Palâstikket sitjani

Plastics on shorelines

Elizabeth Tuglavina (very back), Katrina Anthony, and Susan Nochasak look in a rope quadrat for plastics in Uivak (none found in this sample). June 27, 2024. Photo: Max Liboiron

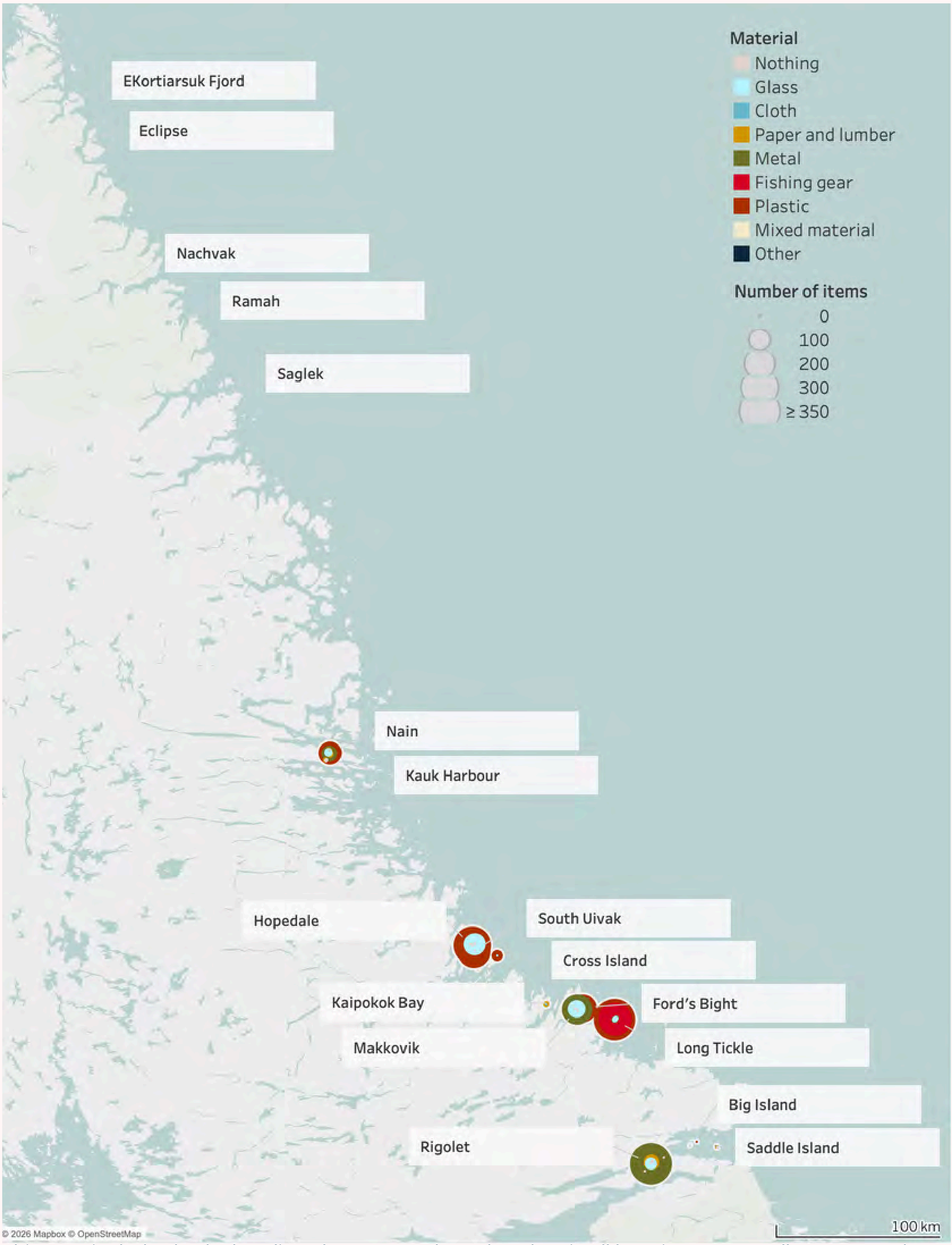
There are two ways we study plastics on shorelines: by picking up large items (shoreline clean ups) and by using a more detailed ecological technique called quadrats where we place a square outline on the ground and count the number of microplastics and other small waste inside.

Each gives us a different kind of information. Shoreline clean ups collect all the waste and give good ratios of the type of waste on the entire shore. We can also get information from the item itself, such as where it might be from. However, it only identifies large items you can see from a standing position. Quadrats give us concentration data—the number of items in a square meter—which can tell us the severity of the issue and lets us directly compare different places. But because quadrats are random and favour smaller items, they often miss larger items like fishing line.

Both methods are represented in the map on the next page.

Tony Andersen shows an example of drift cards released intentionally by scientists (not us!) to track oil spills around Makkovik. He picked this one up and kept it. It tells us where plastics drift as well. August 2023. Photo: Max Liboiron.

Figure 50: Map of all shoreline locations, Nunatsiavut, 2017-2025



This map includes both shoreline clean ups and quadrat data in all locations across all years over the course of the study. Further north in the Torngats, you can see many quadrats had no plastics in them (grey indicates nothing was found). The most items are found in shoreline clean ups, which were often done in or near communities. The most remote location (farthest from a community) with the most plastics was Long Tickle near Makkovik, which also had the greatest share of come-from-away plastics in the study.

Table 32: Summary of plastics in quadrats from Nunatsiavut 2021-2025

Region	Location	Sample size	% of quadrats with no plastic	Mean density (plastics/m²)	Standard deviation [a]	Median density (plastics/m²)[b]	IQR[c]
Hopedale	Near airstrip	71	87%	0.79	2.50	0	0.0
	Town	85	79%	1.41	3.31	0	0.0
	South Uivak	8	100%	0.00	0.00	0	0.0
	Top Pond	62	89%	0.97	3.29	0	0.0
	Total	**226**	**85%**	**1.04**	**3.01**	**0**	**0.0**
Makkovik[d]	Landfill	2	50%	1.00	1.41	1	1.0
	Ranger Bight	21	71%	0.62	1.24	0	1.0
	Sewage outfall	17	53%	0.88	1.50	0	1.0
	Wharf	11	9%	3.64	3.98	2	3.5
	Total	**51**	**51%**	**1.37**	**2.45**	**0**	**2.0**
Nain	Town (Illusuak Cultural Centre)	5	0%	8.40	6.50	9	6.0
	Kauk Bay	8	100%	0.00	0.00	0	0.0
	Kauk Harbour	23	87%	0.30	0.82	0	0.0
	Total	**36**	**78%**	**1.36**	**3.67**	**0**	**0.0**
Rigolet	Big Island	14	100%	0.00	0.00	0	0.0
	Boardwalk	35	86%	0.80	2.34	0	0.0
	Cabin	10	100%	0.00	0.00	0	0.0
	Cross Island	5	100%	0.00	0.00	0	0.0
	Saddle Island	15	87%	0.53	1.41	0	0.0
	Town	12	75%	8.33	15.95	0	5.0
	Total	**91**	**89%**	**1.49**	**6.38**	**0**	**0.0**
Torngats	Eclipse	16	100%	0.00	0.00	0	0.0
	EKortiarsuk Fjord	19	100%	0.00	0.00	0	0.0
	Nachvak	38	92%	0.08	0.27	0	0.0
	Ramah Bay	14	100%	0.00	0.00	0	0.0
	Saglek	184	95%	0.26	1.23	0	0.0
	Total	**271**	**96%**	**0.19**	1.02	**0**	0.0
Nunatsiavut	**Total**	**675**	**87%**	**0.80**	**3.21**	**0**	**0.0**

0-24%
25-49%
50-74%
75-99%
100%

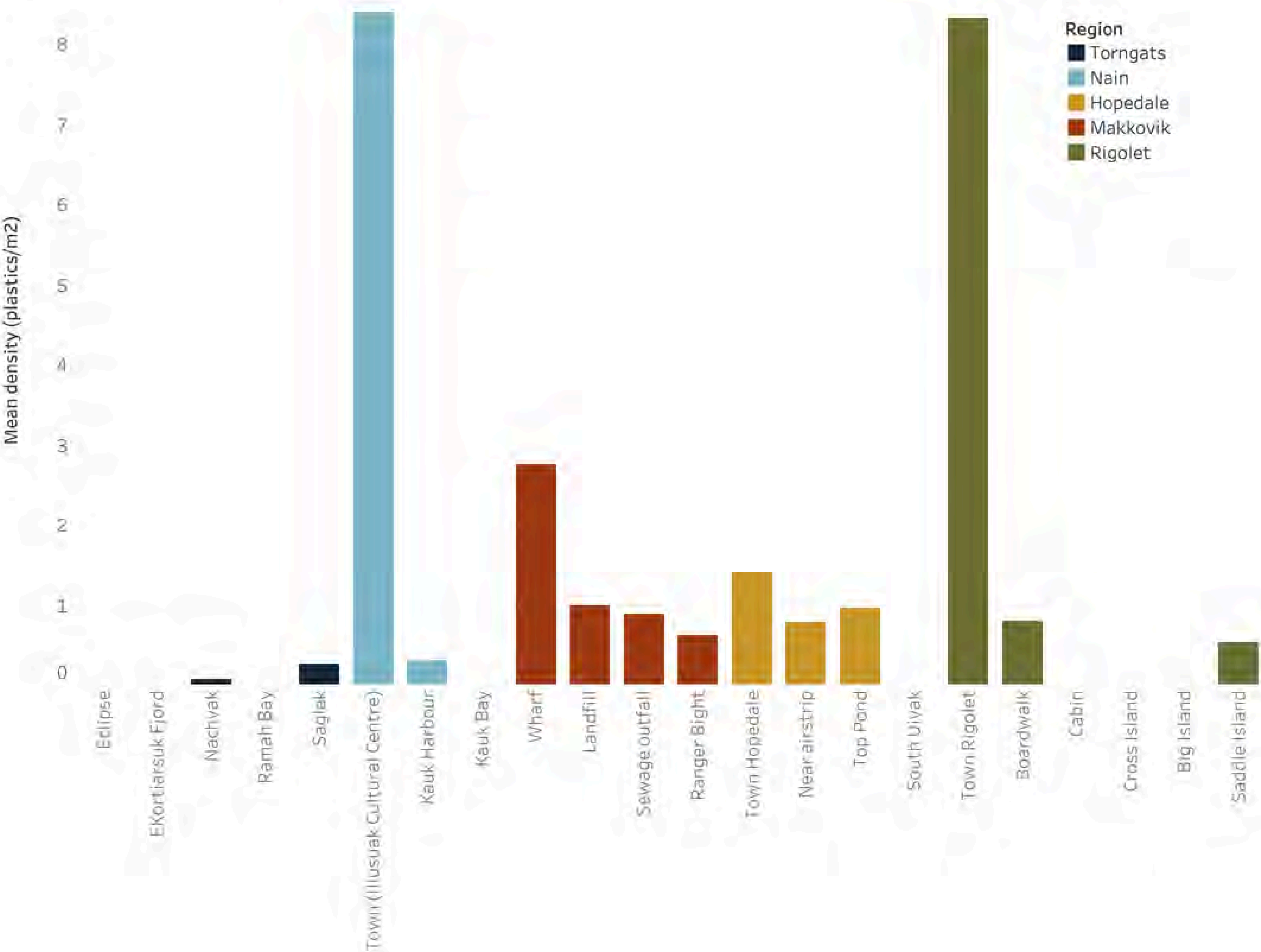
[a] The standard deviation (SD) tells us how far data points are from the mean. It measures variation. When the standard deviation is smaller than the mean, the data points are clustered relatively close to the average, suggesting consistent values. When the SD is larger than the mean, the data is highly spread out (more variation), which often indicates the presence of extreme outliers or that the average isn't a good representation of the "typical" value.
[b] The median is an average that is the most central number in a dataset. If the median number of plastics is 0, it means most animals in the study ate no plastics.
[c] The Interquartile range (IQR) tells us about the spread of the middle 50% of data points. In this baseline, an IQR of 0 means that at least three quarters of the animals ate no plastics.
[d] Makkovik is exclusively around town, while other areas include shorelines farther from roads and wharves, which explains the difference in mean concentrations.

PitaKanningit sitjani palâstikkisajannik

Concentration of shoreline plastics

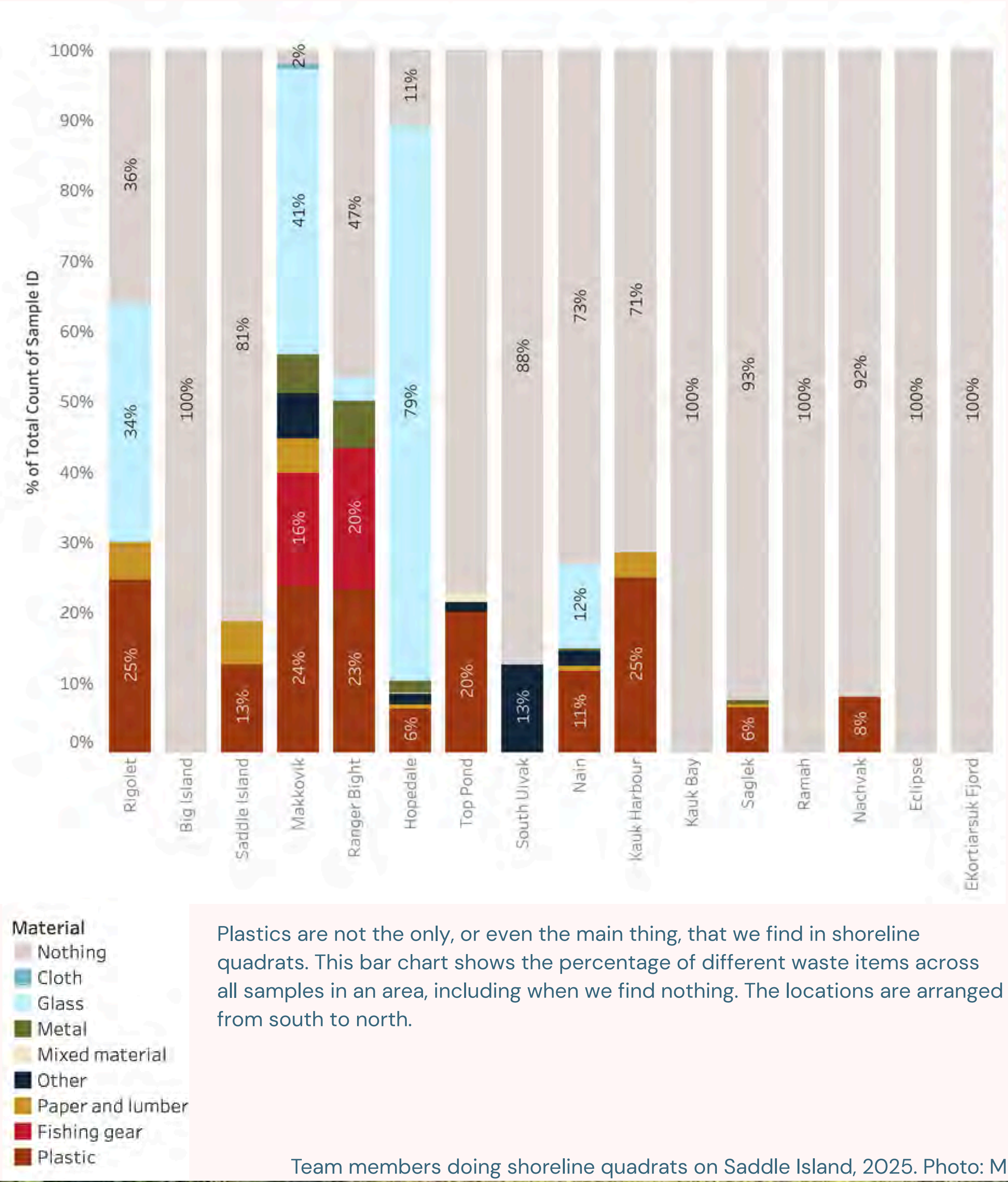
When we use a quadrat – a square marker on the ground – we can calculate how many plastics are in a meter square, and extrapolate that to a region or shoreline. Liz and Max (and many others!) will get on our hands and knees and put our faces close to the ground to find the tiniest plastics we can see. This is the method we always use.

Figure 51: Summary of plastics in quadrats from Nunatsiavut 2021-2025



Each bar in the graph is an average of all the quadrats done in that location.
They are arranged from the most northern to most southern location, so you can see that the main trend is not in north/south, but in distance from a community. That shoreline plastics are highest near communities, and thus originate from communities, is consistent with findings worldwide.

Figure 52: Ratio of waste items in shoreline quadrats from Nunatsiavut 2021–2025



Plastics are not the only, or even the main thing, that we find in shoreline quadrats. This bar chart shows the percentage of different waste items across all samples in an area, including when we find nothing. The locations are arranged from south to north.

Team members doing shoreline quadrats on Saddle Island, 2025. Photo: Max Liboiron.

UKinningit inigijangita sitjani palâstikkisajait

Weight distribution of shoreline plastics

Each year from 2023-2025, we recorded the weights of items collected from shoreline cleanups at three locations—Makkovik (2023), Hopedale (2024), and Rigolet (2025). The results show two ways to think about shoreline plastics—how *many* (count) and how *heavy* (weight) (For details see A16). For instance, we found that plastics from non-food packaging are 18% of all items—the largest share. However, when we look at the weights, fishing line was the most dominant type of shoreline plastic, accounting for 30% of the total plastic weight. Note that we collected the most—and the heaviest—plastics in Long Tickle, Makkovik, which is the farthest from town.

Table 33: Number and weight of plastics collected from shoreline cleanups in Nunatsiavut by location, 2023-2025

Region	Location	# of plastics	Weight (kg)
Makkovik	By Wharf	40 (1.4%)	0.72 (0.7%)
	By the clinic	21 (0.7%)	0.16 (0.2%)
	Ranger Bight	24 (0.8%)	0.22 (0.2%)
	Ford's Bight	189 (6.5%)	10.89 (11.0%)
	Cape Strawberry	20 (0.7%)	6.09 (6.1%)
	Long Tickle	1128 (38.8%)	45.87 (46.1%)
Hopedale	By the airport	333 (11.5%)	9.56 (9.6%)
	North Uivak	759 (26.1%)	10.67 (10.7%)
	South Uivak	74 (2.6%)	0.91 (0.9%)
	Cross Island	88 (3.0%)	4.83 (4.9%)
Rigolet	Rigolet Town	230 (7.9%)	9.57 (9.6%)
Total		**2906 (100%)**	**99.49 (100%)**

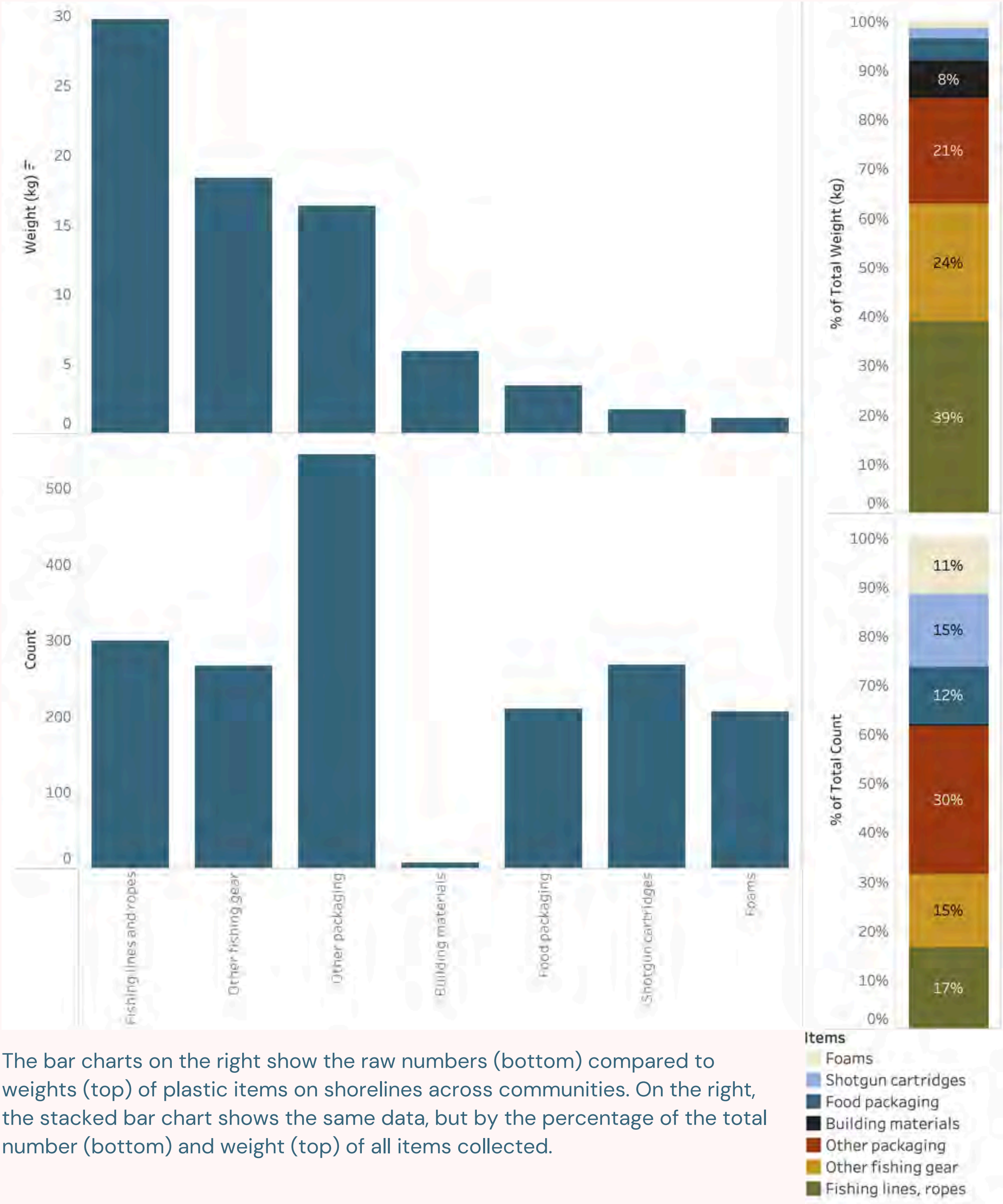
Shoreline plastics collected around Makkovik, 2023.. Photo: Max Liboiron.

Table 34: Number and weight of plastics collected from shoreline cleanups in Nunatsiavut by type, 2023-2025

Type of plastic	# of plastics	Weight (kg)
Fishing line/rope	299 (10.3%)	29.78 (29.9%)
Other fishing gear	267 (9.2%)	18.38 (18.5%)
Food packaging	210 (7.2%)	3.40 (3.4%)
Other packaging	544 (18.7%)	16.34 (16.4%)
Foams	206 (7.1%)	1.08 (1.1%)
Cigarettes	9 (0.3%)	0.002 (0.002%)
Shotgun cartridges	268 (9.2%)	1.70 (1.7%)
Building materials	7 (0.2%)	5.88 (5.9%)
Other plastic	1096 (37.7%)	22.94 (23.1%)
Total	**2906 (100%)**	**99.49 (100%)**

Shotgun shells (left) and threads from fishing line (right) being weighed from cleanup in Makkovik 2024.
Photo: Max Liboiron.

Figure 53: Comparison of the weight and count of plastics collected from shoreline cleanups in Nunatsiavut, 2023-2025



The bar charts on the right show the raw numbers (bottom) compared to weights (top) of plastic items on shorelines across communities. On the right, the stacked bar chart shows the same data, but by the percentage of the total number (bottom) and weight (top) of all items collected.

Plastics are usually small and light, so counting plastics tends to over-represent smaller items, like pieces of foam or fragments. Measuring the weight of plastics can show where the most plastic material is in the environment. Since larger plastics fragment into smaller ones, and larger plastics can also entangle wildlife, this may be the more meaningful measure. The reason count data is prioritized is because most Western scientific data reports counts, and it has become the norm. This doesn't make it the best measure!

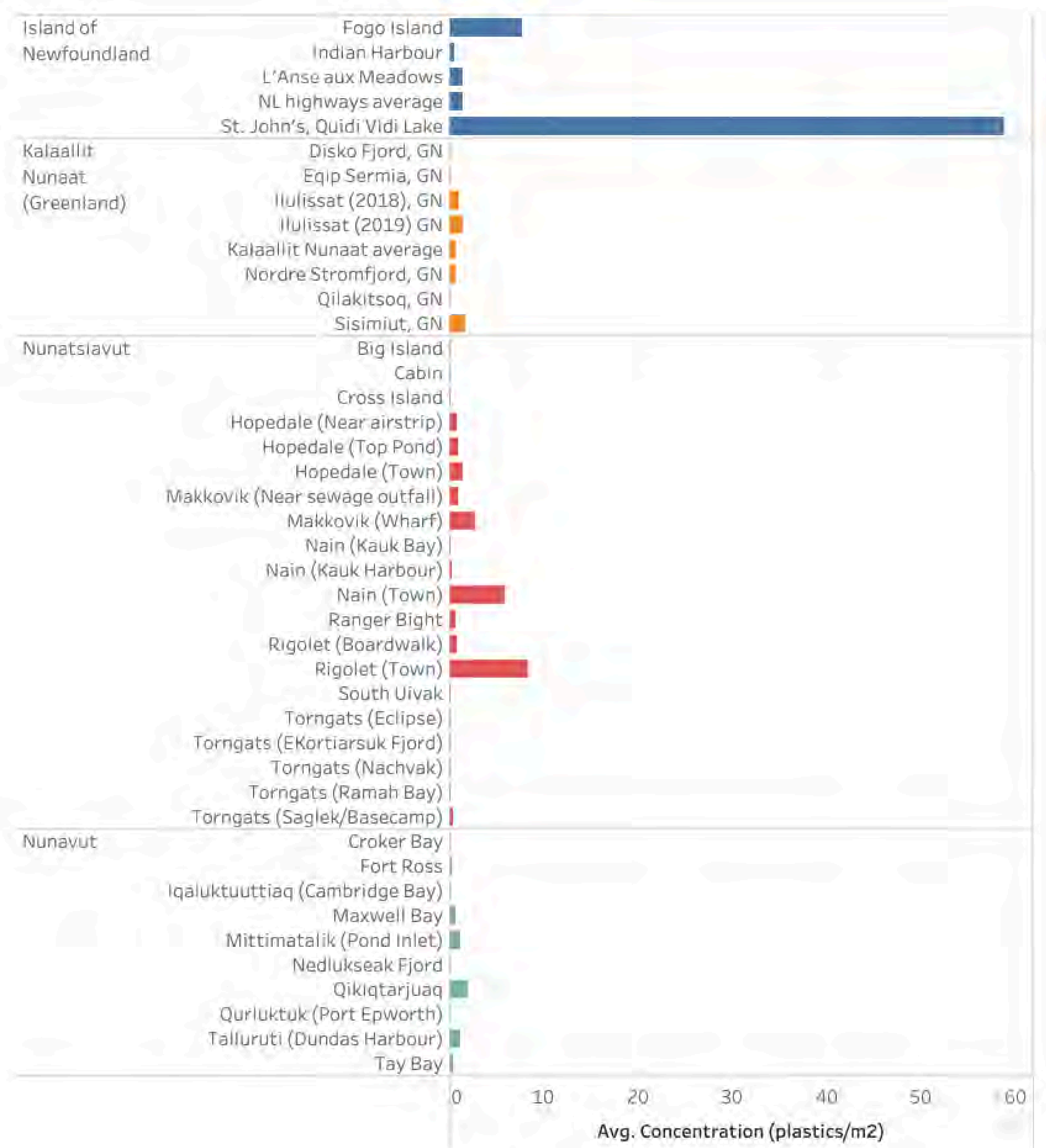
Cigarette butts are a particular concern because they are the most highly toxic form of single-use plastic waste. Most cigarette butts are made from a type of plastic called cellulose acetate. Cigarette butts retain the toxicity from commercial tobacco, including nicotine and carcinogens, and have been found to kill or harm organisms that live in the water around disposed butts (Slaughter et al. 2011). For instance, they can cause malformations in sea urchins, death in crustaceans, and reduced sizes in some fish species (Lucia et al. 2023). Moreover, the toxicants can accumulate in mussels, where it can pass farther up the food web and cause reduced filtration (feeding) in mussels, even with constantly flowing seawater (Lucia et al. 2023, Green et al. 2021). The toxicants from cigarette butts can also stay in sediment for prolonged periods of time (King et al. 2021).

The most common types of plastics shoreline surveys for large debris were packaging (10%), fishing gear (9%), bottles/containers (7%), and plastic bags (5%). Only one of these plastic bags was a carrier bag, of the type that were banned in Nunainguk (Nain) in 2009. Instead, they were trash bags, blue fish bags, and bags that came from other sources.

Globally, about 85% of shoreline wastes are plastics, whether on sandy or rocky shores (Thiel et al. 2013). In Nunatsiavut, the average is 51% plastics, followed by glass/ceramic (23%), metal (15%) and lumber/paper (9%). This mainly indicates that there is long-term use of shorelines in the area (we don’t need science to tell us that).

Cigarette butt among red berries, near Maggovik (Makkovik), 2021. Photo: Max Liboiron.

Figure 54: Comparison of concentrations of plastics on shorelines between Nunatsiavut and nearby regions, 2017-2025



For more details see Appendix Table A13. This comparison is only for plastics, not other waste materials such as glass or metal.

[a] Saglek, inclusive of Torngats Basecamp, which was explicitly surveyed by Mallory et al. 2021. Saglek quadrats in our study include Basecamp and surrounding area

[b] Note that the specific shoreline selected in Joe Batt's Arm for this study was a known high-loading beach, which accounts for the high concentration of plastics.

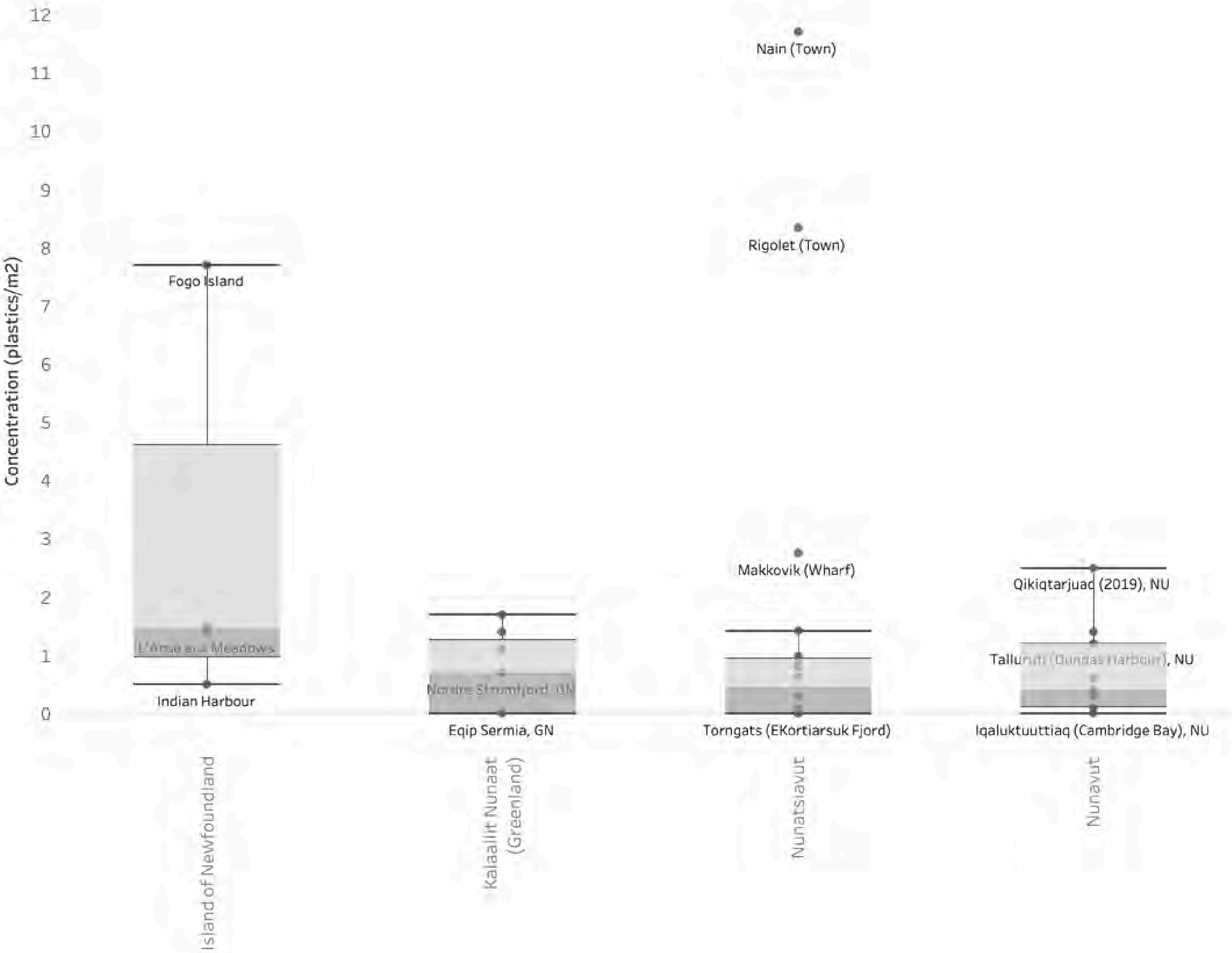
[c] Calculated based on reported average and percent plastics.

This visualization shows that within a region, some variability is normal, and there are even trends in that variability, such as how the highest spikes in Nunatsiavut and on the Island of Newfoundland are in or near communities. It also shows why averages can be misleading for some kinds of data, and why we choose to show two shoreline concentration summaries for Nunatsiavut: one for in town, and one for outside of communities. It's best to compare town-to-town data, and data from outside of communities directly to one another.

In the chart on the facing page, we compare our results from shoreline quadrats to those of other studies, including Mallory et al. (2021), who used photographs of quadrats to quantify plastics. They mention that most of their plastics were larger than 5mm, while most of ours were under 5mm (2021: 4). It is likely that our method found more plastics because we could see much smaller plastics getting close to the ground rather than relying on photographs.

Overall, Nunatsiavut has a lower concentration of plastics on shorelines compared to Nunavut, Kalaallit Nunaat (Greenland), and the island of Newfoundland. But shorelines in town centres (like in Nain and Rigolet) had plastic concentrations that are higher than nearby Arctic and sub-Arctic regions, even rivalling figures on the island of Newfoundland.

Figure 55: Whisker and blox plots of concentrations of plastics comparing shorelines in Nunatsiavut to nearby regions



A box-and-whisker plot (box plot) visually summarizes a dataset's distribution. The boxes represent the interquartile range (IQR) — the middle 50% of the data. Within each box, the light and dark grey shading splits the IQR into two halves: the darker grey is the lower half (Q1 to median), and the lighter grey is the upper half (median to Q3). This helps you quickly see if data is skewed up or down within that middle band.

The horizontal line inside each box marks the median (the most middle number).

Thin vertical "whiskers" extend above and below to show the range of typical (non-outlier) data. Such as Indian Harbour on the Island of Newfoundland.

The blue dots are individual data points that are outliers to the spread. We use this kind of plot because it clearly shows that Nain, Rigolet, and Makkovik town data is very dissimilar to other measurements in the dataset.

As you can see, the island of Newfoundland is very different than the other locations–and this is after we took out Quidi Vidi Lake, which skewed the data enormously because there were so many plastics. The Fogo Island location was chosen for its study because it was a loading beach (a shoreline that collected an usual number of plastics). Greenland, Nunatsiavut, and Nunavut all show low, tight concentrations mostly clustered near 0–2 plastics/m². But you can also see that some of the concentrations in communities in Nunatsiavut are similar to the island of Newfoundland.

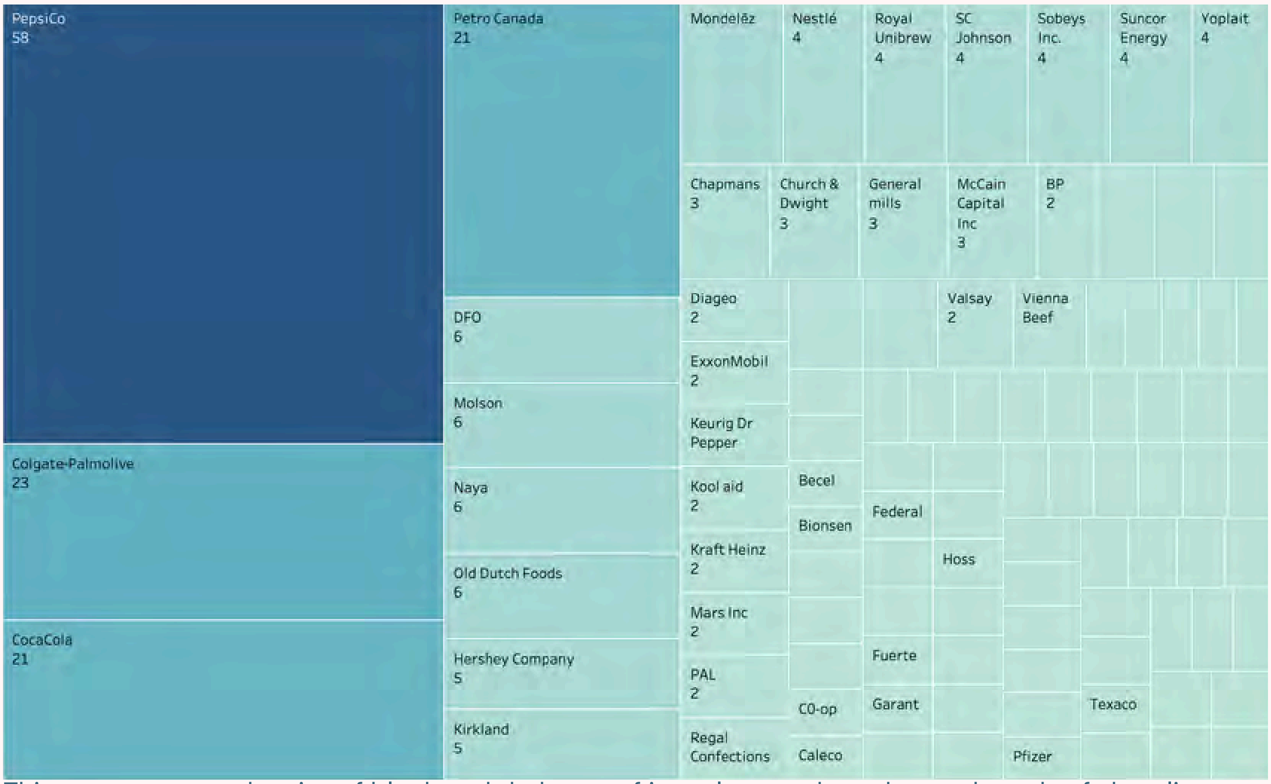
Frédéric Dwyer-Samuel looks for plastics in a quadrat in Kauk Bight near Nunainguk (Nain), 2021. No plastics were found in this quadrat. For more on this area, see the section on sources. Photo: Max Liboiron.

One of the techniques that community and advocacy groups can use to describe shoreline plastics, which tend to be intact, is called a **brand audit.** This means identifying an item's maker, and then seeing if that company is owned by a larger company. In the image below, for example, several types of branded chip bags are created by Frito Lay.

This technique lets communities identify the original source of plastics—not consumers, who do not usually have a choice about what type of packaging food comes in, but producers of disposable plastics that last in the environment.

All shoreline items that have a brand or barcode are sorted so we can identify the company that created and profited from plastic packaging. These are from Hopedale, 2024. Photo: Max Liboiron

Figure 56: Brands of plastics collected from shoreline cleanups in Nunatsiavut, 2017-2025



This treemap uses the size of block and darkness of its colour to show the top brands of shoreline plastics. The total number of items is also noted. PepsiCo accounts for 19.7% of all branded items, followed by Colgate-Palmolvie at 7.8%, and Petro Canada (mainly lube bottles) and Coca-cola tied at 7.1%.

Some of the top polluters in Nunatsiavut are similar to top polluters worldwide: Coca-Cola and PepsiCo. However, many more are unique to North American or Canadian contexts, such as PetroCanada, DFO, Molson Canadian, and Kirkland (Costco).

The image to the left is from the #BreakFreeFromPlastic campaign, an international project that uses brand audits to hold polluters accountable. In 2023, the conducted 250 brand audits in 41 countries, mainly in the global south (Break Free From Plastics, 2023).