

Coastal Litter Monitoring Survey Trial

Whangarei Harbour

November 14 2017



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Introduction

Since 2009 staff from Northland Regional Council (NRC) and Whangarei District Council (WDC) have undertaken annual Hātea River Clean-up's. More recently, Seacleaners have also assisted in removing coastal litter in this area. The typical clean-up area encompasses the Hātea River downstream from the Riverside Bridge, the Waiarohia downstream from the Okara Drive Bridge, then southwards to the Matau ā Pohe Bridge and the southern side of Pohe Island (Figure 1).

The Department of Conservation (DoC) in conjunction with Ministry for the Environment (MfE), Sustainable Coastlines and StatsNZ are developing a coastal litter monitoring methodology (Geange 2016). The draft methodology is complementary to the United Nations Environment Programme (UNEP) and Intergovernmental Oceanographic Commission (IOC) Guidelines on Survey's and Monitoring of Marine Litter. The finalised methodology is hoped to fill the current void on international standardised litter monitoring programmes and accurate data collection. In turn, this can be provided to policy makers, TA's and provide statistically sound data to fulfil MfE reporting requirements. It is also hoped to roll out coastal and land (rivers and lakes) litter monitoring programmes for community groups.

NRC had the opportunity to trial the DoC methodology to better understand the volume and type of litter collected. Furthermore, to provide WDC and other interested parties our findings. In total, three sites were selected Hātea at Pohe Island, Waiarohia at Pocket Park and Hātea at Old BMX Track. These sites were selected as they met the urban depositional, upper harbour aspect of site selection within the DoC draft methodology.



Figure 1. Typical range of the annual NRC and WDC Hātea River Clean-up.

Methods

2.1 Trial Sites

The methodology trialled was based on the UNEP/IOC Guidelines on Survey and Monitoring of Marine Litter (Cheshire et al. 2009) for evaluating litter flux. Litter flux surveys determine the rate and amount of litter arriving on a beach over a fixed period. After conducting the initial clearance, the litter load is set to zero and future surveys determine the rate at which litter accumulates between surveys. With this approach, standing stock can be calculated from the initial removal of litter from the beach and future surveys determine litter flux with each survey involving the removal of all litter from the beach.

The standing stock of beach litter was surveyed at low tide 14 November 2017 along a 100 m x 10 m section of coastline. The hightide (back of beach) mark denoted the landward side of the site, then ran 10 m seaward defining the bottom of the site. This was repeated at three locations which met the urban depositional criteria; Hātea at Pohe Island, Waiarohia at Pocket Park and Hātea at Old BMX Track (Figures 2, 3 & 4 respectively). All litter was collected, counted then grouped by class with the number of items within each class using the UNEP/IOC Litter Classification (Audit sheet). The weight category was omitted due to practicality and resourcing reasons. The number of items within each litter class from the survey were described to determine the initial standing stock.

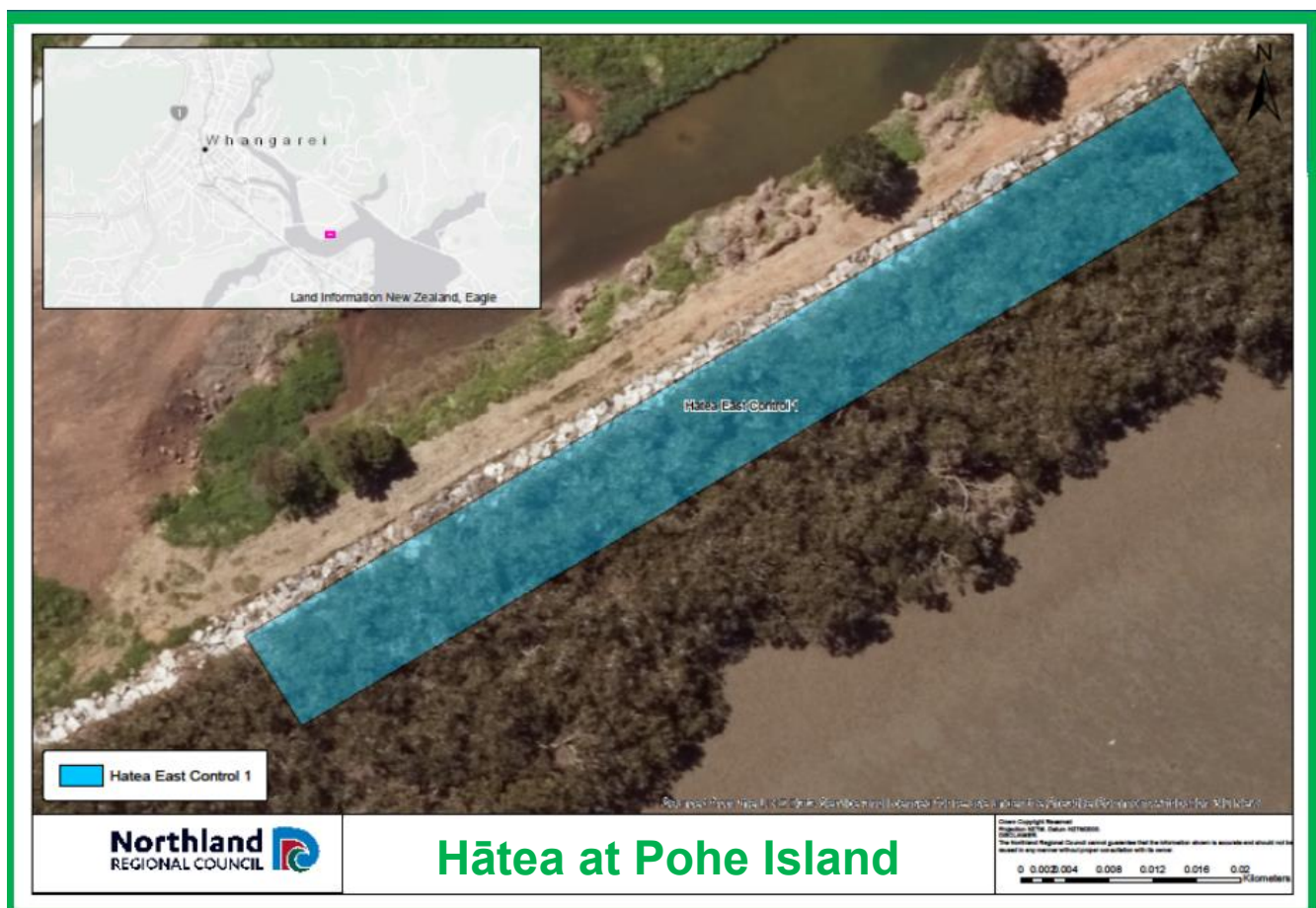


Figure 2. Hātea at Pohe Island.

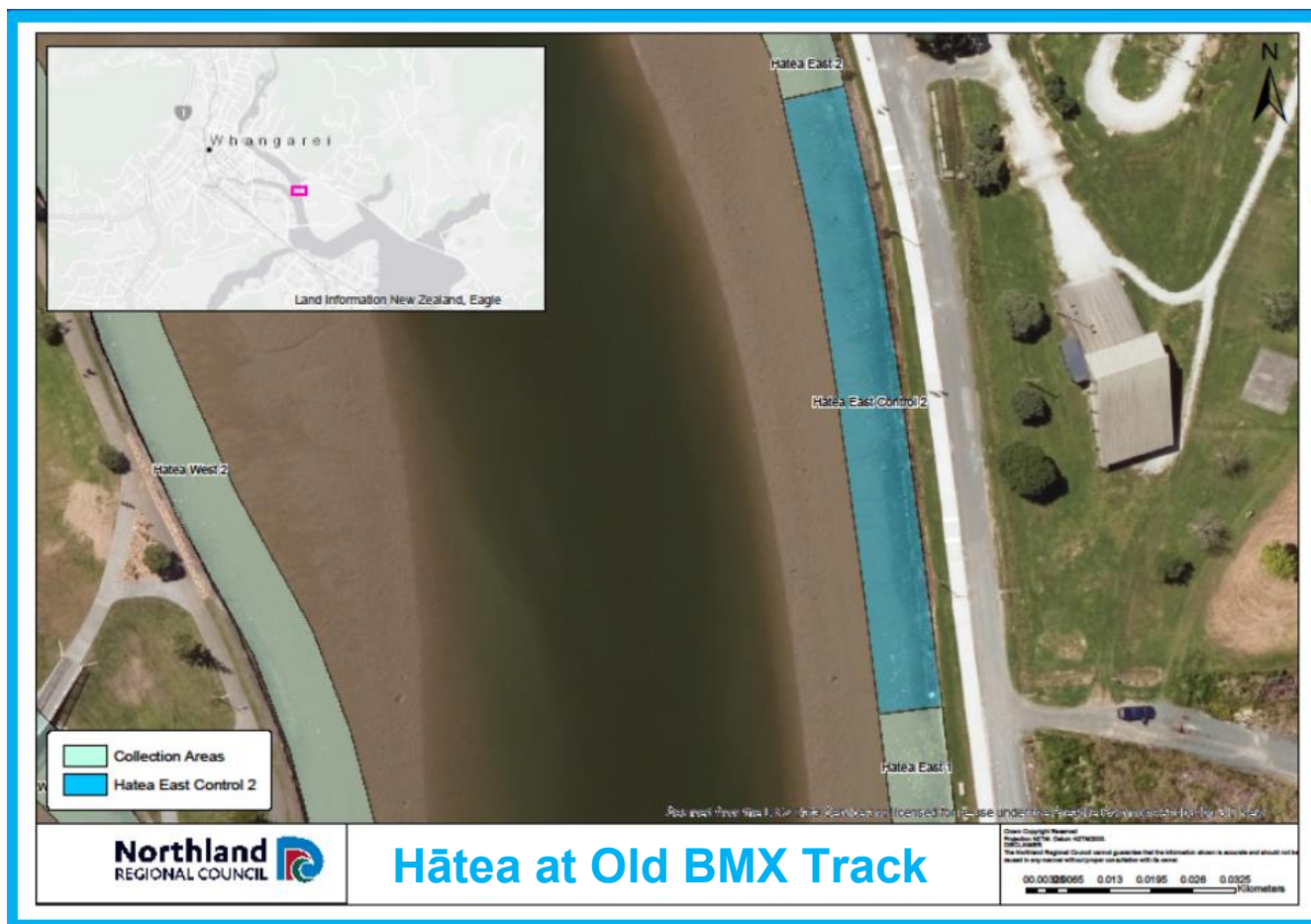


Figure 3. Hātea at Old BMX Track.

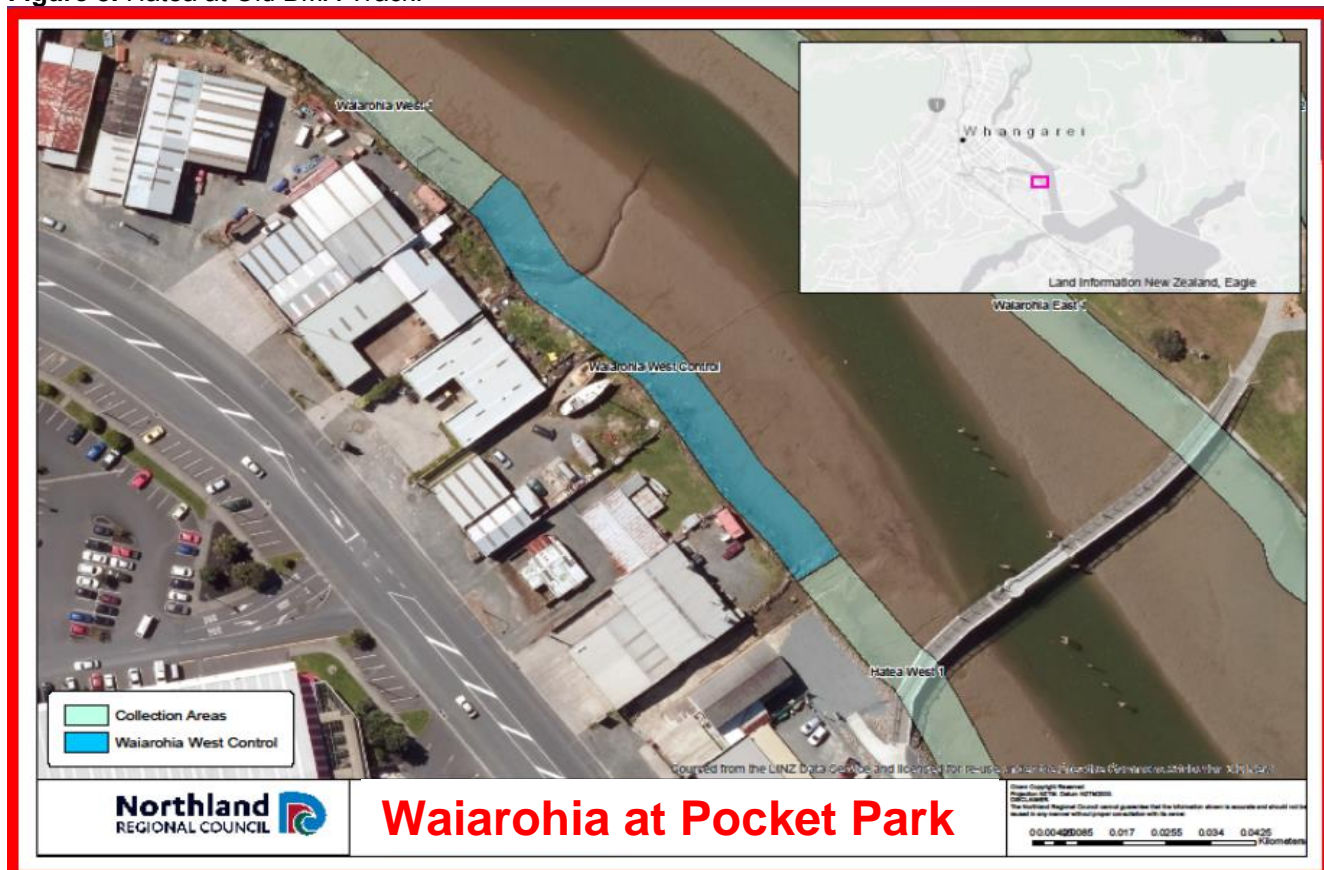


Figure 4. Waiarohia at Pocket Park.

2.2 Data analysis

The number of items within each litter class from this survey were described to determine initial standing stock. Using the beach litter source categorisation developed by Sustainable Coastlines the collected litter was 'filtered' to ascertain litter source and use (Table 1). Once litter items had been sorted and litter source categorised, distribution variables were considered. For example, the percentage of litter sources at each site e.g. stormwater outlet distribution (Figure 5). In addition to this, the total number of litter items collected was calculated to determine the amount of litter per m² at each site.

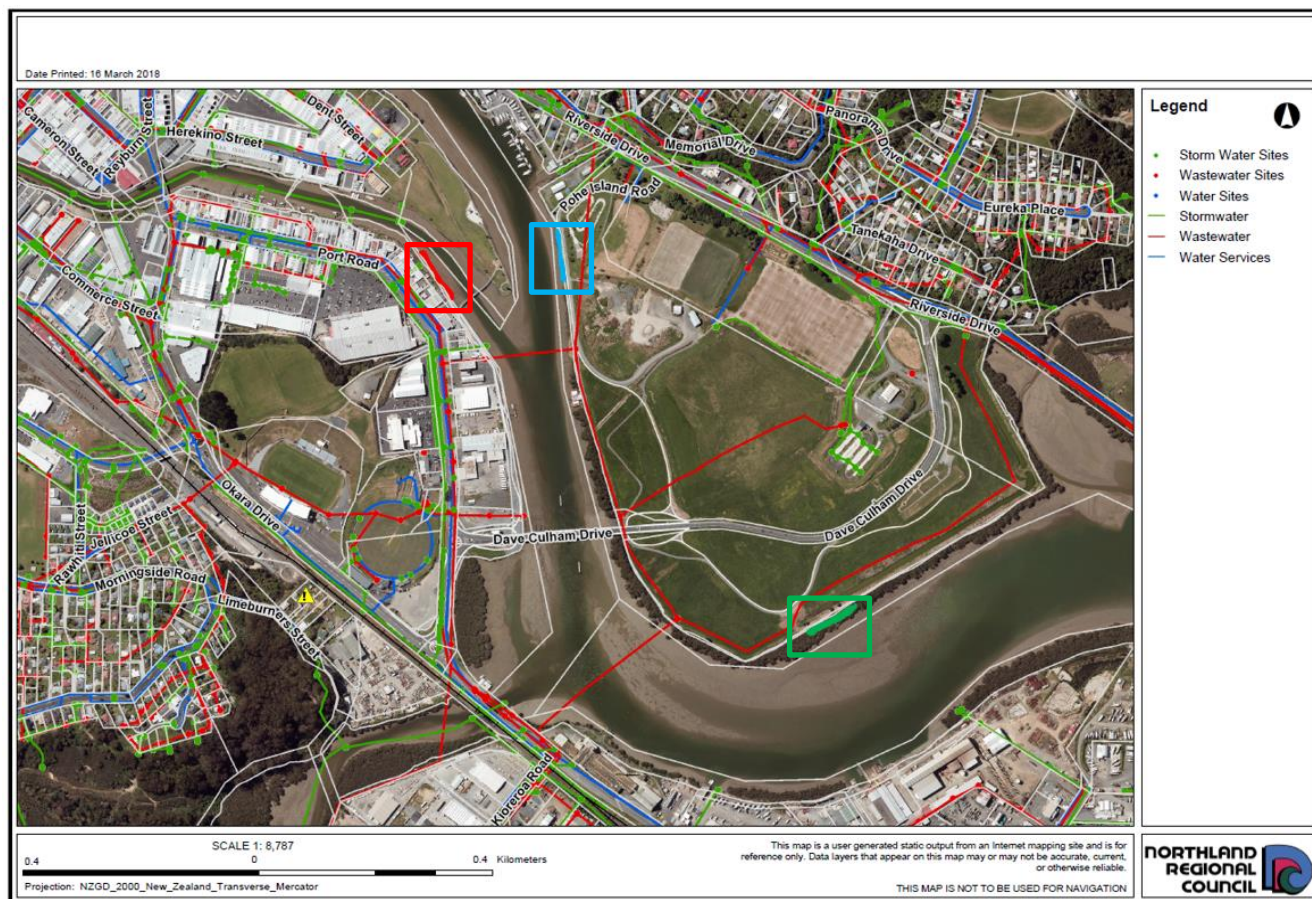


Figure 5. WDC piped services in relation to trial litter monitoring sites.

Table 1. Sustainable Coastlines beach litter source categorisation used to determine litter source and use.

Sustainable Coastlines beach litter source categorisation	
Household and personal	Appliances (refrigerators, washers etc), batteries (household, e.g., AA), bleach/cleaner bottles, cigarette lighters, cigarette packaging/wrappers/butts, clothing pegs/pins, clothing, shoes, condoms, diapers, gardening related, household (cosmetics, brushes etc), light bulbs/tubes, medical (asthma inhalers, pill packets etc), pens, shotgun shells/wadding, syringes, tampons/tampon applicators, toys (including balls, fireworks etc)
Fishing related	Bait containers/packaging, boat parts, buoys/floats, crab/lobster/fish traps, crates/buckets, fishing line, fishing lures/light sticks, fishing nets, ropes
Vehicle related	Vehicle batteries, cars/car parts, oil/lube bottles/cans, parking tickets and receipts, tyres
Food related	6-pack holders, beverage bottles (glass), beverage bottles (plastic), beverage cans, caps, lids, cups, plates, forks, knives, spoons, food wrappers/containers, lollipop sticks, pull tabs, straws, stirrers
Construction related	55-gallon drums, building material, pallets, plastic sheeting/tarps, strapping bands

Results

The total number of litter items and material classes varied between sites (Figures 6 & 7). Plastic items accounted for the majority of collected litter at the Hātea at Old BMX Track site, metal at Waiarohia at Pocket Park and Glass & Ceramic at Pohe Island sites (Appendices A, B & C).

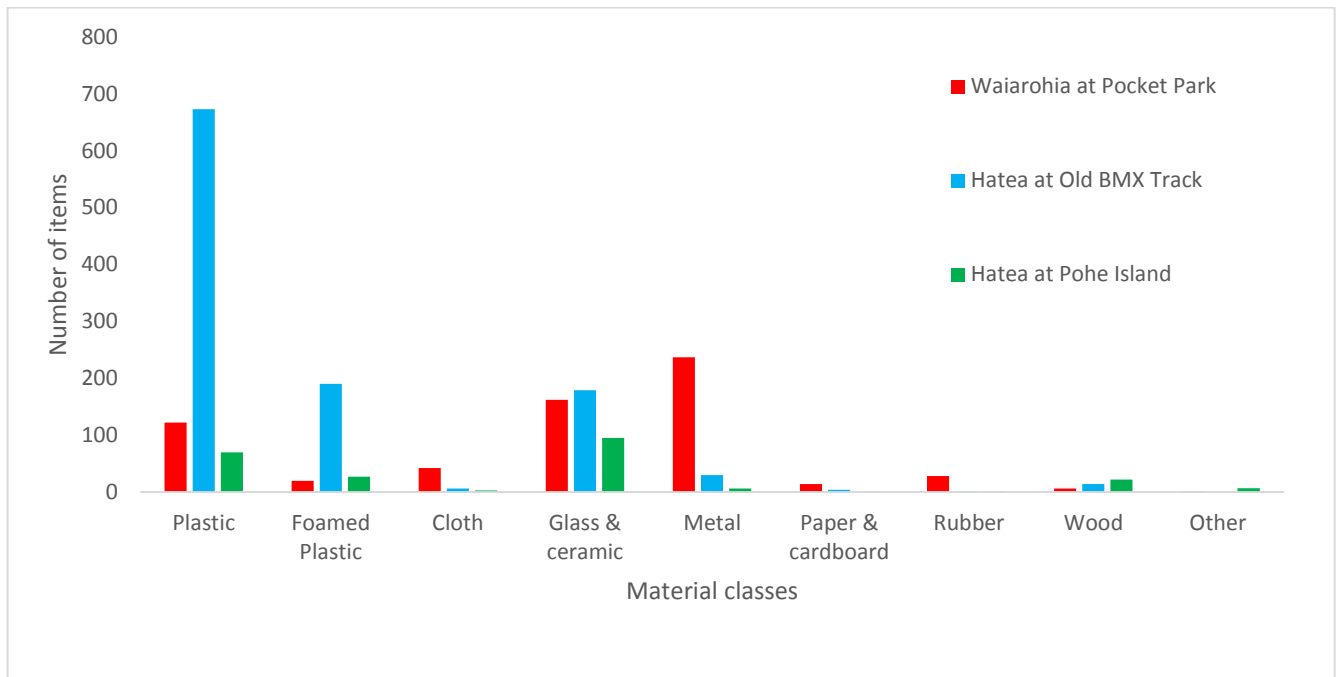


Figure 6. Number of litter items collected in relation to material class.

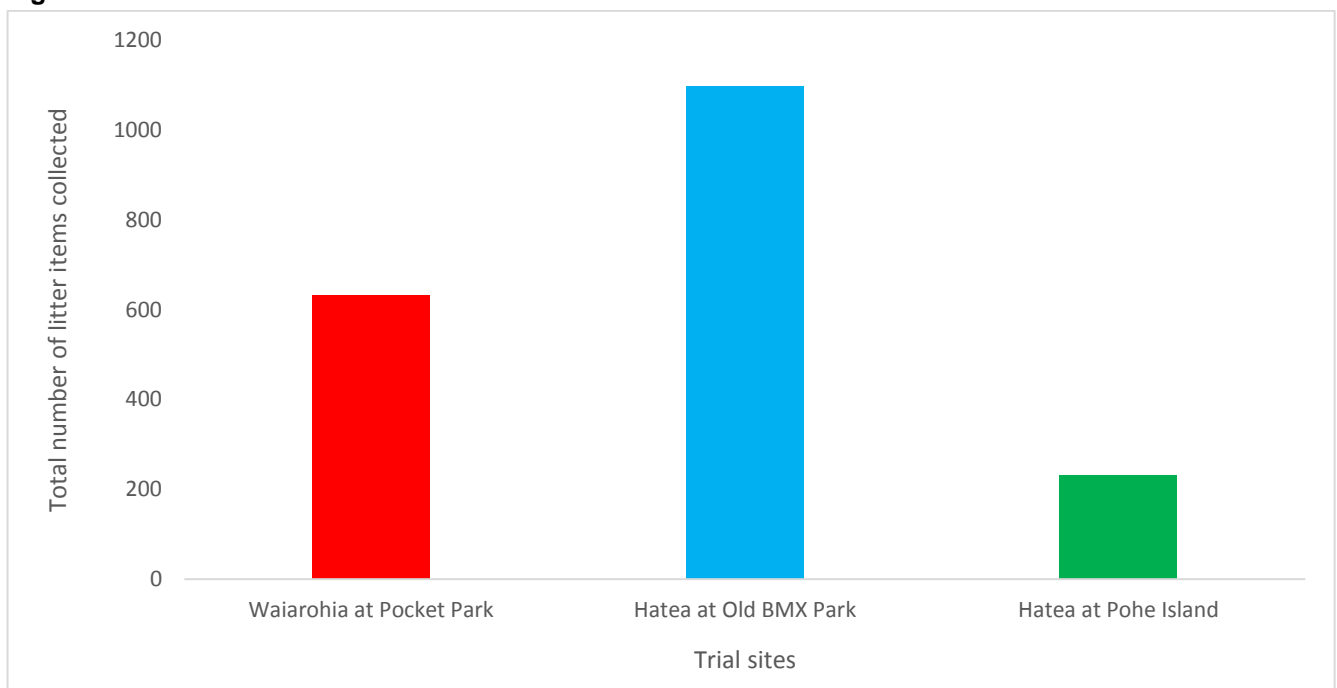


Figure 7. Total number of litter items collected at all sites.

Sorted litter was 'filtered' using the Sustainable Coastlines beach litter source categorisation (Table 1). This revealed variability of litter source categories between sites. The number of food related litter items was highest (616 items) at the Hātea at Old BMX Track site whereas construction related items peaked (449 items) at the Waiarohia at Pocket Park site. Construction related items was the second highest litter source category at the Hātea at Old BMX Track site (336 items). Conversely, at the Hātea at Pohe Island site, construction related items were the highest (157) followed by food related items (65). Household & personal items made up the third highest category between sites (Figure 7).

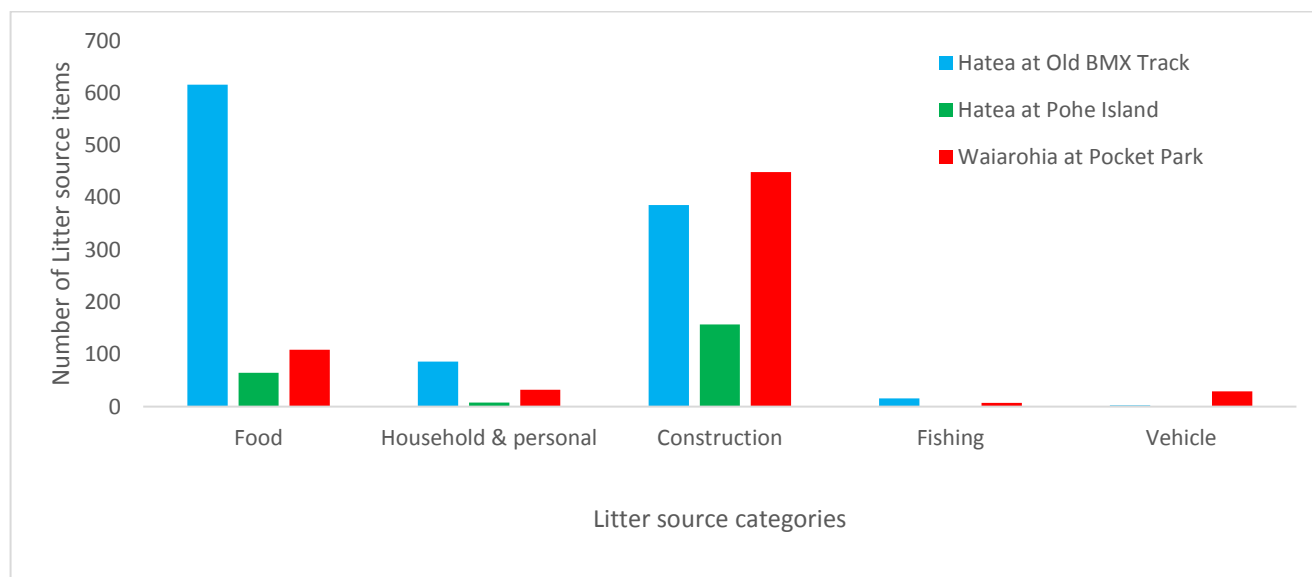


Figure 7 Number of litter source items at all sites.

The percentage of sorted litter source items was represented highest within the construction related category. Construction related items at the Waiarohia at Pocket Park, Hātea at Pohe Island and Hātea at Old BMX Track were 71.2%, 68% and 35.2% respectively. The percentage scale was reversed with food related items between sites. The Hātea at Old BMX Track site held the highest percentage of food related items (56.1%) followed by Hātea at Pohe Island (28.1%) and Waiarohia at Pocket Park (17.3%) (Figure 8).

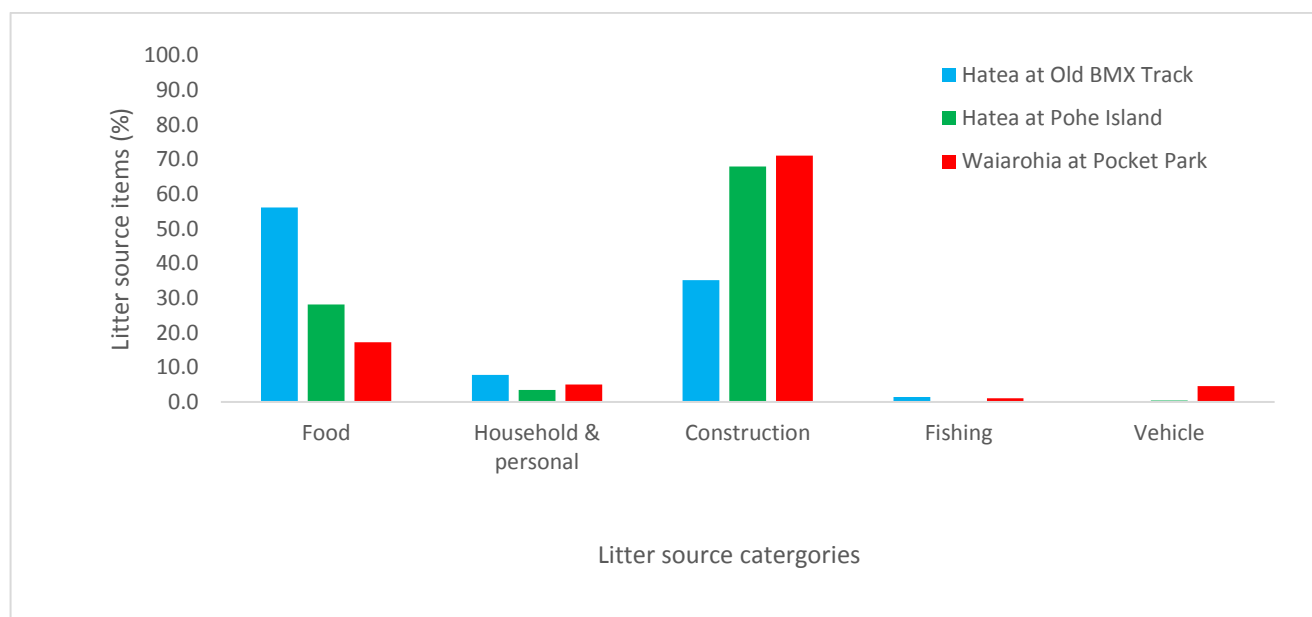


Figure 8 Percentage of categorised litter source items (developed by Sustainable Coastlines) at all sites.

The calculated value of litter items per m² returned a value of slightly over one at Hātea at Old BMX Track, 0.63 at Waiarohia at Pocket Park and 0.23 at Hātea at Pohe Island (Figure 9).

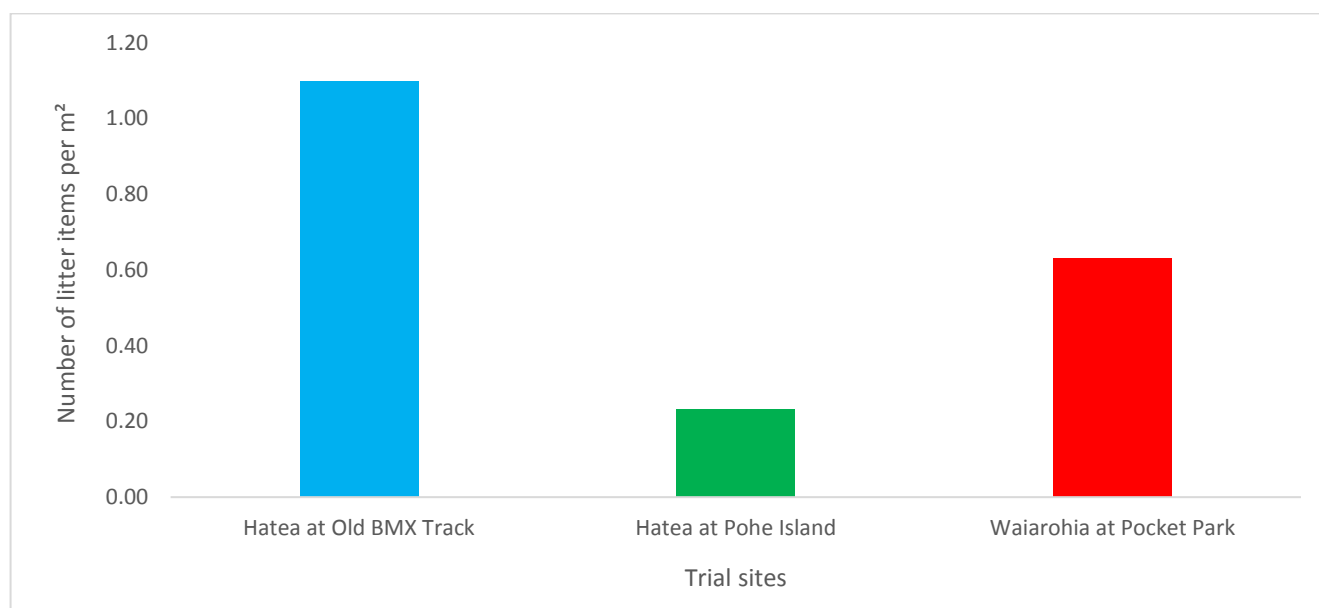


Figure 9 Number of litter items collected at all trial sites per m² (total number of litter items at each site/1000m² (sites 100 m x 10 m)).

Discussion

There was variability of total number of litter items collected, material classes and litter sources between sites. The Hātea at Old BMX Track site had the most plastic and foamed plastic (material classes), highest number of litter items and most number of items of litter items per m². Conversely, Waiarohia at Pocket Park revealed the highest amount of metal (material class) items. The litter sources weighted toward either food or construction related origins. Of which, plastic (food related) items was represented, by number, highest at the Hātea at Old BMX Track site. Food items, (%), was again highest at the Hātea at Old BMX Track site. However, construction source items (%) peaked at the Waiarohia at Pocket Park site. This was closely followed by the Hātea at Pohe Island site with half the construction litter source value (%) of these two sites seen at the Hātea at Old BMX Track site.

The Hātea at Old BMX Track site is adjacent to the popular Hātea Loop Track and two stormwater outlets are immediately upstream of the site (Figure 5). This site is also downstream from the Town Basin and Hātea River which both receive many stormwater outlet inputs and sheet run-off from land. The Waiarohia at Pocket Park site, in many ways, is similar to the Hātea at Old BMX Track site. It receives urban run-off from both the Raumanga and Waiarohia streams. The Waiarohia at Pocket Park site is at the back of primarily, light industrial businesses. The Hātea at Pohe Island site sits at the southern toe of reclaimed land and was once a land-fill.

The results may seem intuitive given the lay and description of each site. However, this trial seeks to identify and implement several ways to prevent litter in northlands waterways and oceans. Plastics can enter waterways and oceans in several ways. Overland-either **fly-dumped/discarded** e.g. thrown down a bank near a waterway, **wind** e.g. overflowing recycling bin or discarded item blown into a waterway, or **rain (stormwater)** dispersed e.g. discarded plastic bottles blown down street, crushed e.g. passing car, rain event washes bottle into stormwater or directly into waterway.

The Waiarohia at Pocket Park litter items consisted mainly of construction related items. These were mainly metal fragments, rubber tubing and ceramic fragments. Since 2015 the Hātea Loop Walkway and adjacent Huarahi o te Whai (Pathway of Opportunity) has channelled thousands of people past this, once unseen part of Whangarei Harbour. More recently the Pocket Park opened 1 August 2017, which has afforded even more visitors to the area.

It is surmised that the litter type collected at the Waiarohia at Pocket Park site will change over-time. Anecdotal evidence from previous Hātea Clean-ups suggests that larger items (shopping trolleys etc) have decreased at the Hātea at Old BMX Track site. Reports from Seacleaners show that larger items such as tyres and pallets are still found in the mangroves in the upper reaches of the Hātea River and Limeburners Creek areas. The Hātea Loop Track and the recent Pocket Park has opened and provided new tracts of waterfront for the public to enjoy. This has reinvigorated these areas and created an emphasis and awareness to keep our waterways clean.

Recommendations

The purpose of this trial was to better understand the amount, type and possible source of litter on the upper Hātea River. In turn, this can be provided to policy makers, community groups, TA's and provide statistically sound data to fulfil MfE reporting requirements.

There are many alternatives for food packaging. Ecosolutions provide environmental education that provide alternatives to plastic, single use items. NRC have offered participants in the 2018 Seaweed Beach Clean-up groups to audit one bag of rubbish their group has collected. This will provide a northland-wide insight to litter types, volume and potential sources. Other northland based groups such as Experiencing Marine Reserves (EMR) and Whitebait Connection (WBC) (collectively the Mountains to Sea Trust) programmes provide litter awareness to their students. These groups are complemented further by enviroschool programmes that forms a solid combined environmental education network.

Food related items accounted for 40% of all collected litter items in this trial. The litter item per m² at the Hātea at Old BMX Track site was 1.10. If all Food related items were absent at this site, the total number of litter items would be reduced by 56% (Figure 8). Construction related items made up 50% of all collected litter items in this trial. If all Construction related items were absent at the Waiarohia at Pocket Park site, the total number of litter items would decrease by 71%. This trial has revealed the scope and real potential for good litter data collection. This methodology could be trialled further by the aforementioned groups thus providing community buy-in and awareness through-out Northland.

Seacleaners provide a lot of publicity through their coastal litter clean-ups. They also provide educational presentations to many schools. Litter is an issue that needs to be dealt with in a multi-faceted way for example: **Prevention** e.g. alternatives and education **Publicity** e.g. publicising clean-up events and litter issues **Policy** Central Government review of packaging (types) investments in recycling and plastic alternatives.

In July 2017, a meeting took place to discuss coastal litter in Northland. Attendees were from NRC, WDC, Seacleaners, Ecosolutions, EMR and WBC. It was highlighted that a stronger collaborative approach was required to tackle and better understand coastal litter in Northland. In October 2017, the draft DoC coastal litter methodology was described to various Regional Councils and TA's in Wellington. Ultimately, this provided the perfect timing to trial the methodology at our annual Hātea clean-up and involve attendees from the July meeting.

It is anticipated that this trial will initiate conversations about what approach/s each group can provide e.g., Prevention, Publicity or Policy. The following are some recommended considerations.

EMR and WBC: Continue the educational message about the effects of litter in our waterways including Drains to Harbour data where relevant.

Ecosolutions: Litterless lunch box (food related items), recycling and upcycling.

WDC: Possible gross-pollutant trap surveys to compare with litter collected at adjacent trial sites. Release of Nixon Street gross-pollutant data (if any). Best practice by recycling and rubbish collection contractors. Fines under the Litter Act 1979, how often are these given or how effective are they? Enviropod (stormwater catchpit) studies in conjunction with WBC and NRC.

Seacleaners: Continued publicising the share amount of litter along our coastlines.

NRC: Identify additional coastal litter monitoring sites (representative of Northland). EnviroSchools and Coastcare groups updated and consolidated with the above groups combating coastal litter issues in Northland. Continued and refined reporting to central government and the Northland public as the DoC methodology develops. Integrate a recycling aspect and quantifying litter flux to the next litter survey.

Recycling

This is an area that wasn't explored during this trial. Once material classes have been separated and counted, each item can be checked for recycling viability and recycling number (See Appendix D).

Quantifying litter flux

Another recommendation is based on a case study undertaken November 2014 and repeated eight days later at the Long Island Marine Reserve. Geange (2016) describes how the initial standing stock survey yielded 118 litter items with a combined weight of 23.826 kg (Appendix E) equating to 23 g m⁻² of Long Island Marine Reserve beach. Resurvey of the same stretch of beach eight days following the initial survey revealed a further ten litter items with a combined weight of 0.172 kg's (Appendix F), resulting in a daily litter flux for this period of 0.02 g m⁻² d⁻¹. Items from this case study with specific risks to wildlife included plastic bags, foil wrappers and plastic fragments that represent an ingestion risk, and rope and string that represent an entanglement risk to wildlife.

5 Acknowledgements

Mountains to Sea Trust (Samara-EMR, WBC-Natalie)

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WDC - For constant support

NRC – All the staff who get muddy every year to clean our waterways!

MfE- Sarah Fish

DoC- Shange Geange

Sustainable Coastlines – Camden Howitt

6 References

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7 Appendices

Appendix A Hătea at Old BMX Track UNEP/IOC Litter classification system for litter collected 14 November 2017.

Litter Code	Material Class	Litter Form	Number of items
PL01	Plastic	Bottle caps & lids	44
PL02	Plastic	Bottles < 2 L	2
PL04	Plastic	Knives, forks, spoons, straws, stirrers, cutlery, lollipop sticks	75
PL05	Plastic	Drink package rings, six-pack rings, ring carriers	1
PL06	Plastic	Food containers (fast food, cups, lunch boxes & similar)	12
PL07	Plastic	Plastic bags (opaque & clear)	24
PL08	Plastic	Toys & party poppers	9
PL10	Plastic	Cigarette lighters	2
PL11	Plastic	Cigarettes, butts & filters	57
PL17	Plastic	Fishing gear (lures, traps & pots)	1
PL18	Plastic	Monofilament line	11
PL19	Plastic	Rope	4
PL21	Plastic	Strapping	1
PL24	Plastic	Other (specify) plastic fragments	430
FP05	Foamed Plastic	Other (specify) Polystyrene pieces	190
CL01	Cloth	Clothing, shoes, hats & towels	2
CL04	Cloth	Rope & string	1
CL06	Cloth	Other cloth (including rags)	3
GC01	Glass & ceramic	Construction material (brick, cement, pipes)	1
GC02	Glass & ceramic	Bottles & jars	8
GC07	Glass & ceramic	Glass or ceramic fragments	170
ME01	Metal	Tableware (plates, cups & cutlery)	2
ME03	Metal	Aluminium drink cans	4
ME04	Metal	Other cans (< 4 L)	1
ME06	Metal	Foil wrappers	14
ME08	Metal	Fragments	3
ME09	Metal	Wire, wire mesh & barbed wire	5
ME10	Metal	Other (specify), including appliances (nut)	1
PC04	Paper & cardboard	Tubes for fireworks	4
RB02	Rubber	Footwear (flip-flops)	1
RB05	Rubber	Inner-tubes and rubber sheet	1
WD06	Wood	Other (specify) Fragments and cork	14
		Total	1098

Appendix B Hātea at Pohe Island UNEP/IOC litter classification system for litter collected 14 November 2017.

Litter Code	Material Class	Litter Form	Number of items
PL01	Plastic	Bottle caps & lids	7
PL02	Plastic	Bottles < 2 L	6
PL04	Plastic	Knives, forks, spoons, straws, stirrers, cutlery, lollypop sticks	7
PL06	Plastic	Food containers (fast food, cups, lunch boxes & similar)	14
PL07	Plastic	Plastic bags (opaque & clear)	23
PL13	Plastic	Baskets, crates & trays	1
PL16	Plastic	Sheeting (tarpaulin or other woven plastic bags, palette wrap)	11
PL24	Plastic	Other (specify) key tag	1
FP01	Foamed Plastic	Foam sponge	1
FP04	Foamed Plastic	Foam (insulation & packaging)	3
FP05	Foamed Plastic	Other (specify) Polystyrene pieces	23
CL01	Cloth	Clothing, shoes, hats & towels	2
CL06	Cloth	Other cloth (including rags)	1
GC01	Glass & ceramic	Construction material (brick, cement, pipes)	28
GC02	Glass & ceramic	Bottles & jars	6
GC07	Glass & ceramic	Glass or ceramic fragments	61
ME04	Metal	Other cans (< 4 L)	1
ME06	Metal	Foil wrappers	1
ME08	Metal	Fragments	4
RB02	Rubber	Footwear (flip-flops)	1
WD04	Wood	Processed timber and pallet crates	21
WD06	Wood	Other (specify) Chair	1
OT03	Other	Appliances & Electronics	1
OT05	Other	Other (specify) Lino flooring pieces	6
Total			232

Appendix C Waiarohia at Pocket Park UNEP/IOC litter classification system for litter collected 14 November 2017.

Litter Code	Material Class	Litter Form	Number of items
PL01	Plastic	Bottle caps & lids	3
PL02	Plastic	Bottles < 2 L	4
PL04	Plastic	Knives, forks, spoons, straws, stirrers, cutlery, lollypop sticks	6
PL06	Plastic	Food containers (fast food, cups, lunch boxes & similar)	2
PL07	Plastic	Plastic bags (opaque & clear)	4
PL08	Plastic	Toys & party poppers	1
PL10	Plastic	Cigarette lighters	1
PL11	Plastic	Cigarettes, butts & filters	1
PL15	Plastic	Mesh bags (vegetable, oyster nets & mussel bags)	1
PL19	Plastic	Rope	6
PL20	Plastic	Fishing net	1
PL21	Plastic	Strapping	2
PL24	Plastic	Other (specify)plastic fragments	88
FP01	Foamed Plastic	Foam sponge	3
FP04	Foamed Plastic	Foam (insulation & packaging) polystyrene	17
CL04	Cloth	Rope & string	11
CL05	Cloth	Carpet & furnishing	4
CL06	Cloth	Other cloth (including rags)	27
GC01	Glass & ceramic	Construction material (brick, cement, pipes)	10
GC02	Glass & ceramic	Bottles & jars	17
GC07	Glass & ceramic	Glass or ceramic fragments	135
ME03	Metal	Aluminium drink cans	3
ME08	Metal	Fragments	218
ME09	Metal	Wire, wire mesh & barbed wire	15
ME10	Metal	Other (specify), including appliances (top of a vice)	1
PC01	Paper & cardboard	Paper (including newspapers & magazines)	13
PC02	Paper & cardboard	Cardboard boxes & fragments	1
RB04	Rubber	Tyres	1
RB08	Rubber	Other (specify) (tubing,pipe,hosing)	27
WD04	Wood	Processed timber and pallet crates	5
WD06	Wood	Other (specify) (bent frame)	1
OT04	Other	Batteries (torch type)	1
OT05	Other	Other (specify) Road cone	1
Total			631

Appendix D Example of amended recycling audit sheet.

Litter Code	Material Class	Litter Form	Recycling number	Viable for recycling	Number of items
PL01	Plastic	Bottle caps & lids		?	3
PL02	Plastic	Bottles < 2 L	2	3/4	4
GC02	Glass & ceramic	Bottles & jars	-	15/17	17

Appendix E The number and weights of litter forms collected from an initial standing stock survey along a 100 x 10m stretch of beach at Long Island Marine Reserve in Nov 2014.

Litter code	Material class	Litter form	Number	Weight (kg)
GC02	Glass & ceramic	Bottles & jars	4	0.842
PC02	Paper & cardboard	Cardboard boxes & fragments	1	0.148
CL04	Cloth	Rope & string	13	0.523
FP02	Foamed Plastic	Cups & food packs	6	0.015
FP05	Foamed Plastic	Other	14	0.156
FP04	Foamed Plastic	Foam (insulation & packaging)	1	0.018
CL05	Cloth	Carpet & furnishing	1	6.180
CL03	Cloth	Canvas, sailcloth & sacking (hessian)	1	0.046
PL02	Plastic	Bottles < 2 L	11	0.477
PL06	Plastic	Food containers (fast food, cups & sim.)	3	0.085
PL01	Plastic	Bottle caps & lids	2	0.006
PL07	Plastic	Plastic bags (opaque & clear)	12	0.029
PL10	Plastic	Cigarette lighters	1	0.009
PL21	Plastic	Strapping	1	0.001
PL24	Plastic	Other	9	0.133
OT03	Other	Appliances & Electronics	1	0.098
PL24	Plastic	Other	1	0.069
ME08	Metal	Fragments	1	0.866
ME03	Metal	Aluminium drink cans	1	0.125
WD04	Wood	Processed timber and pallet crates	35	14.000
TOTAL			118	23.826

Appendix F The number and weights of litter forms collected from a resurvey along a 100 x 10 m stretch of beach at Long Island Marine Reserve eight days after an initial standing stock survey in Nov 2014.

Litter code	Material class	Litter form	Number	Weight (kg)
PL19	Plastic	rope	3	0.007
WD04	Wood	processed timber	1	0.119
GC02	Glass & ceramic	beer bottle	1	0.004
FP02	Foamed Plastic	foam pieces	2	0.002
PL04	Plastic	drinking straw	1	0.001
ME06	Metal	popcorn packet	1	0.010
PL02	Plastic	popcorn packet	1	0.029
TOTAL			10	0.172



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KAITĀIA: 192 Commerce Street, Kaitāia; Phone 09 408 6600, Fax 09 408 6601.

ŌPUA: Unit 10, Industrial Marine Park, Ōpua; Phone 09 402 7516, Fax 09 402 7510.

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