red lid) is full getting rid of additional waste in the recycling yellow bin is very convenient. Cost of proper waste disposal is also no doubt a factor, for example a loaded trailer of waste, household or commercial, costs in the order of \$300 to \$400 a tonne to dispose of properly, and consequently the dumping of rubbish continues. To combat the dumping of rubbish Councils and charity bin owners are increasing the level of surveillance, which is made easier nowadays with technology, i.e., motion sensor cameras and enforcing penalties when people are caught.

If waste and recycling is not being managed as per the MARPOL convention by international ships the reasons why are likely to be much the same as outlined with municipal waste. To address the problem similar strategies such as surveillance and penalties could help deter and prevent waste from international ships ending up in the ocean. Ironically, classification of international ships' waste and recycling as a biohazard creates the high costs of proper disposal, which may in turn be a factor in incorrect disposal (unintentional or otherwise) that in itself is a biohazard risk.

7 Conclusions

The observations and data generated by the Beach Patrol members indicates marine debris is continually arriving on the Shipwrecks Coast's shores. The global issue is being tackled and documented by the Beach Patrol members at the local level and is a good example of the citizen science phenomenon. The debris being collected is somewhat typical of marine debris globally, however, the more regular observations and collection of foreign- branded debris is concerning patrol members. Beach Patrol's investigations lead it to the conclusion that the source of the foreign labelled debris can be most likely and logically explained as originating from international ships travelling along the coast and using the Port of Portland. Lastly, Beach Patrol has expressed it would like to see relevant stakeholders take more action to prevent this occurring. This can be through education, inspection and enforcement (as demonstrated can be done), or by changes to port waste disposal practices that make recycling and waste disposal less of an impost to vessels (and thus hopefully reducing the incidence of errant debris ending up in the ocean and washing up on coasts).