Nakit piKattaningit palâstikket

Sources of plastics

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Plastic fragments, likely from fishing hear, on Long Tickle outside of Makkovik, 2023.
Photo: Max Liboiron

Where are these plastics coming from? For this section of the report, we're going to talk about whether plastics on shorelines, ingested by animals, and in the water came from Nunatsiavut or came from outside the region. Plastics can travel very long distances through water or air, and even inside migrating animals. Figuring out whether plastics in Nunainguk (Nain) came from Nunainguk (Nain) or from Texas (or somewhere even further away) is an actual research question.

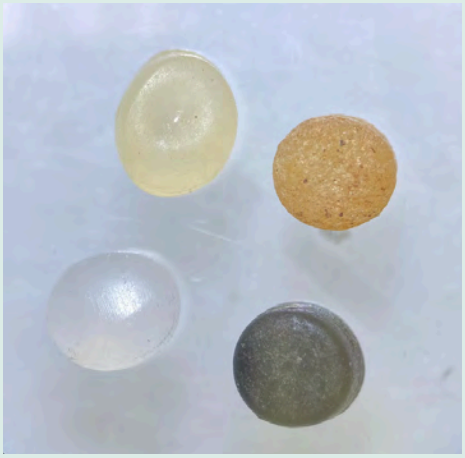
When we can identify where a plastic likely comes from, we find that most plastics in Nunatsiavut likely come from Nunatsiavut. However, plastics aren't made in Nunatsiavut. Even if someone in Nunatsiavut doesn't want to use plastics they don't usually have a choice since the stores do not offer much packaging variety. So when we say the source of plastic pollution in Nunatsiavut is mostly local from land activities in the area, we mean that only as the latest stop in a longer supply chain of plastics. **Plastics truly only come from one place: industry.** The best way to reduce plastics is to reduce the flow of plastics into a community from industry (like Nunatsiavut's plastic bag ban) or better yet, keep them from being produced by industry in the first place. However, because a lot of the plastics in the environment in Nunatsiavut pass through Nunatsiavut, there are also ways that we as a community can reduce plastics in the ocean, on shorelines, and in animals.

One of the major data sources for shoreline plastics in Nunatsiavut is from shoreline cleanups that used the Marine Debris Tracker app.

Polymer fishing line that is starting to fragment in the sun. Long Tickle, near Maggovik (Makkovik), 2023. Photo: Max Liboiron

Palâstikkisajait Nakit pisimanningit Kaujisattaujut

Plastic Source Forensics



We cannot estimate the origin of all plastics, particularly microplastics. But there are a few types of plastics that are obviously from away.

For example, **industrial plastic pellets** are spilled into the ocean from the plastic industry, either directly into waterways or during shipping. We found three of these pellets on the shoreline in Nunainguk (Nain) in 2021, and they absolutely came from somewhere else since there are no plastic plants in Newfoundland and Labrador. Pellets, also called nurdles, look like squished beads with no hole in them.

Other plastic morphologies (shapes) also indicate localness. Some plastics are fragile, such as film plastics like plastic bags and foam plastics like from Styrofoam coolers that shred quickly in the strength of the ocean. When we find those, we know they have been in the water for a relatively short period of time. There are also wastes like paper, cardboard, and other intact materials that break down or dissolve quickly so if we find them intact, they're local.

If a plastic is large enough, we can use the brand of the plastic to identify its origins. Since most communities in Nunatsiavut have a limited number of stores, locals can tell us if and when some brands are available on the coast, when something was likely bought in Goose Bay, and in some cases, when the plastic comes from overseas like in the example pictured below.

Lid to a "Faxe Kondi" soft drink container. A few of these were found around Long Tickle near Maggovik (Makkovik) in 2023 during shoreline clean ups. Faxe Kondi is a Danish soft drink produced by Royal Unibrew. While this may have come from Denmark, when Liz Pijogge went to Kalaallit Nunaat (Greenland) to do research shortly after seeing these in Maggovik (Makkovik), she noticed the drinks were on sale there. This likely came from Kalaallit Nunaat (Greenland). In any case, it isn't local! Photo: Liz Pijogge.

Local knowledge is one of the most reliable ways to source plastics. We held a workshop in Makkovik (2023), Hopedale (2024), and Rigolet (2025), where people helped us identify and categorize plastics we cleaned up from shorelines. Not only were particular types of fishing gear and their associated fisheries identified, but we could also figure out the dates of some items, which stores items were bought from, and in Makkovik we heard lots of stories of plastic items with Russian Cyrillic writing or items with origins that were traced to Nunavik, the USA, or other places.

Thank you to everyone who helped us identify these plastics!

Top: Marilyn Faulkner and Tony Anderson tell Zoltan Mester (center) about the date of an Esso oil container that hasn't been sold in Maggovik (Makkovik) since the 1960s. August 2023. Photo: Lauren Pilgrim. Bottom: Evening analysis session identifying plastics found near Maggovik (Makkovik). Left to right: Max Liboiron, Irene Heard, Billie Andersen

We compare plastic fragments to likely source items. In collaboration with local people, when we identify a likely source for a plastic, we try to gather a local example of the source item to compare it it. We can compare colour, morphology, and polymer type.

Left: A blue microplastic found in surface water in Maggovik (Makkovik) in 2019 near the wharf under the microscope. Rodd Laing thought might be from a tarp.
Middle: A thin shred of plastic found on a shoreline in Maggovik (Makkovik) in 2022 that Max thought might also be from a tarp, based on what Rodd thought.
Right: A worn-out tarp in Maggovik (Makkovik) from 2022 that we took a sample from for comparison. All had the same colour, erosion patterns, and polymer type. They're very likely all from tarps!
Photos: Max Liboiron

There is a type of plastic that tells you exactly where it came from: DFO fish tags. In a study that used fish tags found washed up by beachcombers from all over the world, Max and their students found that 75% of Newfoundland and Labrador's fish tags left the province and washed up in the United Kingdom (19%), France (10%), Ireland (6%), Portugal (4%), Spain (2%), and a handful of other locations (Liboiron et al 2021: 19). Only one of these tags originated in southern Labrador (not Nunatsiavut) and was found on Rathlin Island, Ireland. Three fish tags found in Maggovik (Makkovik) in 2023 were from the local Labrador commercial kavaisitik (salmon) fishery in the late 1980s According to Tony Andersen in Maggovik (Makkovik), likely quite close to where we found the tags in Long Tickle since the boats that picked up the commercial kavaisitik (salmon) hauls used to come by there.

A fish tag from 1989 found in 2023 on Long Tickle. Photo: Max Liboiron.

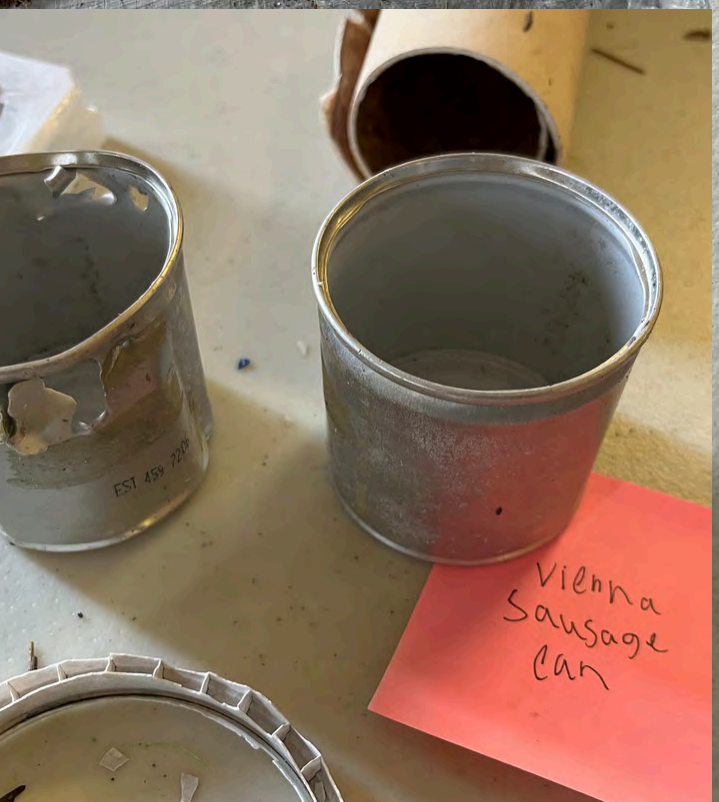
Kanuittoningit Kimiggutausimajut
Brand Audit

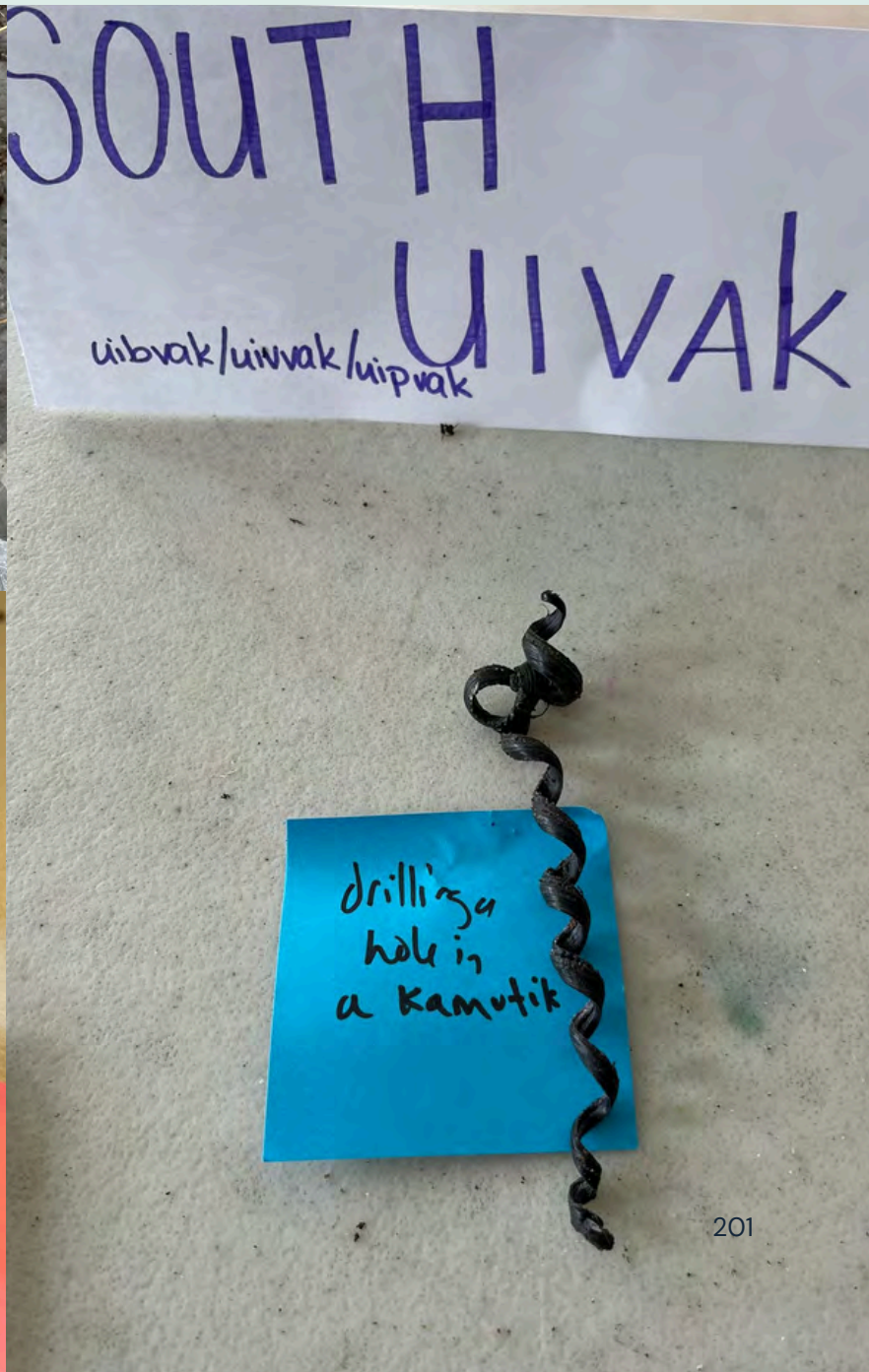
A brand audit is when researchers record the brand of a shoreline plastic to determine which industries are the core sources of plastics in a region. It's a community-based method developed in the Philippines that we also use on our research (Break Free From Plastics, 2023). Figure tktkt in the previous section on shorelines shows the Nunatsiavut brand audit: 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%. There are smaller shares spread across many other brands, many of them regional such as DFO (fish tags), Molson Canadian, or Kirkland (Costco).

You can tell some brands without even needing the label! Top Left: Frito Lay packaging identified in Hopedale, 2025. Photo: Max Liboiron

Bottom Left: Vienna sausage cans identified during the Maggovik (Makkovik) community workshop. Photo: Lauren Pilgrim

Right: From Drilling a hole in Kamutik, identified during the Hopedale Workshop, 2025. Photo: Max Liboiron.





Nalunaittausot Nakit pisimanningit Palâstikkisajait

Identifiable Sources of Plastics

Sources of plastics ingested by fish and seals can be hard to determine because the pieces are so tiny. However, we can use a combination of their morphology (form and shape) and polymer type (the chemical origins) to try to identify sources. On shorelines, sources are often more reliable since the plastics we find there are usually much larger and more intact, making it easier to identify where they came from. Surface water plastics are somewhere in between: they are usually larger and more in-tact than plastics found in animals, but still certainly smaller than shoreline plastics.

These methods mean that we can tell where plastics likely come from– not for certain, but with some forensic confidence.

Table 35: Likely[a] source of plastics by type of sample, Nunatsiavut, 2017-2025

Type of sample[b]	Sample size	Total number of plastics	% waste water	% packaging	% fishing	% cigarettes	% paint	% local[c]
All animals	901	346	43%	7%	10%	0.3%	11%	13%
Shoreline (MDT)	23	7686	[d]	23%	9%	4.0%		59%
Shoreline (quad)	963	134		28%	15%	5.0%		53%
Surface water	70	214	18%	9%	13%	1.0%	8%	23%
TOTAL	**1961**	**4926**	**2%**	**22%**	**9%**	**4.0%**	**1%**	**56%**

75-100%
50-74%
25-49%
1-24%

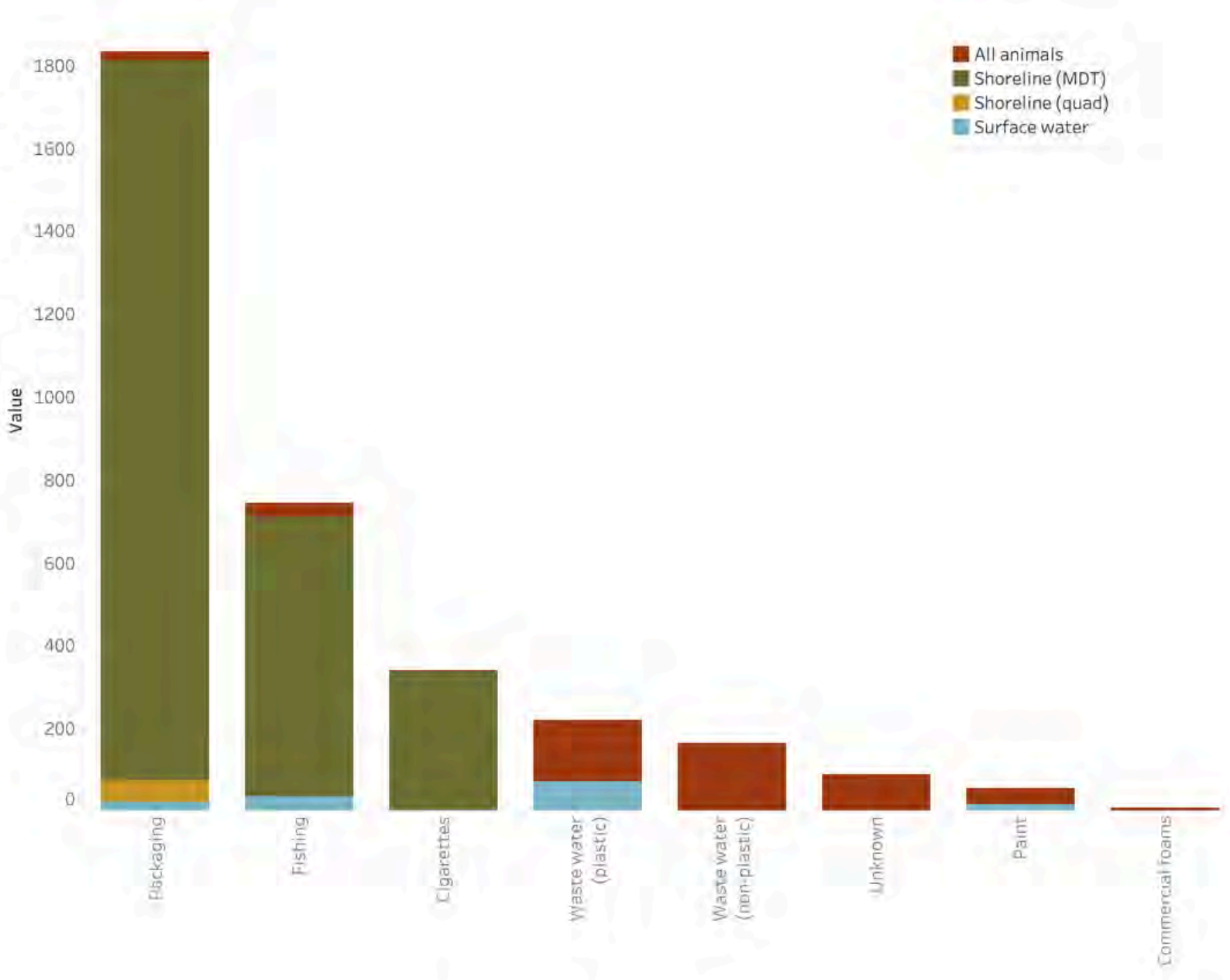
[a] "Likely" indicates a forensic assessment based on material characteristics to infer probable sources of plastics. For example, microfibres are categorized as wastewater because they primarily originate from clothing, even though some may also come from the atmosphere.

[b] Snow, ice, freshwater, and drinking water are not included here because their plastic particles are too small to be robust in source analysis.

[c] These figures include only plastics whose characteristics (such as intact condition) suggest short-range transport or local sources; many plastics, including microfibres, cannot be reliably classified as local or long-range. Even though we only identify 56% of plastics as likely local, we expect that a higher proportion of plastics originate locally given that some plastics, like microfibres, aren't included in this analysis.

[d] Blanks mean that we did not find anything but also that we were not looking for it. We didn't find any paint in shoreline quadrats but we also were not looking for paint, so its not a zero.

Figure 57: Sources of plastics found in Nunatsiavut, based on type of study, 2017-2025



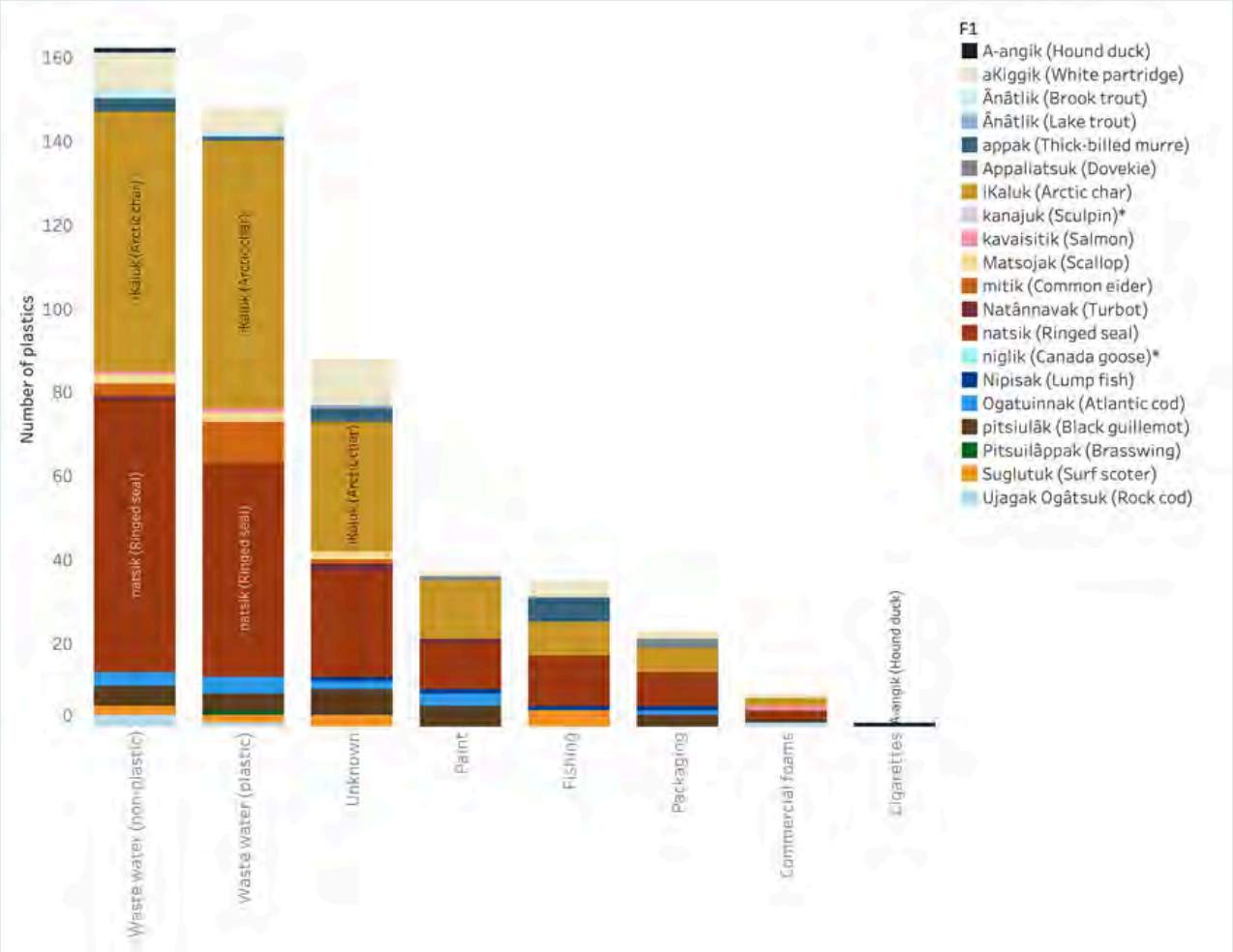
This bar graph shows the number of individual items from each source category (including those we could not identify), colour coded to show which method of research identified them.

As Figure 57 shows, the main, identifiable source of plastic waste in Nunatsiavut is packaging. However, almost all of that was found on shorelines, which is the method that produces the largest plastics and the highest number of plastics. Wastewater, though not a category with the highest count, is the main contributor to plastics in animals (and we cannot see them in shoreline clean ups because they are too small).

The plastics with the highest counts and the plastics that Nunatsiavummiut might want to address the most, with the highest stakes, may not be the same plastics.

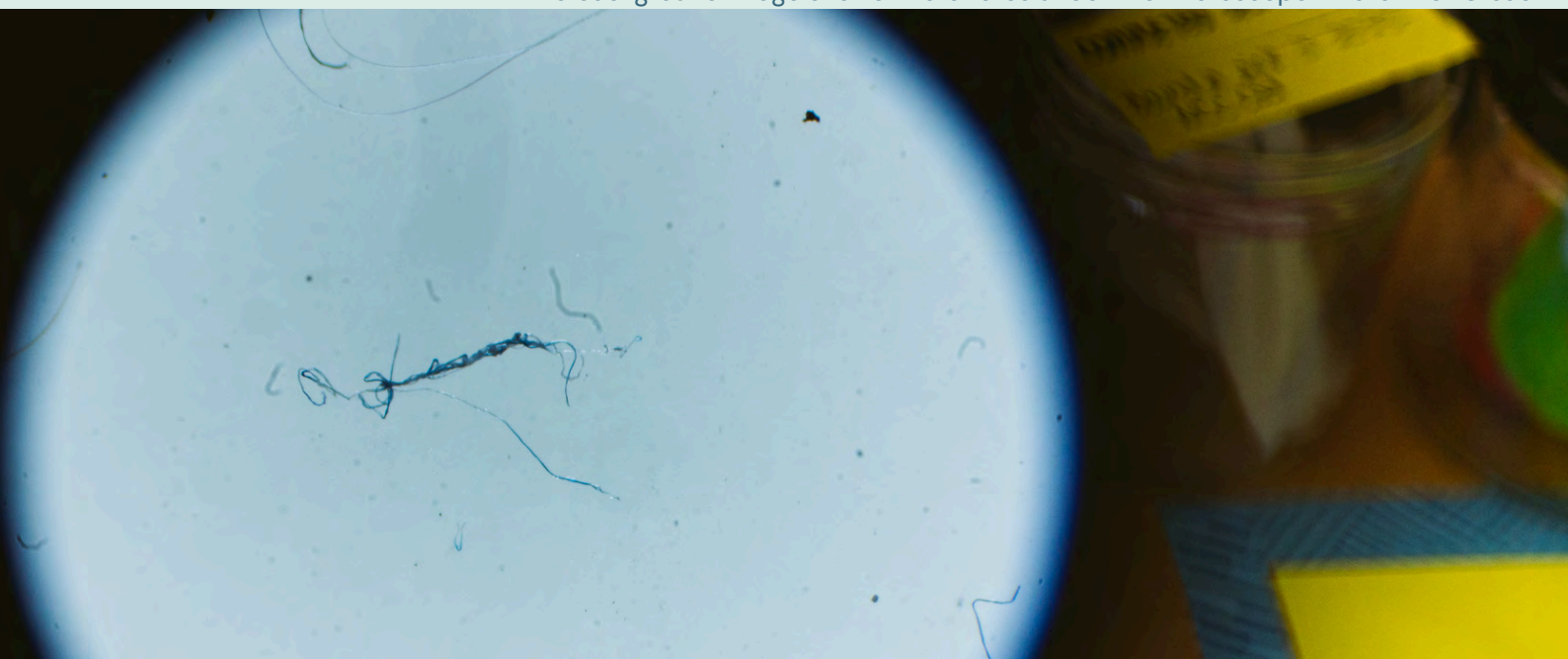
On the right, we highlight this by only focusing on the likely sources of plastics ingested by animals, which looks very different than plastics "overall," which is dominated by shoreline methods.

Figure 58: Likely sources of plastics ingested by animals in Nunatsiavut, 2017-2025



This bar graph shows the number of individual items from each source category (including those we could not identify), colour coded to show which species ingested them. The numbers reflect the high number of iKaluit (Arctic char) and natset (Ringed seal) in the study– no species ingests a particular source of plastic significantly different than any other.
We record microfibres, which make up the wastewater category, regardless of whether they are plastic or organic (such as cotton). They are both represented here, since non-plastic microfibres are still industrially-produced substances, and they account for the largest share of waste items eaten.
The single cigarette butt was ingested by a Hound duck, which is noted on the graph.

The background image shows microfibres under the microscope. Photo: Alex Stead.

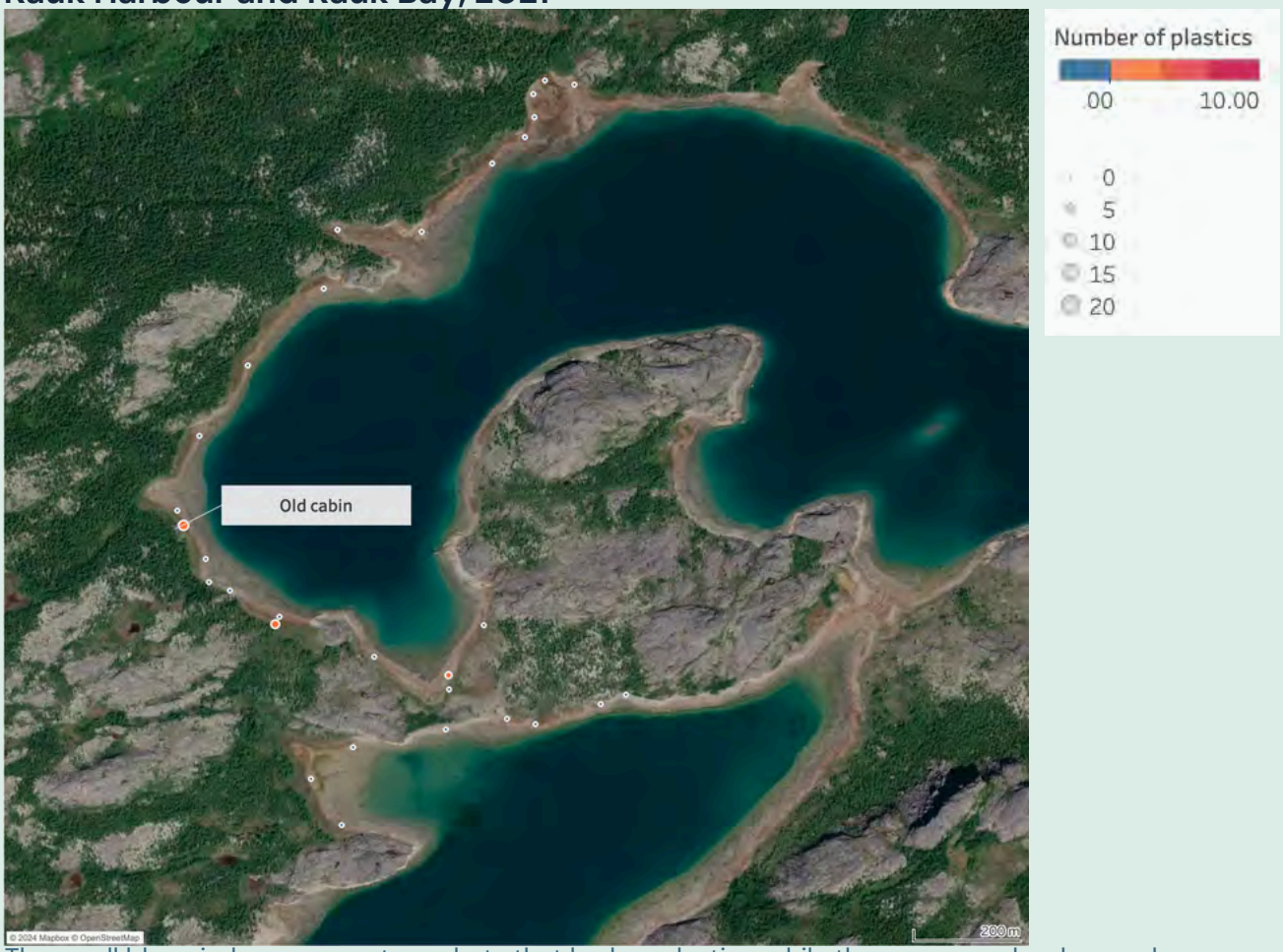


Nunalet & aullasimannik nakit piKattaningit palâstikkisajait iluani avatimmi

Communities & going off as sources of plastics in the environment

One of the clearest examples of how plastics are local was a mini-study where Max and Frédéric Dwyer-Samuel collected shoreline plastics information starting in Nunainguk (Nain), then walking past Mount Sophie to Kauk Harbour, around and over Kauk Bight, and into Kauk Bay. Max thought it was a really, really long hike. Frédéric thought it was a nice stroll. We collected two types of data: we logged all the plastics we saw while walking in a straight line (a continuous capture of plastics that were larger than a dime), and we stopped regularly to do a close analysis on our hands and knees using a 1m2 quadrat, looking for microplastics as small as half a millimeter.

Figure 59: Comparison of concentrations of plastics in quadrats around Kauk Harbour and Kauk Bay, 2021



The small blue circles represent quadrats that had no plastics, while the orange and red ones show quadrats with plastics. In Nain, there were plastics in all quadrats. Here, there are no plastics in most quadrats, with a few by the old cabin (that looked like they came from the cabin, and a couple of food wrappers at the end of the bay.

The good news is that we found very little plastic once we went over the hump in the Mount Sophie trail, and what we did find were macroplastics (large items), not microplastics (small plastics that break down from larger items, indicating older plastics).

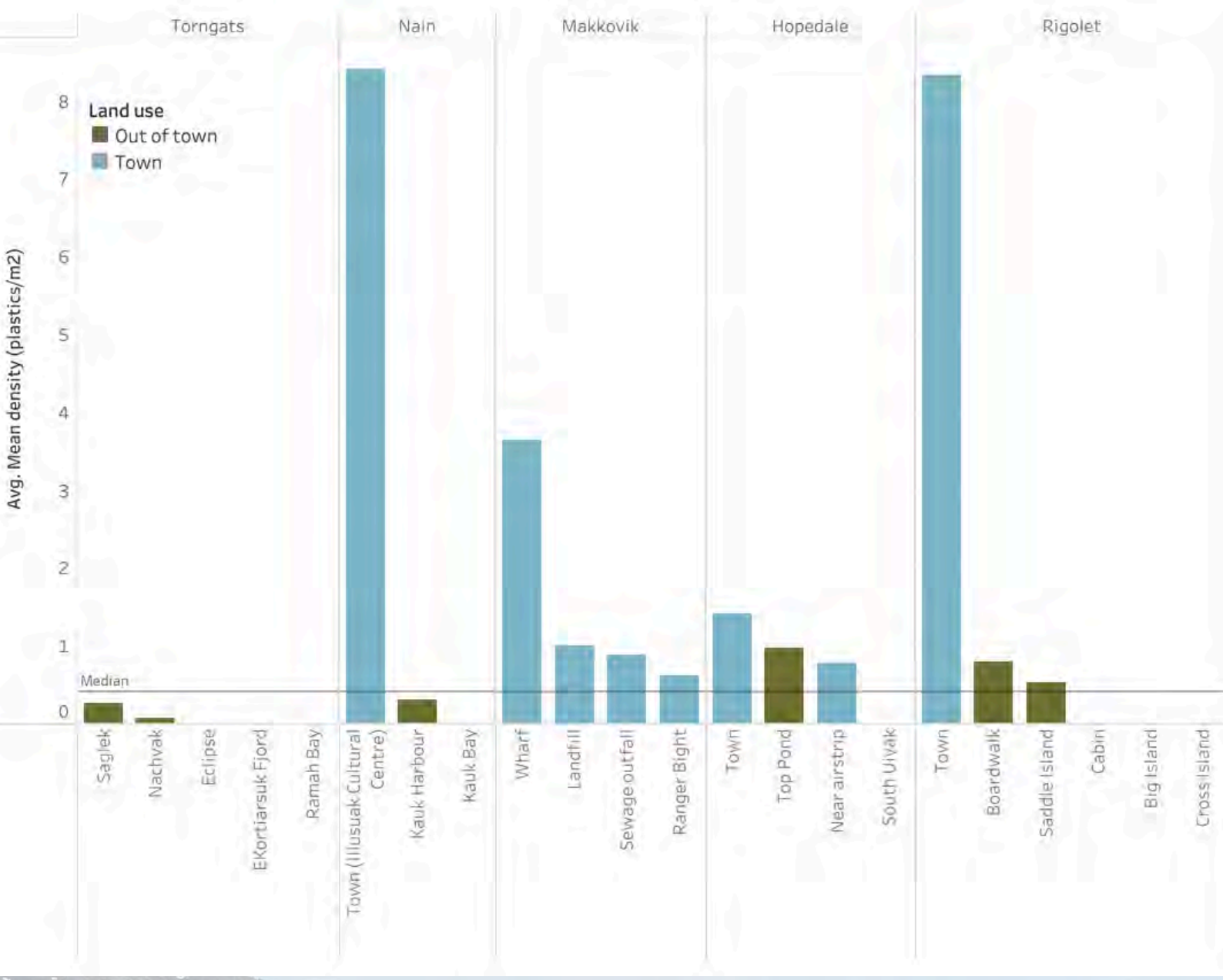
The concentration of shoreline plastics in Nunainguk (Nain) around the Illusuak Cultural Centre was 18.8 microplastics per square meter, while in Kauk Harbour it was an average of less than one plastic (0.35) per square meter and in Kauk Bay there were no plastics found in eight quadrats. It can be odd to think of less than one plastic as an average, but that only happens because there were so many zeros– no plastics! It means that on average, you have to search three quadrats to find a single plastic.

We found there are very few microplastics (small plastics smaller than a grain of rice) in the areas outside of Nunainguk (Nain), but there are macroplastics (larger than a grain of rice, or 5mm), almost all food packaging, all along the far back of the beach where the grass starts growing, likely blown from the water. Since plastics, especially thin plastics, fragment into smaller microplastics over time, it means that the source of these larger plastics is likely local because if they had moved in from far away, they would have broken down into smaller pieces by the time they reached Nunainguk (Nain). The only microplastics we found outside of Nunainguk (Nain) were by the old cabin in Kauk Harbour. They likely fragmented from larger plastic items belonging to the cabin.

These shoreline findings echo what we found in surface water in Maggovik (Makkovik), where the highest concentration of plastics was near the wharf, and plastic concentration decreased the further from the community we went. The same pattern repeated in every community we studied.

Quadrat in the tidal zone in Kauk Harbour, 2021. No plastics found. Photo: Max Liboiron

Figure 60: Baselines of plastics from shoreline quadrats in Nunatsiavut, 2017-2025



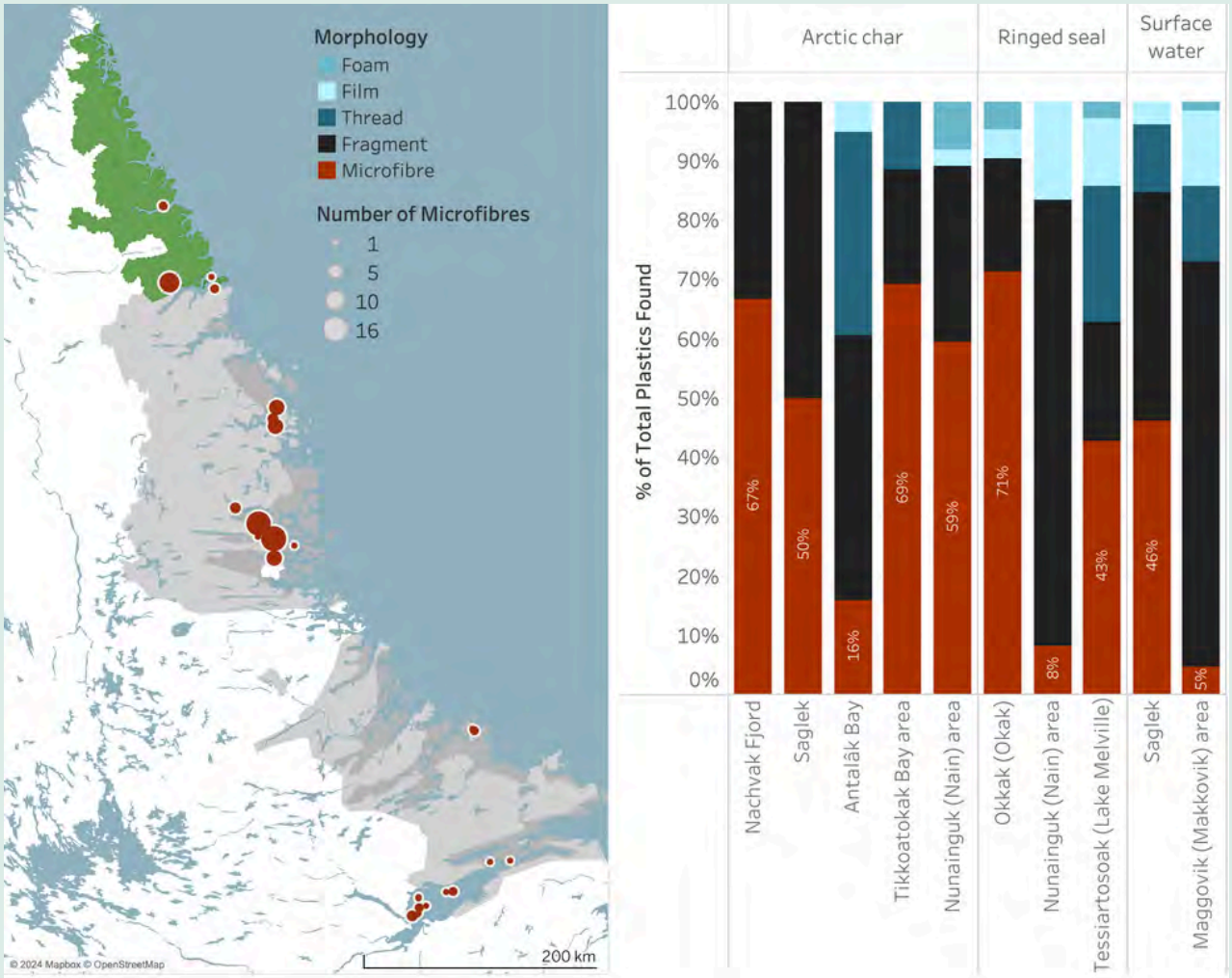
Quadrat in Nain, 2024. Photo: Kayla Wyatt

Anijausimajut imait sakKititsiluaKattajut palâstikkisajannik iluani imâni ammalu omajunni

Waste Water as a Source of Plastics in Water and Animals

Microfibres are a type of tiny plastic that really only comes from laundry – it's essentially lint. They come off in the wash and go into wastewater. Even places with wastewater treatment can let microfibres into the environment because they are so small (Gatidou et al, 2019). Microfibres can also travel in the air and are in house dust and urban dust (Catarino et al. 2018). Microfibres in Nunatsiavut can come from long range transport in the air or water from outside of Nunatsiavut or from local sewage outfalls. In total, **22% of all plastics in surface water and 43% ingested by animals were microfibres.**

Figure 61: Map (left) and percent (right) of microfibres found in animals and surface water in Nunatsiavut, 2017-2023



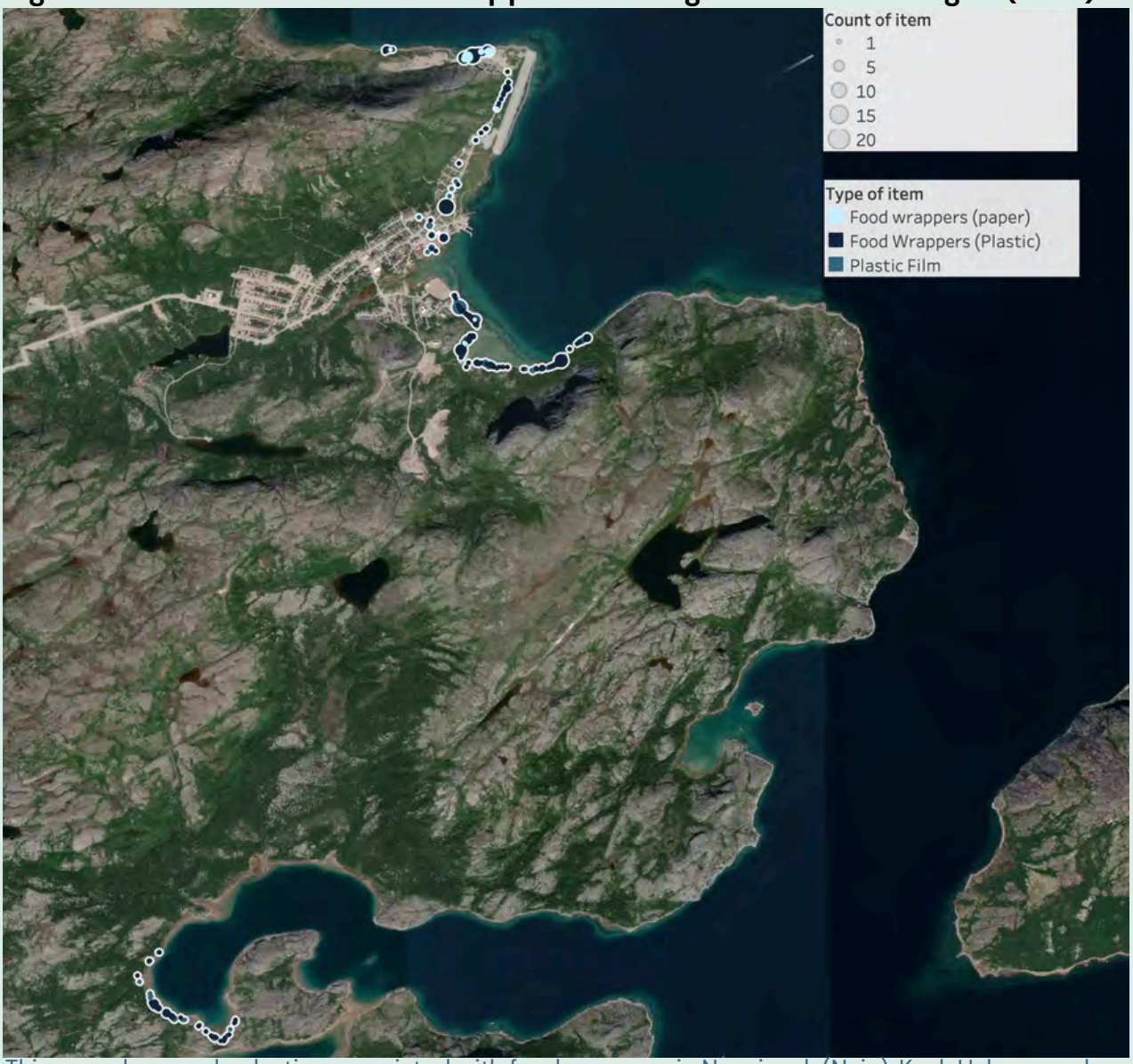
Only microfibres are mapped on the left. Only samples that had four or more plastics are graphed on the right (which removes natânnavait (Greenland halibut), which ingested three fragments).

NiKet pongit sakKititsiluasimajut sitjani palâstikkisajannik

Food Packaging as a Source of Shoreline Plastics

Almost all of the plastics outside of communities nearshore were related to going off, especially food packaging. As mentioned above, in Kauk Harbour, nearly all plastics found were from food packaging from snacks. These results tell us that it is important to do everything we can to keep garbage when going off and bring it back to town to throw away properly. According to this data, if we are careful to bring garbage back to town, keep thin plastics from flying out of boats, and not litter, we can reduce plastics in Nunatsiavut. The map below shows all food packaging and film plastics (fragments of bags, often sourced from food packaging) near Nain.

Figure 62: Plastics from food wrappers and bags around Nunainguk (Nain)



This map shows only plastics associated with food wrappers in Nunainguk (Nain), Kauk Habour, and Kauk Bay from 2017-2022. You can see paper food wrappers are closest to the landfill and town, with none farther out since they do not last long in the environment. Plastic film refers to fragments of larger plastic bags or wrappers.

Sikaret sakKititsiluasimajut sitjani palâstikkisajannik

Cigarettes as a source of shoreline plastics

Cigarette butts are one of the most littered items worldwide. In Nunatsiavut, where 4% of shoreline items were cigarette waste (the average for shorelines in Canada is 24%) (Liboiron et al., 2020). In Nunatsiavut, cigarettes tend to cluster by communities or areas of high use like the fire pit areas in Ranger Bite, Maggovik (Makkovik) or along the airport road in Nunainguk (Nain). But we also found some in places like Kauk Bay, and notably, ingested by a Hound duck north of Nain.

Cigarette butts are extremely toxic to animals and water ecosystems (Dobaradaran et al., 2021. For example, snails are easily killed by the chemicals that flow out of cigarette butts in tide pools after 24 hours (Dobaradaran et al., 2021.). Another study found that one cigarette butt in one litre of water was enough to kill minnows and smelt (Slaughter et al. 2011). **Fish such as smelt, minnows, catfish, and tilapia, as well as snails, frogs, mussels, and oysters have all shown lethal effects from cigarette butt leachates in their water** (Dobaradaran et al., 2021. Lucia et al. 2022). Studies show that the longer a cigarette butt is in the water, the more toxicants it leaches into the environment. They are the most toxic plastic covered in this report.

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

Figure 63: Waste from cigarettes around Nunatsiavut, 2017–2025

This map shows all cigarette waste found in Nunatsiavut. All of it was from shorelines, except for a single butt ingested by a Hound duck north of Nain. While they are not concentrated in high numbers, they are widespread, from as far north as Saglek and as far south as Upper Lake Melville.

Palâstikkisajait pongit sakKititsiluasimajut sitjani palâstikkisajannik

Plastic bags as a source of shoreline plastics

Plastic bags are also one of the most commonly found shoreline plastics. Nunainguk's (Nain's) plastic bag ban in 2009, one of the first in Canada, obviously worked because people could immediately see the difference in the water: there were many plastic bags snagged on rocks and plants before the bag ban, and that amount decreased after the ban. We don't need science to know it worked. Other communities on the coast also banned plastic bags until a complete ban a few years later. The plastic bags we find on shorelines now are not grocery store bags. They include garbage bags, zip lock bags, fish bags, and other sources.

If we look at all shoreline waste in Nunatsiavut, including items that aren't plastic, plastic bags make up 12% of all shoreline waste. The provincial average is 2% (Liboiron et al. 2020). **While the plastic bag ban was effective at reducing carrier bags in the environment, other types of bags are replacing those and ending up in the ocean**, though based on local memory, at a smaller rate than before the bag bans. We also know from other studies in the province that plastic bags tend to be more present in freshwater environments (since they aren't destroyed by waves as quickly), so future work in Nunatsiavut could focus on freshwater shoreline plastics to see if this is also true here (Liboiron et al. 2020).

A plastic bag that has begun to fragment in the strand line on Long Tickle, by Maggovik (Makkovik). One of the reasons we know plastic bags are local is that they shred in the environment very quickly, so bags this large haven't been in the water long. Photo: Max Liboiron

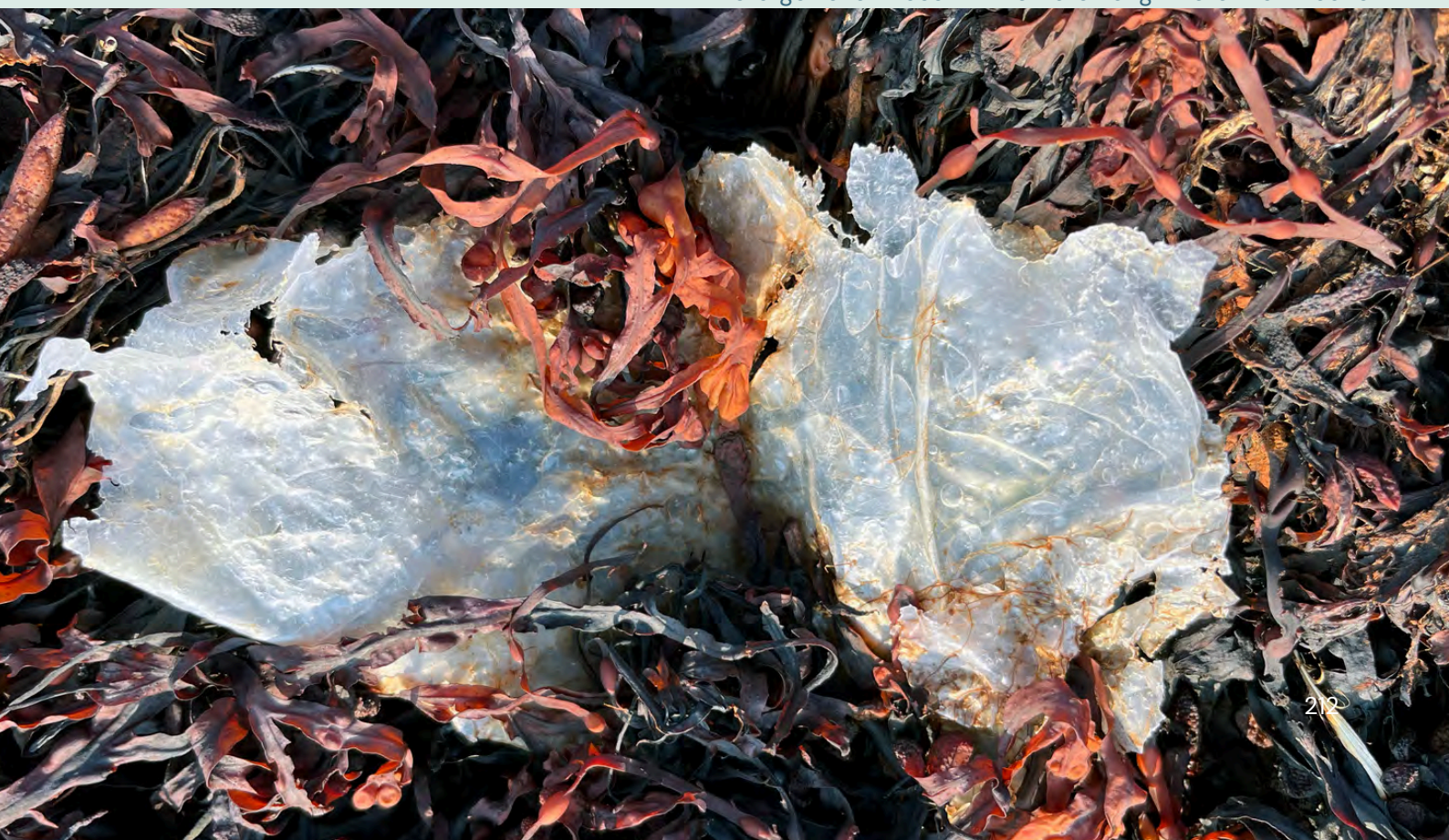
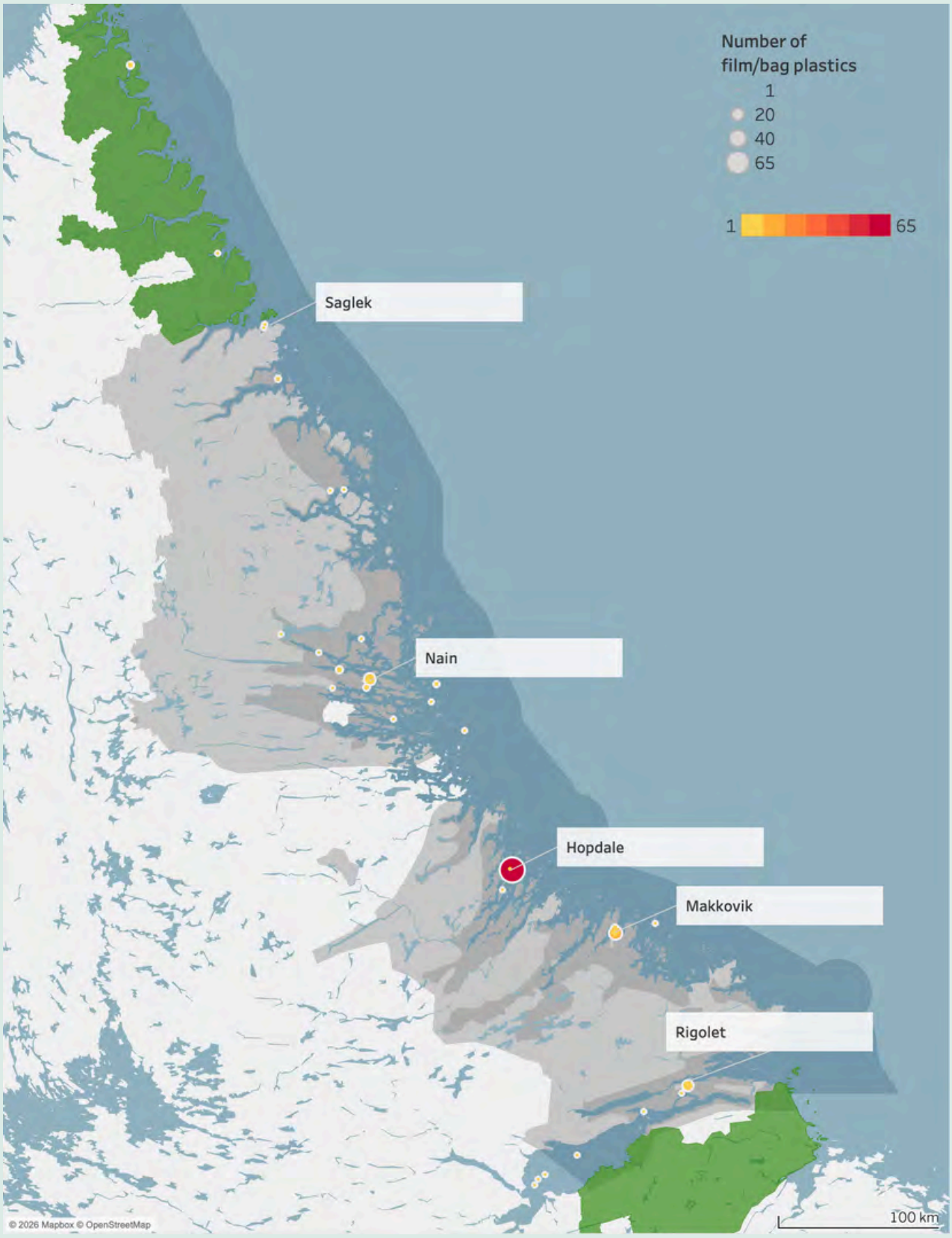


Figure 64: Map of all plastic bags, in whole or part, found in Nunatsiavut, 2017–2025



This map includes plastic bags, film plastics, and film packaging found on land, in water, and ingested by animals. The majority of it is on shorelines.

Itsavinni sakKititsisimajut palâstikkisajannik imânut

Wharves as sources of plastics in water

In Maggovik (Makkovik), Max and Hayward Broomfield chose areas where there might be plastics: the wharf, water near the landfill, where the sewage comes out of town, and the area where the commercial fishery puts fish guts in the bay, as well as some places further from town at the mouth of the bay and just outside the bay. Predictably, the highest concentration of plastics was around the wharf with concentration decreasing the further we went from town (no spikes corresponded to the landfill, sewage outflow, or fish gut area). we did not see this same trend in Hopedale.

Trawled plastics from Nain wharf. Photo: Max Liboiron

Figure 65: Detail of plastics in surface water around Maggovik (Makkovik)

The larger and darker the circle is, the higher the concentration of plastics in surface water. This sampling design in Maggovik (Makkovik) was created with Hayward Broomfield, who took us by areas most likely to pollute: the wharf (highest concentration of plastics), the landfill, sewage outfall, mouth of the bay, and where the fishery dumps guts (similar amounts of plastics), and outside the mouth of the bay (lowest amounts of plastics).

Oganniatet piKutingit sakKititsiluasimajut sitjani ammalu nigijausimajut palâstikkisajait

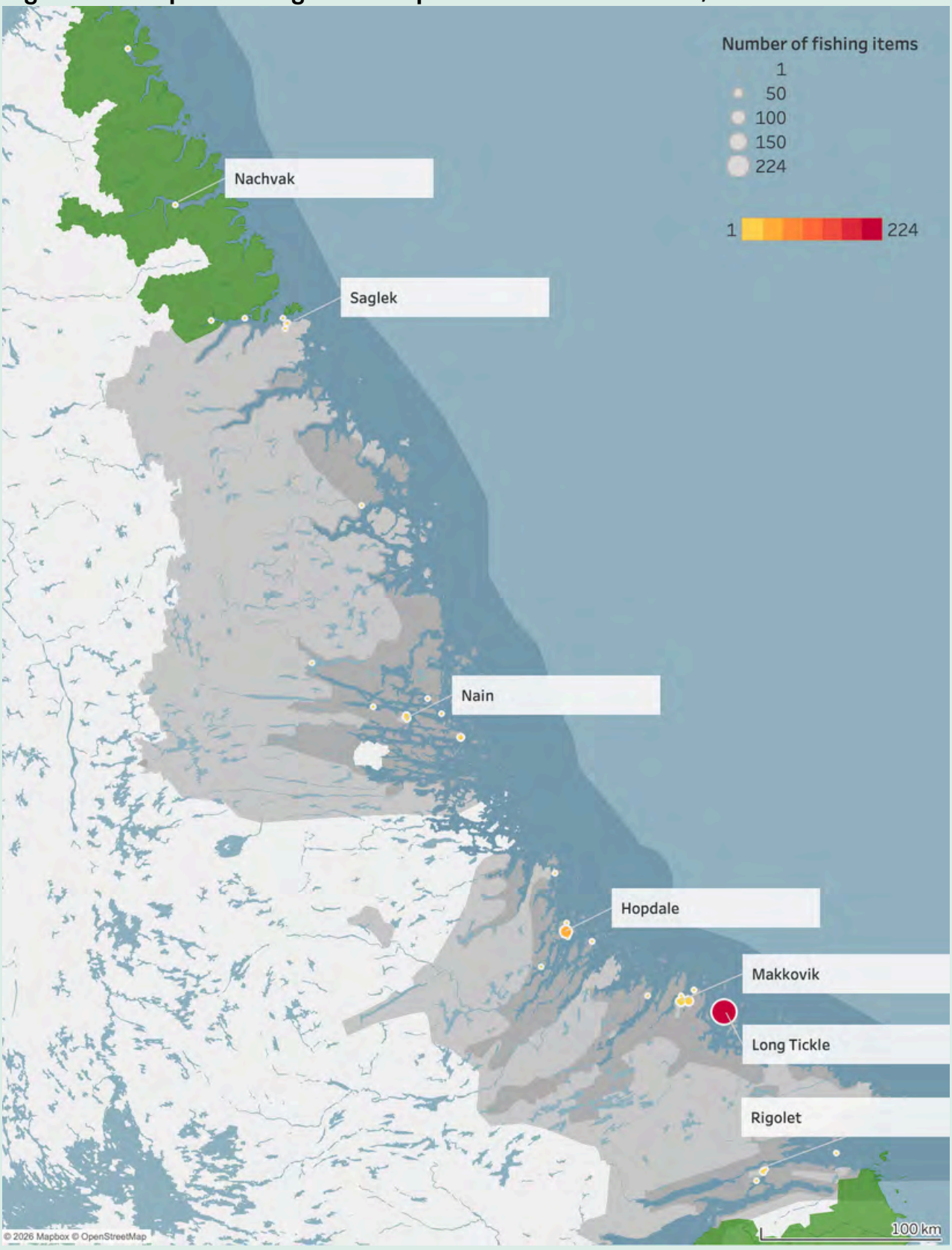
Fishing gear as a source of shoreline and ingested plastics

Fishing gear is a global plastic pollution problem. Worldwide, scientists estimate that 5.7% of all fishing nets, 8.6% of all traps, and 29% of all lines are lost at-sea every year (Richardson et al 2019). **10% of shoreline plastic by count and 30% by weight and 10% of plastics ingested by animals in Nunatsiavut is related to fishing.**

We found that some areas with high fishing activity don't necessarily have a lot of animals eating fishing line, like in Nain Bay, while some places with less fishing activity have a lot of fishing gear in the water, like two locations in Saglek compared to a lower amount in Maggovik (Makkovik). It likely means that fishing gear moves around since it's neutrally buoyant; it's meant to float in the water column and continues to do so after it's lost or fragmented and may be pushed long distances in the water. In an overview of plastic pollution in the province, Liboiron et al. (2020) showed that the percentage of fishing gear on a shoreline had less to do with whether or not a community had a high amount of fishing activity and more to do with the way currents pushed or pulled fishing gear in the ocean. We are not sure if that is also true in Nunatsiavut.

James Jacques sorting fishing line found in Hopedale, 2024. Photo: Laura Crick

Figure 66: Map of fishing-related plastics in Nunatsiavut, 2017-2025



The larger and darker the circle is, the higher the concentration of fishing gear. This includes mainly rope and line, but also buoys and fish tags. The high number of plastics on Long Tickle outside of Makkovik is more reflective of many, older plastics on a shore that gets a lot of waste than a particular problem from the area.