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The Success of Water Refill Stations Reducing Single-Use Plastic Bottle Litter

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Abstract: Bottled water is one sector of the beverage industry that has recently experienced substantial growth. The littering of plastic water bottles and the carbon emissions produced from bottled water production results in harmful effects on the environment. To reduce the harm of bottled water production and litter, government and non-government organisations have implemented litter abatement and behavioural change strategies targeting bottled water consumption and subsequent loss of bottles to the environment. Our study evaluated the success of one of these strategies, which is a filtered water refill station, implemented along the Brisbane River in Queensland, Australia. We found plastic bottle litter decreased after a water refill station was put into operation. However, given the location of the refill station, we suggest the behavioural change strategy employed did not reach its full potential. We highlight factors that could be employed to achieve maximum benefits when implementing similar behavioural change strategies.

Keywords: river; behavioural change; plastic bottle; litter; water refill station; waste minimisation

1. Introduction

Plastic litter is present in nearly every environment on the land and in the sea. Plastic can become litter from its *point of production* such as microbeads in plastic factory waste water [1,2], *during use* such as a fishing net breaking free from its anchor [3] and *disposal*, such as from littering [4,5]. Plastic litter has shown to be harmful to wildlife via entanglement and ingestion [6,7], to economies [8–10] and, potentially, to human health [11–13]. Plastic production is predicted to double within the next 20 years [14] with the amount of plastic escaping into the environment anticipated to increase accordingly [15–17].

The driver of increased plastic production is the constant growth in demand and consumption of plastic products. One area in which this rapid growth occurs is the beverage industry, particularly bottled water. One million plastic bottles are consumed every minute, with consumption expected to increase by 20% by 2021 [18]. In the United States, bottled water is becoming the most consumed packaged beverage by volume [19]. In Australia, bottled water is predicted to be the fastest growth sector in the beverage industry [20] with Australians spending more than half a billion dollars per year on bottled water [21]. This increased consumption has been linked to the preconception by consumers that bottled water is healthier, more convenient, and tastier than tap water [21–23]. That rationale is illusionary, however [24], with tap water often demonstrated to be 'cleaner' or less contaminated than that sold in bottles.

In Australia where the majority of people have the luxury of safe-to-drink, high-quality tap water, an estimated 10% of water consumption is derived from bottled water [25]. This widely consumed mass commodity is associated with non-trivial environmental costs. For example, the production and transportation of bottled water contributes to human-derived climate change. Plastic beverage containers account for 30% of the global demand of polyethylene terephthalate (PET) production [26] and bottled water production and transport accounted for almost half a million barrels of oil and more than 60,000 tons of greenhouse gas in 2014 in Australia alone [22].

Furthermore, plastic beverage bottles are a commonly littered item. Of all litter found during clean-ups, on land, and on coasts, plastic beverage containers are in the top three most littered items. For example, plastic bottles were the third most littered item in 2018 in the International Coastal Cleanup [27] and the second most littered item in 2017 by Clean Up Australia [28]. These littered bottles not only make an area aesthetically unappealing with potential negative effects on tourism revenues but can also cause harm to wildlife [29,30].

The increasing supply and demand for portable cold filtered water (i.e., bottled water) [19,20] is linked with consumers either unintentionally losing or intentionally littering the plastic bottle into the environment. The littering of plastic bottles can be viewed as a negative externality to the supply and demand of cold filtered water. For instance, how a plastic bottle is disposed of does not directly affect the price and quantity of bottled water that producers supply or that consumers demand. To reduce the externality of plastic bottle litter, governments have developed policies, regulations, and infrastructure. Non-government organisations (NGOs) have developed consumer outreach strategies that target plastic bottle consumption and disposal. Using a supply-demand curve [31], the consumption of portable cold filtered water (i.e., bottled water) can be represented alongside the different strategies used to reduce its consumption and subsequent disposal (Figure 1). For example, a plastic bottle ban is a policy strategy that can reduce bottle litter by removing the supply of plastic bottles (containing water) to the consumer. Alternately, promoting the benefits of reusable drink bottles is a public outreach strategy that reduces the consumer demand for bottled water.

Selecting the right strategy for the desired audience is critical for the strategy to reach the desired outcome of fewer plastic bottles entering the environment. For example, a campus-wide bottle ban in Allegheny College, Pennsylvania, would not successfully reduce bottle litter in the campus since the majority of bottled water consumed on campus was purchased off-campus [32]. This highlights the importance of gaining an in-depth understanding of the target population's current behaviours when designing a behavioural change strategy.

In Queensland, Australia, almost three billion beverage containers are used each year and they are consistently among the most frequently littered items in the state [33]. In the Brisbane River itself, beverage containers are the number one littered item, which comprises 22% of all items recorded [34]. To reduce bottle litter in the Brisbane River, an independent natural resource management organisation, Healthy Land and Water (HLW), instigated a behavioural change strategy by installing filtered water refill stations in litter 'hot spots' (i.e., areas along the Brisbane River that have the highest density of litter) and ran a public awareness campaign on litter in the Brisbane River.

In this paper, we looked at the success of this single-use plastic behavioural change strategy and ask how to best apply such a strategy. We approach the research question from a socio-ecology lens to determine if a behavioural change strategy can solely reduce the amount of litter entering a riverine environment. HLW provided daily clean up data [34] to determine whether installing free water refill stations at designated litter hot spots resulted in a significant reduction in plastic bottle litter found in the Brisbane River. We describe the survey design and discuss the success of the chosen strategy based on analysis of daily litter data. We also present suggestions on relevant factors to consider when designing a behavioural change strategy. We conclude with suggestions of regulatory and non-regulatory strategies government and non-government organisations could use to encourage "better" behaviour by consumers not motivated to switch to the pro-environment alternative.

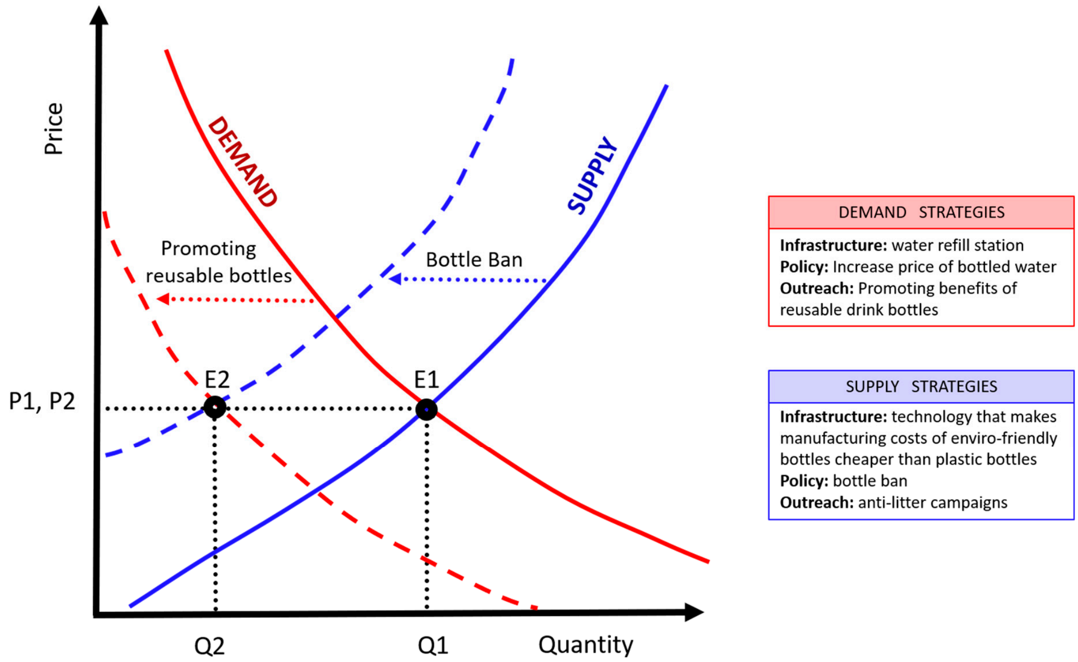


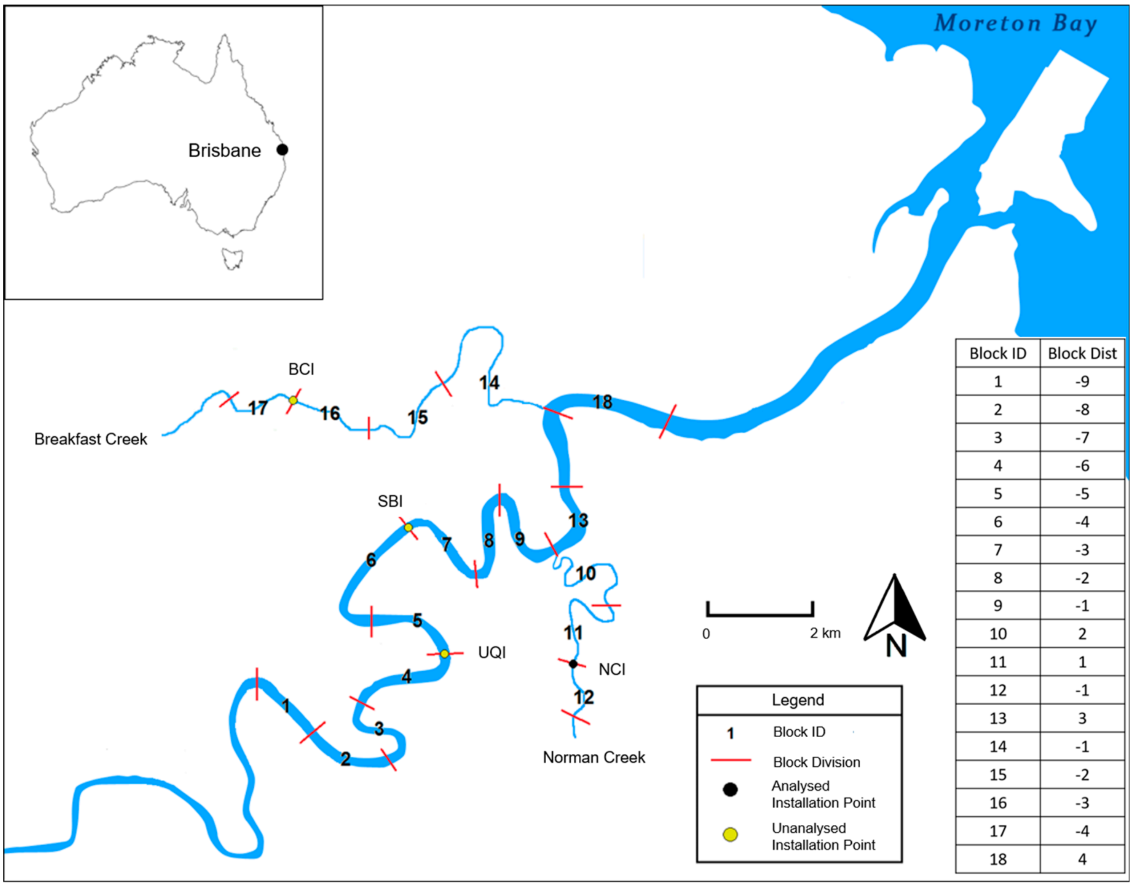
Figure 1. The supply (blue) and demand (red) of portable, cold, filtered water (bottled water) and the different policy, infrastructure, and public outreach strategies used to reduce its consumption and subsequent disposal. Each strategy decreases either the supply or demand of bottled water and, hence, shifts the curve to the left, thereby shifting the point of equilibrium from pre-strategy quantity and price (E1, Q1, P1) to post-strategy quantity and price (E2, Q2, P2). For example, promoting the benefits of reusable drink bottles to consumers will reduce consumer demand for bottled water. Less bottled water is demanded by consumers even though the price of bottled water has stayed the same.

2. Materials and Methods

To determine whether water refill stations were successfully decreasing the number of plastic bottles littered in the Brisbane River and two of its tributaries, surveys of litter floating on the river surface and deposited on the river banks were conducted. Litter surveys were completed by HLW contractors using the clean-up method described in Section 2.2.

2.1. Study Area and Go2Zone Campaign

The behavioural change strategy and associated study were carried out in Brisbane, which is the capital city of Queensland, Australia. Brisbane has a population of 2.4 million [35] and is situated along the Brisbane River in the south-east coastal area of the state (Figure 2). Three community surveys conducted by HLW identified litter as the number one factor that negatively affects waterway health in the southeast Queensland region (in 1997, 2010, and 2015) [34]. In addition, plastic beverage bottles are the most abundant litter item found in the Brisbane River based on the 10 years of weekly river clean-ups [34]. These two factors led HLW to implement a behavioural change strategy to reduce plastic bottle litter in the Brisbane River. On 30 September 2018, the HLW social enterprise Go2Zone was official launched. Go2Zones are a range of water refill stations that dispense free chilled water and reusable water bottles (at a cost) (www.go2zone.com.au). An initial four machines were installed in late 2017 and early 2018 as a pilot before more than 100 machines were installed in southeast Queensland in late 2018. In conjunction with the installation of Go2Zones, the HLW enterprise and clean-up program were featured multiple times on prime-time commercial television in Queensland.



Block ID	Block Dist
1	-9
2	-8
3	-7
4	-6
5	-5
6	-4
7	-3
8	-2
9	-1
10	2
11	1
12	-1
13	3
14	-1
15	-2
16	-3
17	-4
18	4

Figure 2. Map of survey block (Block ID) and water refill station installation locations in the Brisbane River in Queensland, Australia. Block Dist in the table indicates the distance each block is from the analysed installation point (negative values = upstream, positive values = downstream, i.e., −9 = 9 blocks upstream of the installation point). NCI = Norman Creek installation, UQI = education institute installation, SBI = body corporate installation, and BCI = Breakfast Creek installation. Note: section of the river between block 13 and 18 was not surveyed.

The pilot Go2Zones were installed at four areas in Brisbane that were identified by HLW as litter hot spots. Each area targeted a different audience. The first Go2Zone was installed in a local small business owners' area located on Norman Creek (NCI, Figure 2). The second was installed at a sporting grounds located on Breakfast Creek (BCI, Figure 2). The third and fourth Go2Zones were located along the Brisbane River, with one installed in a body corporate area (SBI, Figure 2) and the other installed at an education institute (UQI, Figure 2). The first Go2Zone was installed at NCI on 25 November 2017, BCI on 10 April 2018, and SBI and UQI were installed on 10 April 2018.

2.2. Data Collection

The river and tributaries were divided into two-kilometer long blocks along the river's course. Four blocks were surveyed upstream and downstream of each Go2Zone installation, which created a total of eight blocks surveyed for each Go2Zone installation (Figure 2). Each block was surveyed once before and once after each Go2Zone was installed. Surveys were completed between 27 October 2017 to 11 April 2018. Contractors did not conduct their regular weekly clean-up in the Brisbane River, Norman Creek, and Breakfast Creek 30 days prior to the first litter survey and recommenced their regular clean-up activity after the last litter survey was completed.

Each item of litter collected was recorded using set categories on a litter tally sheet designed by HLW (Supplementary File S1). Categories included bottles (glass, plastic coke branded, plastic water, and other plastic), plastic pieces, plastic bags, plastic food wrap, aluminum cans, waxed paper cartons, and other items such as needles, coolite (plastic foam such as polystyrene), aerosol cans, and industrial wrapping. The following was also recorded for each survey: date of survey, block number, water or land survey, start and end time of survey on each block, start and end latitude and longitude of each block, skipper of boat, and number of surveyors. This information was used to establish survey effort and account for any surveyor bias.

2.2.1. Land Surveys

Land surveys to count and remove litter were completed in each survey block at selected locations where the natural river bank could be accessed. Large sections of the river bank had restricted access by urban development (canals, walls) and dense vegetation (mangroves, reeds). Two to five surveyors completed land surveys using a clean-up method [36]. Surveyors were positioned side-by-side across the width of the river bank, (i.e., from the water's edge up to the crest of the river bank). In this formation, surveyors would then walk slowly in one direction collecting and recording all litter they observed.

2.2.2. Water Surveys

Water-based surveys to identify, count, and remove floating debris were completed from a motorized dinghy (3.8 m, 6 hp). Two surveyors motored at a maximum of 5 knots in the centre of the river channel in the survey block and looked for floating litter on both sides of the boat. If floating litter was observed, the boat would leave the centre and motor to collect and record information about the litter removed. The boat then returned to the centre of the block if no additional floating litter was observed from the last observed item. Surveyors would continue looking for litter while the boat returned to the centre of the block. Collected litter was stored in large bags for later disposal. Water surveys were completed on the rising tide to maximise access up creeks. Due to shallow water levels in the upper section of both Breakfast and Norman creeks, only one block upstream was surveyed for Breakfast Creek (block 17, Figure 2). Within Norman Creek water surveys could only be completed from two kilometres downstream of the installation point, i.e., Block 10 (Figure 2).

2.3. Statistical Analysis

Analysis were completed in the statistical program R [37] using generalised additive models (GAMs) in the mgcv package [38] with a tweedie distribution. Separate analyses were completed for water and land surveys. The statistical analyses tested four potential explanations for litter reduction in the Brisbane River: (1) local variation in litter loads between survey blocks, (2) an overall decrease in litter before and after the water refill station was installed, (3) spatial variation in litter loads between upriver and downriver survey blocks, and (4) a localised decrease in litter post installation in survey blocks neighbouring the refill station.

Model Arrangement

The analysis used three different litter categories to determine the success of the behavioural change strategy including the total litter load (all litter items observed), total number of plastic water bottles, and total number of plastic bottles (a combined category of all water, coke, and other plastic bottles). The strategy was deemed successful if any of the selected litter categories decreased after the installation of a water refill station. Models for each litter category included the following terms: unique survey block name (block ID) and an interaction between the distance a survey block was from the installation point (block distance). Whether the survey occurred before or after a water refill station was installed (NCI) as a smooth term. Block distances were given a negative value if they were upstream from the installation point and a positive value if they were downstream (Figure 2: inset table). The upstream and downstream values are relative to one another since the Brisbane River is tidal. Hence, no block is strictly upstream or downstream since litter floating in each block has the potential to travel upstream or downstream into adjacent blocks.

The following covariates were analysed in each model with the following assumptions,

1. More littering may occur on school or public holidays as more people frequent recreation areas around the river,
2. On hotter days, more people will purchase water and, hence, there is a higher probability that littering may occur, and
3. Higher rainfall will result in more litter entering the river via waterways or drain networks than days with no rainfall.

Each litter model was run with every possible combination of terms and the most parsimonious model was determined using the Akaike Information Criterion (AIC) score [39]. The best model was selected if it had the lowest AIC score and if that score was at least two units lower than the next best model AIC score.

3. Results

Due to a timing error, the post installation surveys were completed before all four water refill stations were installed. This resulted in only the NCI refill station (Figure 2) to be included in the analysis. The most parsimonious model for each litter type in water and land surveys included both block ID and the before/after interaction term. Daily temperature, daily rainfall, and public/school holiday did not influence the amount of litter. Models that included mean daily temperature, total daily rainfall, and public/school holiday in any combination were worse than the null model (Tables 1 and 2).

Table 1. Best land GAM compared to the null and resulting AIC scores.

Model	Covariates	AIC
Total Litter	block distance × NCI, block ID	483.415
	NULL	512.178
Plastic Water Bottle	block distance × NCI, block ID	273.401
	NULL	305.576
Plastic Bottle	block distance × NCI, block ID	314.898
	NULL	365.065

Table 2. Best water GAM compared to the null and resulting AIC scores.

Model	Covariates	AIC
Total Litter	block distance × NCI, block ID	302.656
	NULL	337.755
Plastic Water Bottle	block distance × NCI, block ID	150.937
	NULL	174.864
Plastic Bottle	block distance × NCI, block ID	183.918
	NULL	219.808

To visualise how litter quantities changed along the river, relative to the position of the survey with respect to the water refill station, we used our best statistical model to predict the difference between pre-installation and post-installation litter loads. To standardise the data for the geographical location, we adopted the survey block nearest the median litter load value. We predicted the change in total litter load (Figure 3A), total plastic bottle litter, and plastic water bottle litter (Figure 3B) on the river surface before and after the Go2Zone was installed (Figure 3). A negative value along the y-axis indicates there was more litter collected in the post-installation surveys than in the pre-installation surveys. A negative value along the x-axis indicates survey blocks that are upstream of the Go2Zone installation location. Hence, the bottom left corners of each graph are survey blocks upstream of the

Go2Zone that had more litter collected in the post-installation surveys than the pre-installation surveys. Figure 3 shows that all types of litter along the river start to steadily decrease downstream of the Go2Zone (0 on the x axis).

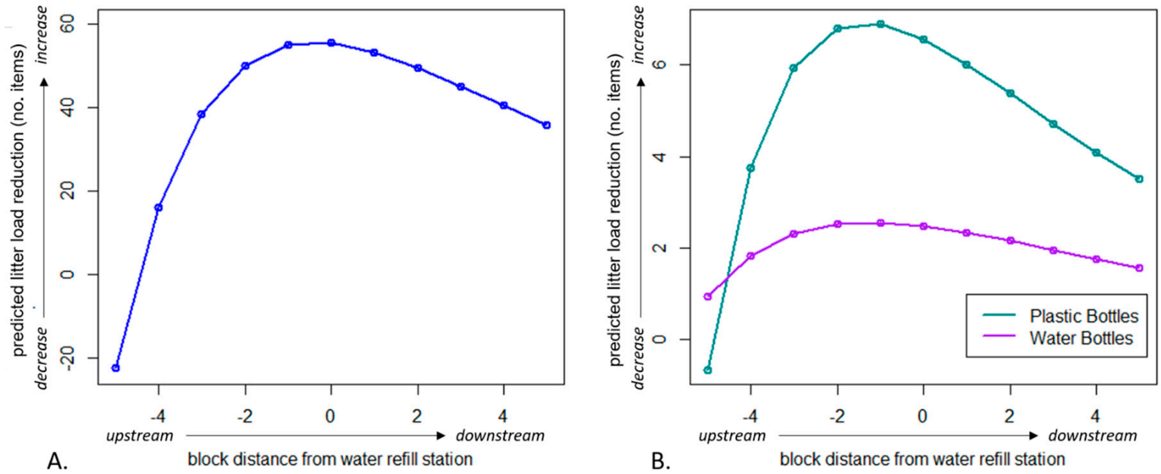


Figure 3. Estimated change in (**A**) total litter loads, and (**B**) all plastic bottles and plastic water bottles, along the Brisbane River after the water refill station was installed. The x axis shows the survey block distance upstream (negative on x axis) and downstream (positive on x axis) of the water refill station location (0 on x axis). The y axis indicates the change in quantity of litter between pre-installation and post-installation surveys. Note that all types of litter start to steadily decrease downstream of the water refill station.

3.1. Litter along the Banks of the Brisbane River

3.1.1. Total Litter Load on Land

The number of litter items found in the land surveys almost halved after the behavioural change strategy. A total of 20,946 litter items were observed before and 10,844 items of litter were observed after the water refill station was installed, which was normalized for the survey effort.

The best model included the interaction term and block ID (Table 1). We found the total litter load along the river banks decreased after NCI was installed. The amount of litter observed in a survey block also decreased as distance to the river mouth decreased (Figure 4A, Figure 2: inset table). The model revealed nine of the survey blocks had significantly lower total litter loads after the water refill station was installed (Supplementary File S2). However, only one of the blocks with significantly lower litter loads was downstream of the installation (block 11, Supplementary File S2). This suggests the water refill station may have only had a localised effect (i.e., blocks nearest to the installation point) on the amount of litter found along the river banks. The finding also points to potential opportunities for improvement to the strategy intervention (see Section 4.3 below).

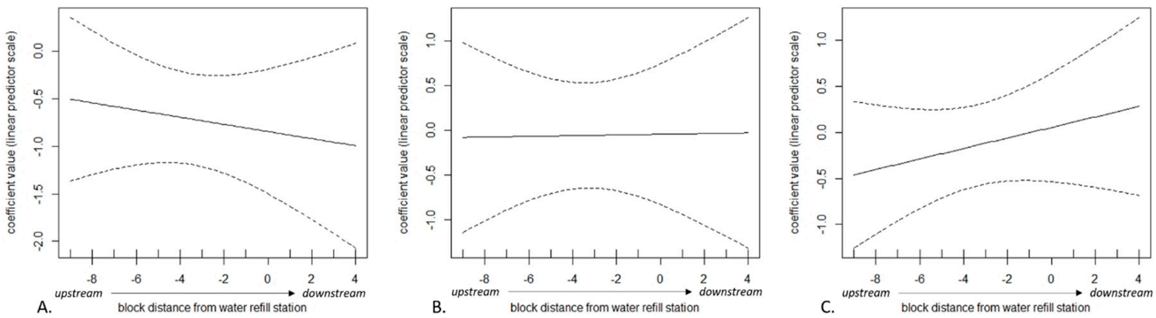


Figure 4. Total litter load (**A**), plastic water bottle load (**B**), and plastic bottle load (**C**) observed in land surveys based on GAM analysis. The x-axis is the distance the survey block is located from the installation point (blockdist) and the y-axis represents the interaction between the difference in the amount of litter found in each block before and after the Norman Creek water refill station installation (NCI). Dotted lines indicate 95% confidence intervals.

3.1.2. Plastic Water Bottle Litter on Land

A total of 775 plastic water bottles were observed before and 592 plastic water bottles were observed after the installation of a water refill station. Overall, the number of plastic water bottles slightly increased along the banks of the Brisbane River as distance to the river mouth decreased (Figure 4B). This suggests that there was no broad-reaching spatial effect from installing the water refill station on the water bottle litter along the river bank. Plastic water bottle loads significantly changed in four survey blocks after the NCI water refill station was installed (Supplementary File S2). However, the model interaction term was not statistically significant, which suggests that the water refill station did not affect the amount of plastic water bottle litter found along the river banks.

3.1.3. Total Plastic Bottle Litter on Land

A total of 1964 plastic bottles were observed before and 1392 plastic bottles were observed after the installation of a water refill station. Again, we found that the number of plastic bottles along the river banks increased as distance to the river mouth decreased (Figure 4C). Plastic bottle litter significantly changed in seven survey blocks after the water refill station was installed (Supplementary File S2). Similar to the plastic water bottle model, the interaction term was not significant. This suggests the installation of a water refill station did not significantly affect the amount of plastic bottle litter found along the river banks.

3.2. *Litter Floating on the Brisbane River*

3.2.1. Total Litter Floating on the River

The number of litter items found in the water surveys increased slightly but non-significantly after the installation of a water refill station. A total of 2262 items of litter were observed before and 2460 items were observed after the installation of a water refill station.

The final model included the interaction term and block ID (Table 2). The model showed that total litter load on the river surface decreased further downstream of the survey block (i.e., closer to the river mouth) (Figure 5A). The total amount of litter floating on the river significantly changed in eight survey blocks after the water refill station was installed (Supplementary File S2). As the model interaction term was statistically significant, the change in litter loads could be attributed to the water refill station installed at NCI. The survey blocks directly downstream of the installation point in Norman Creek (block 10) and the Brisbane River (block 13, 18) had significantly less litter after the installation, whereas the blocks directly upstream of the mouth of Norman Creek in the Brisbane River did not change (block 7–9) (Figure 3A). This could suggest the water refill station had a localised effect on littering.

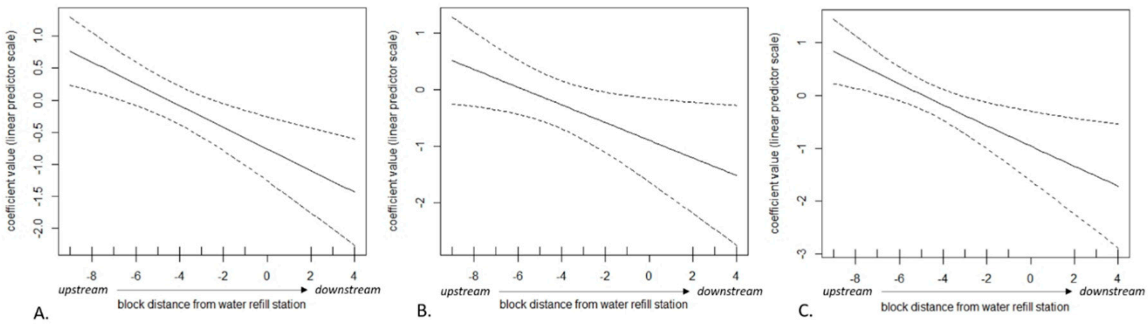


Figure 5. Total litter load (**A**), plastic water bottle load (**B**), and plastic bottle load (**C**) observed in water surveys based on GAM analysis. The x-axis is the distance the survey block is located from the installation point (blockdist) and the y-axis represents the interaction between the difference in the amount of litter found in each block before and after the Norman Creek water refill station installation (NCI). Dotted lines indicate 95% confidence intervals.

3.2.2. Plastic Water Bottle Litter Floating on the River

A total of 105 plastic water bottles were observed before and 102 plastic water bottles were observed after the installation of a water refill station. The final model included the interaction term and block ID, based on the AIC score (Table 2). The model showed that plastic water bottle loads on the river surface decreased the further downstream the survey block (Figure 5B). Plastic water bottle litter significantly changed in three survey blocks after the NCI water refills station was installed (Supplementary File S2, Figure 3B). However, the interaction term was not statistically significant (p-value > 0.05), which suggests that the installation of a water refill station did not have a strong effect on the decrease in plastic water bottle litter observed in this study.

3.2.3. Total Plastic Bottle Litter Floating on the River

A total of 253 plastic bottles were observed before and 244 plastic bottles were observed after the installation of a water refill station. The final model included the interaction term and block ID (Table 2). The model showed that plastic bottle loads on the river surface decreased the further downstream the survey block (Figure 5C). This indicates that plastic bottle litter was influenced by the installation of the water refill station (Figure 3B). Plastic bottle litter significantly changed post-installation in six survey blocks (Supplementary File S2). A localised effect of the water refill station could also explain why a significant change in plastic bottle litter was observed in the Norman Creek directly downstream of the refill station in block 10 but not observed in the Brisbane River directly upstream of the Norman Creek mouth in block 9 (Figure 1).

4. Discussion

4.1. Litter along the Banks of the Brisbane River

The land analysis showed that plastic water bottle litter load did not change whereas the total litter load slightly decreased and the plastic bottle load slightly increased after the Go2Zone installation. This suggests that, although total litter loads decreased downstream of the Go2Zone and after the refill station was installed, the decrease of all litter cannot be attributed to a decrease in plastic bottle litter. A major source of rubbish observed on the river banks is direct littering. The large amount of riparian vegetation, particularly mangroves, along the river could act as a trap for rubbish during flood events but also act as a barrier preventing rubbish from the land from entering the waterway. This combination of a trap and barrier could cause the river bank to be a sink for litter. As such, once litter has entered the bank vegetation, very little is released into the waterway itself. This litter sink characteristic of a river bank could explain why there was very little change in litter loads observed in this study. Litter clean-ups and large flood events are the main source of litter removal along the

Brisbane River banks [34]. Neither a major rain and flooding event nor a local litter clean-up took place during the survey period. Hence, it is not unexpected that litter loads did not substantially change.

4.2. Litter Floating on the Brisbane River

The analysis of litter within the Brisbane River showed that the total litter, plastic water bottle litter, and plastic bottle litter loads on the river surface decreased downstream of the Go2Zone and after the Go2Zone installation (Figures 3 and 5). This suggests that the Go2Zone was successful at changing consumer behaviour from purchasing bottled water to the environmentally-friendly alternative of refilling a reusable bottle, at least at a local level. Bartolotta and Hardy [40] found increasing water refill stations was the preferred method to encourage the use of a reusable bottle instead of plastic beverage bottles. This change could have also influenced the consumer to follow other behaviours such as not littering [41].

Our analysis showed total litter and total plastic bottle litter decreased in survey blocks directly downstream but not in survey blocks directly upstream of the refill station, which again, points to a localised effect on human behaviour. Perhaps, consumers closer to a refill station (block 10) choose the environmentally-friendly option more than consumers who are further away from a refill station (blocks 7–9). However, the greatest decrease in litter was not observed in the downstream survey block closest to the refill station (block 10) but in the downstream survey blocks closer to the river mouth (blocks 13 and 18). If the Go2Zone was the sole reason for the decrease in litter, then perhaps, the greatest decrease in litter would be observed closest to the Go2Zone (block 10) with a smaller decrease in litter observed further downstream from the Go2Zone (in block 13 and 18). Since this pattern was not observed, it is likely that other factors are also influential. For example, the HLW social marketing campaigns such as the television feature of people cleaning the river of plastic bottles could have resulted in a change in consumer behaviour [42]. In advertisements, consumers view the damage a plastic bottle can cause to the environment, and, hence, this may be changing their behaviour more generally, including using the water refill option at the Go2Zone. Uehara and Ynacay-Nye [43] found that, the more information provided to consumers on pro-environmental behaviour, the more willing the consumers were to use and pay for a water refill station.

The decrease in litter further downstream could also be attributed to the changing riparian vegetation, urban population, land use, and tidal flux across the study region. Urban population density and recreational areas decrease toward the river mouth. Hence, there is a lower probability of littering occurring and entering the waterway in those less densely populated areas [44–46]. Additionally, riparian vegetation density is higher in Norman and Breakfast Creek and in the upper reaches of the river compared to the lower reaches near the river mouth. The denser vegetation may trap litter entering the river system and prevent it from floating further downstream [47]. Lastly, tidal fluxes move litter up and down the river. However, there is an overall net downward movement (drainage) toward the river mouth and ocean. Hence, litter hotspots further downstream could be accumulating more litter than hotspots upstream since the downstream hotspots are receiving litter locally and from a larger upstream river extent than upstream hotspots. Therefore, a bigger effect of litter decreasing after the water refill station installation would be observed in the downstream hotspots compared to the upstream hotspots.

4.3. Go2Zone Success

4.3.1. Location, Location, Location

The Go2Zone was located in a litter hot spot area. Hot spots are not necessarily the source of litter entering the environment but rather where litter accumulates from human, water, and wind transportation [48–50]. HLW aimed to reduce plastic bottle litter by providing an alternative source of cold water in an area where plastic bottle litter accumulates, rather than in an area of bottled water purchases. Hence, the current location of the Go2Zones is likely providing water to consumers who already have cold water, whether it be in a reusable bottle or a single-use plastic water bottle [23,51]. For the Go2Zones to maximise their impact as an intervention opportunity, they may be better placed where consumers purchase bottled water, which is the main point of bottled water supply and demand. A suggested alternative location of a Go2Zone that targets the point of supply/demand would be next to vending machines or convenience stores where people commonly buy bottled water (Figure 6).

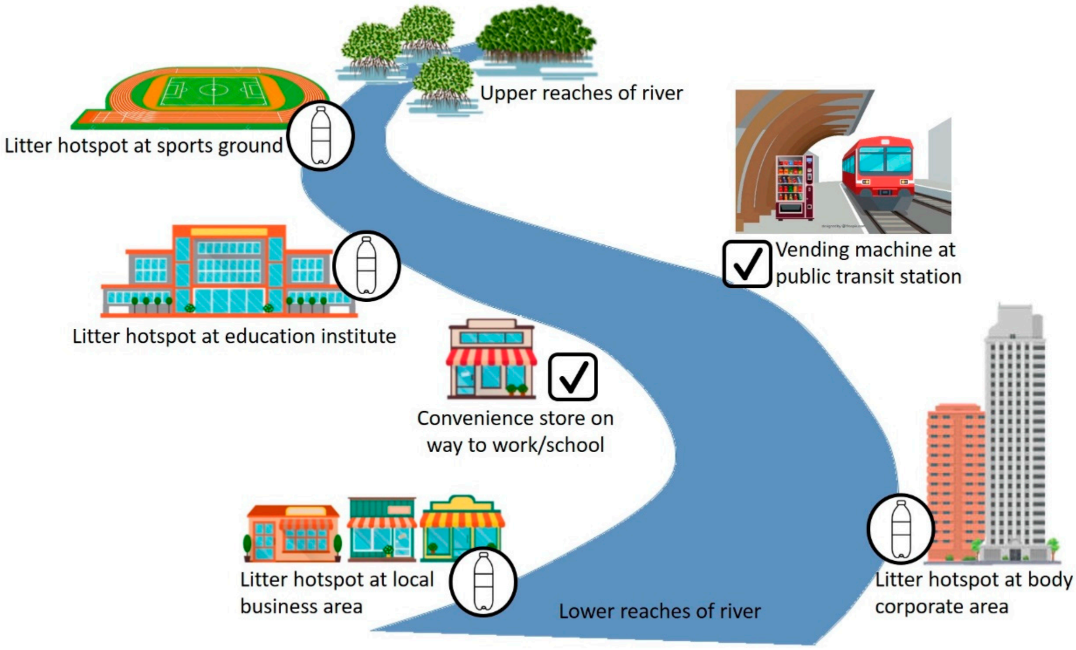


Figure 6. Graphical representation of Healthy Land and Water strategy location of water refill stations at litter hotspots and the recommended location based on multiple transport modes people use and places where they commonly purchase bottled water. For example, convenience stores on the way to work or school, and vending machines at public transit stations are common places where bottled water is purchased. Installing water refill stations at these targeted areas will provide consumers with a free alternative supply of cool filtered water and hopefully prevent them from purchasing bottled water at a store. ☑ = recommended location ○ = original location 🧴 = litter hotspot. Vectors in figure from Freepik.com.

Litter hot spots are a common location choice for the establishment of interventions. For example, beach raking and volunteer clean-ups target the dirtiest beaches and litter traps on drains that target the dirtiest waterways [52,53]. While such activities and interventions successfully remove litter from the environment, they do not address the leakage problem at the source location [54]. To effectively reduce the overall quantity of litter entering the environment, interventions that prioritise source reduction over the clean-up of litter will have greater harm minimisation. For example, reusable shopping bags and food containers, 'The Last Straw' campaign (www.laststraw.com.au), are successful source reduction strategies.

4.3.2. To Refill or Not to Refill?

Considering not only the supply and demand of a targeted product but also considering the time and location of the desired alternative behaviour/product for the consumer to switch to is an important component of behavioural change campaigns. An intervention will succeed at reducing plastic bottle litter if it decreases the costs and increases the benefits of the desired behaviour, such as not purchasing bottled water or littering plastic bottles in the environment [42]. With Go2Zones, the consumer receives the benefit of saving money because using the water refill station is free. However, the location of the Go2Zones may have increased a barrier for the consumer since the consumer needed to travel further to use the Go2Zone than to purchase a bottle of water. If a consumer needs to travel a further distance or spend a longer time to use the Go2Zone compared to buying bottled water, then the consumer is less likely to swap to the desired environmentally-friendly option [42,55]. For the Go2Zone to achieve maximum success, refill stations will ideally require no more effort as buying a bottle of water. An example of a successful strategy is a reusable coffee cup. The consumer using a reusable coffee cup needs to travel the same distance and spend the same amount of time purchasing a coffee as a consumer using a single-use coffee cup. Hence, it requires no additional effort for a consumer to transition to the environmentally-friendly option (although the consumer must bring the cup). Additionally, the consumer's environmentally-friendly choice is often rewarded with a cash incentive (discount) on their coffee purchase (https://responsiblecafes.org/).

4.4. Encouraging "Better" Behaviour by Consumers not Motivated by Pro-Environment Strategies

How can regulatory and non-regulatory organisations reduce litter by those consumers who do not switch to the environmentally-friendly alternative? Non-government organisations (NGO), like HLW, can generate public support through campaigns and other efforts to motivate or even compel governments and the industry to implement strategies that reduce littering. Extended producer responsibility (EPR) programs and circular economy approaches are two strategies that industries could adopt to reduce plastic bottle litter [56,57]. For example, in response to an NGO identifying Nestlé as a major source of plastic pollutants [58], Nestlé announced that it would shift toward a circular economy by changing all packaging to being entirely recyclable or reusable by 2025 [59]. Another example is the EU circular economy strategy, which includes EPR as an essential part of waste management that the industry must abide and implement [60]. Industry actions recognise the plastic pollution issue but do not change or take responsibility for the disposal of products. Moreover, the change to recyclable materials will not result in a reduction in the production of plastic products, nor will it encourage the change in consumer behaviour to dispose responsibly or consume less. NGOs and special interest groups are increasingly pressuring industries to include reduction, reuse, and responsible disposal of plastic in their corporate policies [56,61,62], which effectively reduces plastic litter from an industry and consumer level.

An option for regulatory organisations, such as governments and local councils, could be to prohibit the production or sale of the undesirable product (such as the sale of water in single-use plastic bottles). Bans have shown to be successful at reducing commonly littered items from the environment and waste stream [63,64] with bottle bans as a particularly popular choice in universities [65,66]. However, a ban may not always be the most appropriate choice. First, a ban does not encourage a litterer to stop littering. It only limits the number of products available to be lost to the environment. For example, a campus-wide bottle ban was not a viable option to reduce bottle litter at Allegheny College because the majority of bottled water was purchased off-campus [32]. Second, a ban can lead to more undesired behaviours such as increasing the consumption of sugary beverages and, consequently, not limiting the quantity of plastic bottles becoming waste [67].

Another option is improving the location and availability of rubbish bins in litter hot spot areas. Littering frequency increases as distance to a rubbish bin increases and in areas without rubbish bins [68,69]. Increasing access to rubbish bins in an area can discourage others from littering in that same area since people litter less in clean areas compared to littered areas [70–73]. Additionally, incorporating anti-littering signage in litter hot spot areas or on rubbish bins can also reduce littering. Litter signage that appeals to personal norms that activate an altruistic behaviour or signage that uses persuasive communication have shown to be successful at reducing littering [74–77] and, in some cases, even encourage the picking up of litter [78].

Lastly, implementing economic incentives such as deposit-refund schemes has been shown to reduce littered materials, such as plastic bottles, in the environment [79–82]. In both Australia and the United States, states with container deposit legislation (CDL) had a lower proportion of beverage containers found in coastal debris surveys than states without a CDL. In addition to cleaner public spaces, CDLs can be more cost effective compared to other waste management practices [81]. In Queensland, 12 months after the installation of the first Go2Zone, a CDL was implemented. Presently, all Australian states, except Victoria, will implement a CDL by 2022. This growing implementation of CDLs by governments demonstrates the value of incentives for reducing litter in the environment.

5. Conclusions

This study highlights the importance of decreasing the barriers to and increasing the benefits from a desired behavioural change strategy. A strategy may not succeed if consumers are required to travel further or spend more time to use the desired pro-environmental choice over the original less-desired choice. Our study found installing a water refill station could decrease the amount of plastic bottle litter in a localized area. However, we suggest implementing where impact can be maximised to reduce single-use plastic bottle consumption and subsequent littering. For example, supplying a water refill station where consumers purchase bottled water was compared to placing a station where consumer's dispose of plastic bottles, which was found to reduce single-use plastic bottle consumption and subsequent littering. Furthermore, the awareness campaign, which occurred in conjunction with the installation of the water refill station, may have influenced a consumer's choice to litter a plastic bottle more than solely providing the refill station. Awareness campaigns in conjunction with infrastructure have been shown to reduce local litter [54]. In addition to awareness campaigns, the use of nudges and education can be adopted to extend the impact water refill stations, which can shift the consumer social norm toward pro-environment alternatives [41,83,84].

Water refill stations are an increasingly popular waste reduction strategy across the globe with stations implemented in the U.K. (https://refill.org.uk/), North America (https://findtap.com/), south-east Asia (https://refilltheworld.com/map/), and Africa (https://www.idropwater.com/). Considering the placement of stations and the intervention strategy to drive uptake and behavioural change will be key to achieving their maximum benefit as an additive strategy for reducing litter.

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References

1. Kataoka, T.; Nihei, Y.; Kudou, K.; Hinata, H. Assessment of the sources and inflow processes of microplastics in the river environments of Japan. *Environ. Pollut.* **2019**, *244*, 958–965. [CrossRef] [PubMed]
2. Sundt, P.; Schulze, P.-E.; Syversen, F. *Sources of Microplastic—Pollution to the Marine Environment*; Technical Report No. M-321/2015; Norwegian Environment Agency (Miljødirektoaret): Trondheim, Norway, 2014; p. 86.

3. Richardson, K.; Gunn, R.; Wilcox, C.; Hardesty, B.D. Understanding causes of gear loss provides a sound basis for fisheries management. *Mar. Policy* **2018**, *96*, 278–284. [CrossRef]
4. Schultz, P.W.; Bator, R.J.; Large, L.B.; Bruni, C.M.; Tabanico, J.J. Littering in Context: Personal and Environmental Predictors of Littering Behavior. *Environ. Behav.* **2013**, *45*, 35–59. [CrossRef]
5. Slavin, C.; Grage, A.; Campbell, M.L. Linking social drivers of marine debris with actual marine debris on beaches. *Mar. Pollut. Bull.* **2012**, *64*, 1580–1588. [CrossRef] [PubMed]
6. Gregory, M.R. Environmental implications of plastic debris in marine settings—Entanglement, ingestion, smothering, hangers-on, hitch-hiking and alien invasions. *Philos Trans. R Soc. Lond. B Biol. Sci.* **2009**, *364*, 2013–2025. [CrossRef] [PubMed]
7. Gall, S.C.; Thompson, R.C. The impact of debris on marine life. *Mar. Pollut. Bull.* **2015**, *92*, 170–179. [CrossRef] [PubMed]
8. McIlgorm, A.; Campbell, H.F.; Rule, M.J. The economic cost and control of marine debris damage in the Asia-Pacific region. *Ocean. Coast. Manag.* **2011**, *54*, 643–651. [CrossRef]
9. Jang, Y.C.; Hong, S.; Lee, J.; Lee, M.J.; Shim, W.J. Estimation of lost tourism revenue in Geoje Island from the 2011 marine debris pollution event in South Korea. *Mar. Pollut. Bull.* **2014**, *81*, 49–54. [CrossRef]
10. Wilcox, C.; Mallos, N.J.; Leonard, G.H.; Rodriguez, A.; Hardesty, B.D. Using expert elicitation to estimate the impacts of plastic pollution on marine wildlife. *Mar. Policy* **2016**, *65*, 107–114. [CrossRef]
11. Rochman, C.M.; Tahir, A.; Williams, S.L.; Baxa, D.V.; Lam, R.; Miller, J.T.; Teh, F.C.; Werorilangi, S.; Teh, S.J. Anthropogenic debris in seafood: Plastic debris and fibers from textiles in fish and bivalves sold for human consumption. *Sci. Rep.* **2015**, *5*, 14340. [CrossRef]
12. Van Cauwenberghe, L.; Janssen, C.R. Microplastics in bivalves cultured for human consumption. *Environ. Pollut.* **2014**, *193*, 65–70. [CrossRef] [PubMed]
13. Campbell, M.L.; Slavin, C.; Grage, A.; Kinslow, A. Human health impacts from litter on beaches and associated perceptions: A case study of 'clean' Tasmanian beaches. *Ocean. Coast. Manag.* **2016**, *126*, 22–30. [CrossRef]
14. Lebreton, L.; Andrady, A. Future scenarios of global plastic waste generation and disposal. *Palgrave Commun.* **2019**, *5*, 6. [CrossRef]
15. Jambeck, J.R.; Geyer, R.; Wilcox, C.; Siegler, T.R.; Perryman, M.; Andrady, A.; Narayan, R.; Law, K.L. Plastic waste inputs from land into the ocean. *Science* **2015**, *347*, 768–771. [CrossRef] [PubMed]
16. Geyer, R.; Jambeck, J.R.; Law, K.L. Production, use, and fate of all plastics ever made. *Sci. Adv.* **2017**, *3*, e1700782. [CrossRef] [PubMed]
17. Lebreton, L.C.; van der Zwet, J.; Damsteeg, J.-W.; Slat, B.; Andrady, A.; Reisser, J. River plastic emissions to the world's oceans. *Nat. Commun.* **2017**, *8*, 15611. [CrossRef] [PubMed]
18. Euromonitor International. *Global Trends in Packaging*; Euromonitor International: London, UK, 2017.
19. Beverage Marketing Corporation. *Bottled Water Becomes Number-One Beverage in the U.S.*; Beverage Marketing Corporation: New York, NY, USA, 2017.
20. Johnson, C. Industry Update: Future Looks Bright for Bottled Water. Available online: https://foodmag.com.au/industry-update-future-looksbright-for-bottled-water/ (accessed on 28 June 2019).
21. Bolland, H. *Reuse Refill and Reduce: The Eco-Logical Way to Drink Water*; University of the Sunshine Coast: Sunshine Coast, Australia, 2014; p. 18.
22. Ragusa, A.T.; Crampton, A. To Buy or not to Buy? Perceptions of Bottled Drinking Water in Australia and New Zealand. *Hum. Ecol.* **2016**, *44*, 565–576. [CrossRef]
23. Díez, J.R.; Antigüedad, I.; Agirre, E.; Rico, A. Perceptions and consumption of bottled water at the University of the Basque Country: Showcasing tap water as the real alternative towards a water-sustainable university. *Sustainability* **2018**, *10*, 3431. [CrossRef]
24. Debbeler, L.J.; Gamp, M.; Blumenschein, M.; Keim, D.; Renner, B. Polarized but illusory beliefs about tap and bottled water: A product-and consumer-oriented survey and blind tasting experiment. *Sci. Total Environ.* **2018**, *643*, 1400–1410. [CrossRef]
25. Euromonitor International. *Country Report: Bottled Water in Australia*; Euromonitor International: London, UK, 2018; p. 25.
26. Ji, L.N. Study on preparation process and properties of plyethylene terephthalate (PET). *Appl. Mech. Mater.* **2013**, *312*, 406–410. [CrossRef]

27. Ocean Conservancy International Coastal Cleanup. Available online: https://oceanconservancy.org/trash-free-seas/international-coastal-cleanup/ (accessed on 27 June 2017).
28. Clean Up Australia. *Rubbish Report 2017*; Clean Up Australia Limited: Darlinghurst Australia, 2017; p. 48.
29. Oberbeckmann, S.; Osborn, A.M.; Duhaime, M.B. Microbes on a bottle: Substrate, season and geography influence community composition of microbes colonizing marine plastic debris. *PLoS ONE* **2016**, *11*, e0159289. [CrossRef] [PubMed]
30. Kinniburgh, C. *Dead Eastern Quoll Found on a Bruny Island Beach with Its Head Stuck in a Plastic Cream Bottle*; Mercury: New York, NY, USA, 2019.
31. Marshall, A. *Principles of Economics*, 1st ed.; Macmillan: London, UK, 1890.
32. Choate, B.; Davis, B.Y.; Verrecchia, J. Campus bottled water bans, not always the solution. *Int. J. Sustain. High. Educ.* **2018**, *19*, 987–997. [CrossRef]
33. *Keep Australia Beautiful*; Technical Report No. 2016–2017; National Litter Index: 2017; Keep Australia Beautiful National Association: Sydney, Australia, 2017; p. 36.
34. Healthy Land and Water. *Annual Clean Up Program*; Report; Healthy Land and Water: Brisbane, Queensland, Australia, 2018; p. 34.
35. ABS, A.B. o. S. Data by Region. Available online: https://itt.abs.gov.au/itt/r.jsp?databyregion (accessed on 11 June 2019).
36. Tangaroa Blue Foundation AMDI How to videos and manual. Available online: https://www.tangaroablue.org/resources/how-to-manual.html (accessed on 2 August 2019).
37. *R Core Team R: A Language and Environment for Statistical Computing*; Foundation for Statistical Computing: Vienna, Austria, 2014.
38. Wood, S.N. *Generalized Additive Models: An Introduction with R*; Chapman and Hall/CRC Press: Boca Raton, FL, USA, 2006.
39. Akaike, H. A new look at the statistical model identification. *IEEE Trans. Autom. Control.* **1974**, *19*, 716–723. [CrossRef]
40. Bartolotta, J.F.; Hardy, S.D. Barriers and benefits to desired behaviors for single use plastic items in northeast Ohio's Lake Erie basin. *Mar. Pollut. Bull.* **2018**, *127*, 576–585. [CrossRef] [PubMed]
41. Thomas, C.; Sharp, V. Understanding the normalisation of recycling behaviour and its implications for other pro-environmental behaviours: A review of social norms and recycling. *Resour. Conserv. Recycl.* **2013**, *79*, 11–20. [CrossRef]
42. Saylor, A.; Prokopy, L.S.; Amberg, S. What's Wrong with the Tap? Examining Perceptions of Tap Water and Bottled Water at Purdue University. *Environ. Manag.* **2011**, *48*, 588–601. [CrossRef]
43. Uehara, T.; Ynacay-Nye, A. How water bottle refill stations contribute to campus sustainability: A case study in Japan. *Sustainability* **2018**, *10*, 3074. [CrossRef]
44. Willis, K.; Hardesty, B.D.; Kriwoken, L.; Wilcox, C. Differentiating littering, urban runoff and marine transport as sources of marine debris in coastal and estuarine environments. *Sci. Rep.* **2017**, *7*, 44479. [CrossRef] [PubMed]
45. Ivar do Sul, J.A.; Costa, M.F. Plastic pollution risks in an estuarine conservation unit. *J. Coast. Res.* **2013**, *65*, 48–53. [CrossRef]
46. Hidalgo-Ruz, V.; Thiel, M. Distribution and abundance of small plastic debris on beaches in the SE Pacific (Chile): A study supported by a citizen science project. *Mar. Environ. Res.* **2013**, *87*, 12–18. [CrossRef]
47. Martin, C.; Almahasheer, H.; Duarte, C.M. Mangrove forests as traps for marine litter. *Environ. Pollut.* **2019**, *247*, 499–508. [CrossRef] [PubMed]
48. Brennan, E.; Wilcox, C.; Hardesty, B.D. Connecting flux, deposition and resuspension in coastal debris surveys. *Sci. Total. Environ.* **2018**, *644*, 1019–1026. [CrossRef] [PubMed]
49. Turrell, W.R. A simple model of wind-blown tidal strandlines: How marine litter is deposited on a mid-latitude, macro-tidal shelf sea beach. *Mar. Pollut. Bull.* **2018**, *137*, 315–330. [CrossRef] [PubMed]
50. Hardesty, B.D.; Lawson, T.J.; van der Velde, T.; Lansdell, M.; Wilcox, C. Estimating quantities and sources of marine debris at a continental scale. *Front. Ecol. Environ.* **2017**, *15*, 18–25. [CrossRef]
51. Shimazu, H. Littering behavior analysis based on survey and questionnaire about littering in the Nagase River. *Int. J. Geomate* **2018**, *14*, 95–101. [CrossRef]

52. Hardesty, B.D.; Harari, J.; Isobe, A.; Lebreton, L.; Maximenko, N.; Potemra, J.; van Sebille, E.; Vethaak, A.D.; Wilcox, C. Using Numerical Model Simulations to Improve the Understanding of Micro-plastic Distribution and Pathways in the Marine Environment. *Front. Mar. Sci.* **2017**, *4*, 30. [CrossRef]
53. Commonwealth of Australia. *Toxic Tide: The Threat of Marine Plastic Pollution in Australia*; Senate Printing Unit, Parliament House, Committee Secretariat: Canberra, Australia, 2016.
54. Willis, K.; Maureaud, C.; Wilcox, C.; Hardesty, B.D. How successful are waste abatement campaigns and government policies at reducing plastic waste into the marine environment? *Mar. Policy* **2018**, *96*, 243–249. [CrossRef]
55. Güngör-Demirci, G.; Lee, J.; Mirzaei, M.; Younos, T. How do people make a decision on bottled or tap water? Preference elicitation with nonparametric bootstrap simulations. *Water Environ. J.* **2016**, *30*, 243–252. [CrossRef]
56. Vince, J.; Hardesty, B.D. Governance Solutions to the Tragedy of the Commons That Marine Plastics Have Become. *Front. Mar. Sci.* **2018**, *5*, 214. [CrossRef]
57. Vince, J.; Hardesty, B.D. Plastic pollution challenges in marine and coastal environments: From local to global governance. *Restor. Ecol.* **2017**, *25*, 123–128. [CrossRef]
58. *Break Free from Plastic. Branded: In Search of the World's Top Corporate Plastic Polluters*; Greenpeace: Washington, DC, USA, 2018; p. 32.
59. Nestlé. What is Nestlé Doing to Tackle Packaging Waste? Available online: https://www.nestle.com/ask-nestle/environment/answers/tackling-packaging-waste-plastic-bottles (accessed on 24 July 2019).
60. The European Parliament. Union. C.O.T.E. Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 Amending Directive 2008/98/EC on Waste; 2018/851. *Off. J. Eur. Un.* **2018**, *61*, 32.
61. Ellen MacArthur Foundation. *New Plastics Economy Global Commitment*; Ellen MacArthur Foundation: Cowes, UK, 2019.
62. Moss, E.; Eidson, A.; Jamback, J. *Sea of Opportunity: Supply Chain Investment Opportunities to Address Marine Plastic Pollution*; Encourage Capital on behalf of Vulcan, Inc.: New York, NY, USA, 2017.
63. Vasquez, M.; Carter, J.; Valko, P. *Bottled Water Ban: Update 2015*; Office of Sustainability: Washington University in St Louis: Washington, DC, USA, 2015; p. 3.
64. Auty, K.; Dickson, K. *Unfantastic Plastic-Review of the ACT Plastic Shopping Bag Ban*; Commissioner for Sustainability and the Environment; Office of the Commissioner for Sustainability and the Environment: Canberra, Australia, 2018; p. 76.
65. Curtis-Murphy, M.; Sessions, C. Ban the Bottle: Implementing a Ban on the Sale of Plastic Water Bottles at the University of Washington. *Evans Sch. Rev.* **2014**, *4*, 44–58.
66. Morton, A. University to Ban Bottled Water Sales. *Sydney Morning Herald*. 21 January 2011. Available online: https://www.smh.com.au/environment/university-to-ban-bottled-water-sales-20110120-19xzl.html (accessed on 24 July 2019).
67. Berman, E.R.; Johnson, R.K. The unintended consequences of changes in beverage options and the removal of bottled water on a university campus. *Am. J. Public Health* **2015**, *105*, 1404–1408. [CrossRef] [PubMed]
68. Durdan, C.A.; Reeder, G.D.; Hecht, P.R. Litter in a University Cafeteria: Demographic Data and the Use of Prompts as an Intervention Strategy. *Environ. Behav.* **1985**, *17*, 387–404. [CrossRef]
69. Finnie, W.C. Field Experiments in Litter Control. *Environ. Behav.* **1973**, *5*, 123–140. [CrossRef]
70. Al-Mosa, Y.; Parkinson, J.; Rundle-Thiele, S. A Socioecological Examination of Observing Littering Behavior. *J. Nonprofit Public Sect. Mark.* **2017**, *29*, 235–253. [CrossRef]
71. Keizer, K.; Lindenberg, S.; Steg, L. The spreading of disorder. *Science* **2008**, *322*, 1681–1685. [CrossRef]
72. Weaver, R. Littering in context(s): Using a quasi-natural experiment to explore geographic influences on antisocial behavior. *Appl. Geogr.* **2015**, *57*, 142–153. [CrossRef]
73. Cialdini, R.B.; Reno, R.R.; Kallgren, C.A. A Focus Theory of Normative Conduct—Recycling the Concept of Norms to Reduce Littering in Public Places. *J. Personal. Soc. Psychol.* **1990**, *58*, 1015–1026. [CrossRef]
74. Powers, R.B.; Osborne, J.G.; Anderson, E.G. Positive reinforcement of litter removal in the natural environment. *J. Appl. Behav. Anal.* **1973**, *6*, 579–586. [CrossRef]
75. Geller, E.S.; Brasted, W.S.; Mann, M.F. Waste Receptacle Designs as Interventions for Litter Control. *J. Environ. Syst.* **1979**, *9*, 145–160. [CrossRef]
76. Bateson, M.; Robinson, R.; Abayomi-Cole, T.; Greenlees, J.; O'Connor, A.; Nettle, D. Watching eyes on potential litter can reduce littering: Evidence from two field experiments. *PeerJ* **2015**, *3*, e1443. [CrossRef]

77. De Kort, Y.A.W.; McCalley, L.T.; Midden, C.J.H. Persuasive Trash Cans: Activation of Littering Norms by Design. *Environ. Behav.* **2008**, *40*, 870–891. [CrossRef]
78. Brown, T.J.; Ham, S.H.; Hughes, M. Picking up litter: An application of theory-based communication to influence tourist behaviour in protected areas. *J. Sustain. Tour.* **2010**, *18*, 879–900. [CrossRef]
79. Schuyler, Q.; Hardesty, B.D.; Lawson, T.J.; Opie, K.; Wilcox, C. Economic incentives reduce plastic inputs to the ocean. *Mar. Policy* **2018**, *96*, 250–255. [CrossRef]
80. Oosterhuis, F.; Papyrakis, E.; Boteler, B. Economic instruments and marine litter control. *Ocean Coast. Manag.* **2014**, *102*, 47–54. [CrossRef]
81. Lavee, D. A cost-benefit analysis of a deposit-refund program for beverage containers in Israel. *Waste Manag.* **2010**, *30*, 338–345. [CrossRef]
82. Walls, M. *Deposit-Refund Systems in Practice and Theory*; Social Science Research Network: Rochester, NY, USA, 2013; pp. 133–137.
83. Rivers, N.; Shenstone-Harris, S.; Young, N. Using nudges to reduce waste? The case of Toronto's plastic bag levy. *J. Environ. Manag.* **2017**, *188*, 153–162. [CrossRef]
84. Heidbreder, L.M.; Bablok, I.; Drews, S.; Menzel, C. Tackling the plastic problem: A review on perceptions, behaviors, and interventions. *Sci. Total Environ.* **2019**, *668*, 1077–1093. [CrossRef]