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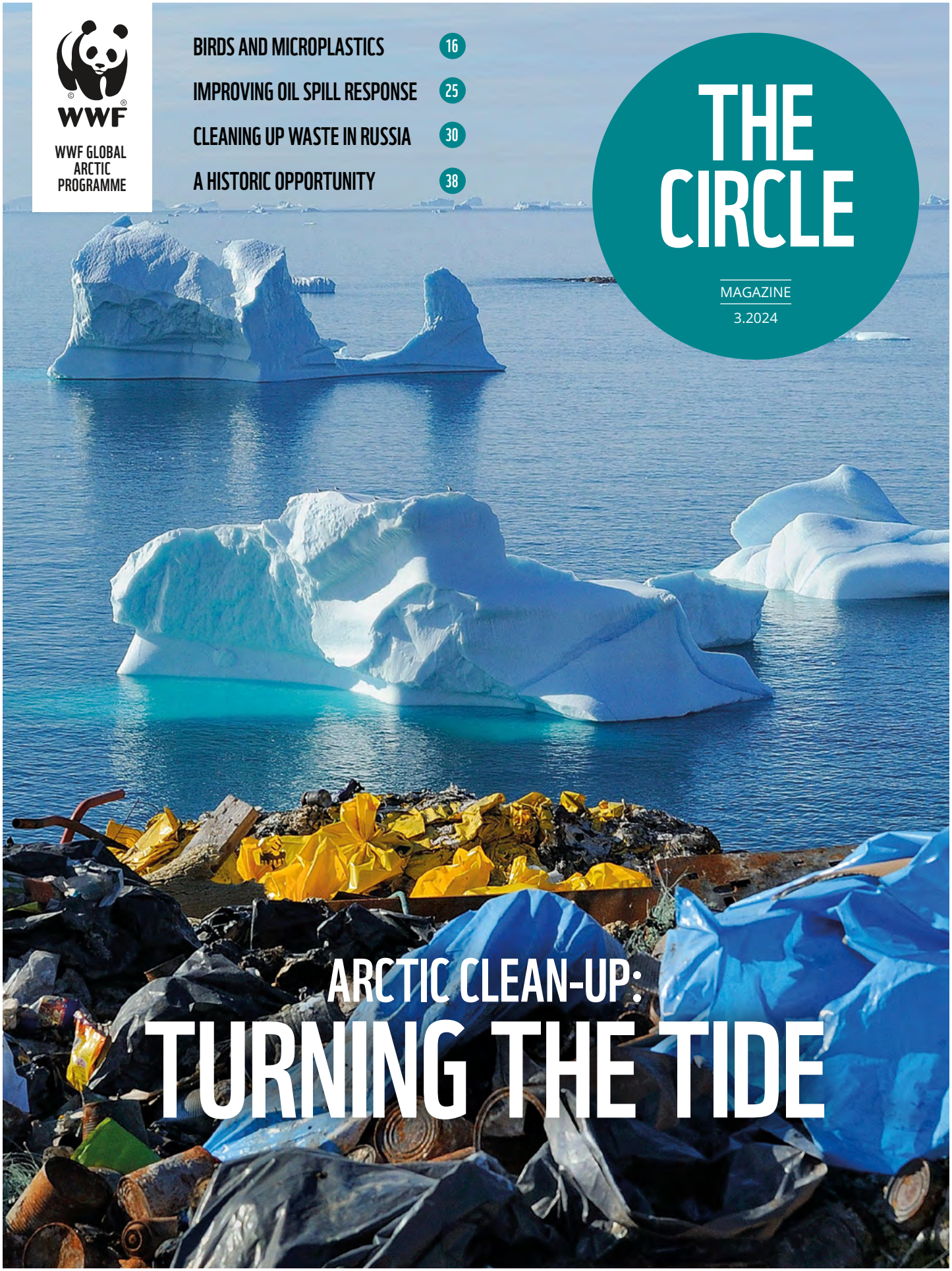

ARCTIC CLEAN-UP:

TURNING THE TIDE

The Circle 3.2024

ARCTIC CLEAN-UP: TURNING THE TIDE

COVER: A garbage dump in Nuussuaq, Greenland.
Photo credit: Hemis / Alamy Stock Photo

THIS PAGE: Plastic rope and fragments of nets are, by weight, the most common litter type along our coastlines. Over time, even the sturdiest rope breaks down into microplastic fibres that spread.
Photo credit: Bo Eide, CC BY 2.0 via Flickr.com

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Plastic bursts from an albatross carcass as it decomposes. This particular bird had 558 pieces of plastic in its stomach when it died.

Photo credit: Eric Dale/USFWS, public domain via Flickr.com

Tackling pollution and waste in the Arctic

POLLUTION AFFECTS EVERYONE. Although managing materials and solid waste reduces pollution, some communities have an easier time doing so. In the Arctic—where communities are spread across vast, remote expanses and often disconnected from, or underserviced by, roads or transport systems—the social and financial costs of properly managing waste are formidable.

We often think of the Arctic as unspoiled, but in reality, plenty of pollution and waste sources affect the region. Resource extraction, shipping, and industrial boom and bust cycles affect the capacity of communities to operate and maintain essential services, leading to pollution and solid waste. When not managed properly, these activities can contaminate the natural environment that people depend on for livelihoods and survival. Dumpsites, unlined landfills and buried waste are perpetual challenges in Arctic communities, where the mounting impacts of climate change are reshaping coastlines, roads, river systems—and the movement of landfill waste. Add to that the heavy inflow of waste and pollution from beyond the Arctic, transported on air and ocean currents, and you have a serious challenge.

This harsh reality is both visible and invisible. For example, seabirds, seals and whales can consume or become entangled in plastic, sometimes dying as a result, while people can inadvertently ingest unseen microplastics and chemicals when consuming fish or water.

There is no one-size-fits-all solution, and federal entities have limited authority to manage solid waste. They do at least provide baseline laws and regulations in addition to resources to help communities implement waste management programs. But even when municipalities are committed to meeting the challenge, they can be overwhelmed by rising costs, safety concerns, and the complex logistics of collection and removal. And corporate liability often ends the moment a package is opened or a product is used, leaving individuals to decide how to dispose of or manage items after they're no longer useful.

Communities are leading projects that highlight both the complex challenges of waste and the potential for solutions.

Fortunately, there is hope. Arctic Indigenous communities and local residents are developing innovative and collaborative solutions, working hard to better manage solid waste and protect human, animal and environmental health. An Indigenous community in the Alaskan Islands recently hosted a community event to safely dispose of hundreds of pounds of e-waste and other materials. Sámi communities in Europe have partnered with local non-governmental organizations (NGOs) and municipal authorities to formally identify and clean up illegal dumpsites. Successful local clean-ups of illegal dumpsites have also become important community-building, awareness-raising events for Arctic residents.

Communities are creating waste solutions that involve local, municipal and governmental actors as well as private corporations and NGOs. Federal governments are negotiating a legally binding instrument on plastics. Indigenous communities are implementing tools, best practices and resources that can be replicated by or shared with other communities. Corporations are improving the design and circularity of products, the recyclability of materials, and the management of products at the ends of their lifecycles.

Managing waste requires a comprehensive materials management approach infused with better funding, innovative collaboration across knowledge systems, and infrastructure changes to help communities prevent pollution that arises from buildings falling into the sea as shorelines erode. Urban and rural communities are leading projects that highlight both the complex challenges of life in the Arctic and the great potential for solutions.

Despite some adversity, healthy ecosystems are still possible across the Arctic—and if we work together, we can make a difference. ●

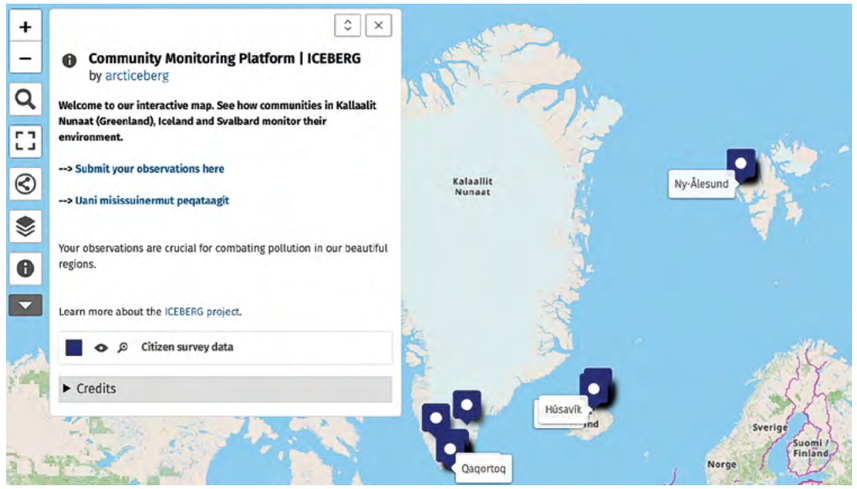
PATRICK HUBER is chair of the Arctic Council's Arctic Contaminants Action Program Working Group.

IN BRIEF

MARINE POLLUTION

Three-year ICEBERG project studies Arctic Ocean pollution

OVER THE NEXT three years, researchers working on a project known as ICEBERG will study the impacts of ocean and coastal pollution on Arctic ecosystems and communities. The project is led by the University of Oulu (Finland) and involves researchers from 16 organizations and diverse fields, including toxicology, social science and environmental science. A key goal is to develop strategies to combat pollution and climate change and create policy recommendations to improve pollution control in the Arctic.



ICEBERG project's online mapping platform, where citizens can add their observations.

Field research will take place in three Arctic locations: western Svalbard, northern Iceland and southern Greenland. The sites were chosen because of their vulnerability to climate change and pollution and the economic importance of fisheries and tourism to their economies.

In Svalbard, research began in June 2024 and was slated to continue until October, with studies focusing on pollutants like marine litter, microplastics, chemicals and heavy metals. Additional research in Iceland and Greenland will emphasize community engagement, including collaboration with Indigenous and local populations.

METHANESAT

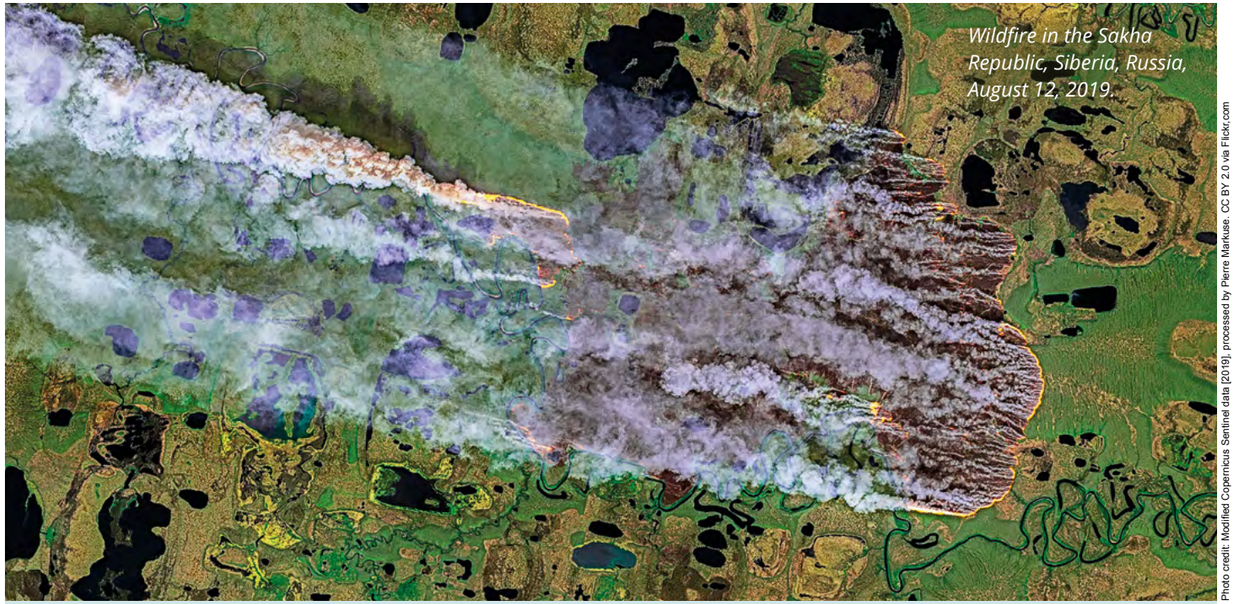
Tracking methane pollution from space

DATA FROM A privately funded satellite launched earlier this year could soon shed more light on the scale of methane pollution globally. MethaneSAT, a collaborative mission between Environmental Defense Fund, Google, the Government of New Zealand and several other partners, aims to identify and quantify the greenhouse gas.

Methane is about 80 times more harmful, in terms of causing climate change, than carbon dioxide for 20 years after its release into the atmosphere. Yet we don't have a good understanding of its scale or precise origin points.

MethaneSAT's mission is to detect and track methane from oil and gas production and consumption, the biggest sources of the polluting gas, as well as from coal mines, landfills and agriculture. It will use observed spectrographic data to calculate quantitative emission rates. This will reveal just how much methane is being emitted, where it is coming from, and how emissions change over time.

The satellite is expected to land later this year. The project team expects to be able to capture and attribute data on emissions from 80 per cent of oil and gas fields around the globe. The data MethaneSAT collects can then be used by oil and gas companies to quantify their emissions more accurately and improve their operations to reduce them. Governments and environmental agencies can also use the data to improve or enforce methane reduction regulations and track climate progress.


Wildfire in the Sakha Republic, Siberia, Russia, August 12, 2019.

WILDFIRE FUEL

Sea ice loss drives boreal fires

SIBERIA HAS BEEN a hot spot for summer boreal wildfires in recent decades, but the reasons for the rise have been unclear. A recent study suggests the culprit is declining summer sea ice in the Russian Arctic.

Summer sea ice reduction is the main cause of sea-ice loss on a long-term scale. The decline is fuelling two meteorological trends—vapour pressure deficits (VPDs) and Siberian blocking events—that, in turn, create the conditions for wildfires.

The study, published in *Nature Communications*, indicates that declining sea ice accounts for 79 per cent of the increase in the summer VPDs in the region through higher temperatures over land. A VPD is a measure of how much moisture the air can hold versus how much it is actually holding. In other words, it indicates the air's drying power. A greater VPD can fuel wildfires by pulling moisture from plants and soils to make up for the deficit, making the vegetation more flammable.

Siberian blocking events are characterized by stalled high-pressure systems that cause prolonged periods of extreme weather that can fuel wildfires. Indirectly, these events are also driven by declining sea ice, which leads to warmer temperatures. They have been lasting longer and covering larger areas.

TOXIC METALS

Mercury escaping into the environment

AS THE ARCTIC warms, mercury that has been sequestered in permafrost for millennia is escaping into the environment, according to a study by researchers at the University of Southern California.

Mercury is a toxic metal that poses environmental and health threats. In the Arctic, it lurks in thawing riverbank sediment and can enter the environment because of erosion. Some three million people in the Arctic live in areas where permafrost is forecast to thaw completely by 2050.

The study's co-author, Josh West, a professor of earth sciences and environmental studies at USC Dornsife, described the situation as a "giant mercury bomb in the Arctic waiting to explode."

The research team analyzed mercury in riverbanks and sandbars, tapping into deeper soil layers. The levels they found were consistent with the higher estimates from previous studies, confirming that sediment samples provide a reliable measure of mercury content and offer deeper insight into the hidden dangers of thawing permafrost.

The noise patterns of ships, including cruise and expedition vessels, overlap with Arctic marine mammals' communication and hearing ranges.

Underwater noise pollution from expedition cruises

COULD ARCTIC PORTS BE PART OF THE SOLUTION?

Vessels tend to venture away from established shipping routes into the comparatively secluded backyards of Arctic marine mammals.

Photo credit: Fabienne Mannherz

Expedition cruises to the remote Arctic are in vogue. But with their sturdy, purpose-built design, these vessels are increasing noise levels in the relatively tranquil Arctic underwater soundscape. **FABIENNE MANNHERZ, MAAIKE KNOL-KAUFFMAN** and **HEIDI AHONEN** consider whether Arctic ports could play a role in mitigating this noise.

SOUND MAY BE invisible to the human eye, but it is everything for species who live beneath the surface, helping them to communicate, navigate, forage and interact socially. This is particularly true for marine mammals.

Unfortunately, the noise patterns of ships, including cruise and expedition vessels, overlap with Arctic marine mammals' communication and hearing ranges. The potential consequences include masking of important sounds, behavioural disturbances, physiological stress, and displacement, with cumulative long-term effects on marine populations.

UNKNOWN THREATS

Expedition cruise operations differ from more transitory maritime activities because the vessels spend prolonged time cruising and manoeuvring in a given area. The cruises are exploratory in spirit and seek out wilderness, so the vessels tend to venture away from established shipping routes into the comparatively secluded backyards of Arctic marine mammals. To date, there have been limited efforts to understand and address the risks that the underwater noise they bring might pose to these species. But researchers and industry pioneers are working closely to study and address these unknown threats.

It is sometimes assumed that when a sound source departs or is turned off, negative impacts from the noise cease. But that is an overly simplified view. The potential consequences are highly context-sensitive and vary according to the intensity, duration and repetition of the noise exposure as well as the marine mammal's circumstances. For example, the harm might be much more significant when an animal is feeding or nursing.

In 2023, the International Maritime Organization (IMO) adopted revised guidelines to reduce radiating underwater noise from shipping. These guidelines are meant to encourage noise reduction by focusing on propeller hulls, machinery and operational aspects. The guidelines are not mandatory, but cruise expedition operators have started to comply with them by seeking silent notation certifications. These certifications are awarded by global ship classification societies, such as DNV or Lloyd's Register, to ships that meet specific underwater noise criteria. They indicate that a vessel has been designed and operates in a way that minimizes underwater noise, thereby reducing the impact on marine life.

These ship classification societies also certify ships during their construction phase based on standards for safety, environmental protection and more. If the mandatory standards are not met, the IMO can block a ship from going to sea.

However, given the complexity and financial constraints involved in retrofitting vessels, ship owners might be more likely to invest in and comply with noise reduction measures when economic benefits are available. This is where Arctic ports could become a vital part of the solution. In the remote Arctic, ports serve as central hubs for expedition vessels to take on guests, refuel and seek assistance in hazardous conditions. Arctic port authorities could apply port fee reductions based on classifications, ship design and compliance with noise reduction measures.

Commercial cruise ship MSC Preziosa*, built to hold 3,500 passengers, sits at the only dock in the port of Longyearbyen, Svalbard. A much smaller expedition vessel—the* MS Fram*, built for just 250 passengers—sits further out.*

As key hubs, Arctic ports could monitor and promote solutions to mitigate underwater noise from expedition vessels bound for remote regions.

Photo credit: Fabienne Mannherz

A CANADIAN EXAMPLE

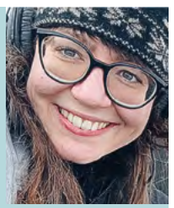
A concept put forward by the Port of Vancouver, on Canada's west coast, has reported promising outcomes along these lines. The port has two programmes dedicated to raising awareness of—and reducing—underwater noise and the impacts of port-related activities on marine mammals.

First, the Enhancing Cetacean Habitat and Observation (ECHO) programme is designated to facilitate research, generate knowledge and encourage responsible practices. A collaboration led by the port authority involving governmental agencies, the maritime industry, conservation groups and researchers, this programme has established continuous recording of the underwater soundscape using listening stations in the port area that feature passive acoustic monitoring. Vessels are encouraged to slow down so the potential for noise reduction can be studied.

Second, the Port of Vancouver EcoAction Program protects the harbour's operational and economic interests while addressing environmental concerns, including underwater noise. The aim is to encourage the maritime industry to consider quieter ships and noise reduction technologies. Compliance with approved noise reducing designs and technologies enables ships to earn a quiet notation certification from classification societies. The Port of Vancouver discounts harbour fees based on these certifications.

Could a similar combination of initiatives be used to raise awareness and reduce underwater noise in Arctic waters? The Port of Vancouver example suggests that it could. Every cruise expedition vessel stops at an Arctic port on its way to more remote regions, and cruise operators have a growing desire to protect the Arctic marine environment. Starting with solutions at the port level could spark proactive and inclusive discussion among all involved.

As key hubs, Arctic ports could monitor and promote solutions to mitigate underwater noise from expedition vessels bound for remote regions. Fostering compliance with noise reducing designs and operations could incubate collaborative actions from ports, the industry and research institutions. These efforts could enhance our understanding of the negative consequences of noise exposure for marine mammals, foster quieter navigation by Arctic expedition ships, and safeguard the region's marine species. ●



FABIENNE MANNHERZ is a PhD candidate at Aarhus University (Denmark) who studies the effects of anthropogenic underwater noise on marine mammals.

MAAIKE KNOL-KAUFFMAN is a senior researcher at the Norwegian Institute for Water Research (NIVA) whose work focuses on marine governance.

HEIDI AHONEN is a bioacoustics research scientist at the Norwegian Polar Institute who studies the key contributors of sound in Arctic and Antarctic marine environments and the impacts of anthropogenic noise on marine fauna.

Lights from an oil rig float in the fog behind a subsistence fishing camp in North Slope, Alaska.

Plastic pollution

A GLOBAL PLASTICS TREATY COULD HELP CLEAN UP THE ARCTIC

Global plastic pollution could triple by 2040 if nothing changes. In the Arctic, it is threatening marine ecosystems, food security, health and the human rights of Indigenous Peoples. Alaska residents **ROSEMARY AHTUANGARUAK, VI WAGHIYI** and **PAMELA MILLER** hope that an ambitious global plastics treaty in 2025 can control plastic production and eliminate the use of toxic chemicals.

Our people are being exposed to toxic chemicals without our consent. We face some of the most drastic changes in the Arctic. These are burdens we did not create.

FLAMES, BELCHING SMOKE and black carbon in the sky—on nights when I (Rosemary) saw 20 or more flares, I knew sick people would be coming. As a community health aide in Nuiqsut, Alaska, when oil and gas operations were flaring, I would see a stream of people with respiratory issues. Before I was finished with one patient, I already had another. It got to the point where we were up all night helping people breathe.

Most people don't think of plastics when they hear about increasing rates of respiratory illnesses and other health problems, but plastics create toxic hazards linked to many serious conditions. Within one lifetime, Arctic Indigenous communities have seen rates of various illnesses skyrocket due to toxic pollution from the interlinked plastics, chemicals and climate crises. Respiratory diseases, cancer, reproductive disorders and many other health problems now threaten our very existence.

As the First Peoples of Alaska, we have long been stewards of our land, air and waters. But our people are being exposed to toxic chemicals without our consent. We face some of the most drastic changes in the Arctic. These are burdens we did not create.

Plastics are made from fossil fuels and chemicals, and the oil and gas industries are betting on their continued use to grow their markets. Fossil fuels extracted from Alaska, often on or near Indigenous lands, expose Indigenous Peoples to toxic chemicals. Left unchecked, the petrochemical industry is projected to account for half of oil consumption by 2050. More plastics ➤

Microplastics have been found in our fish, seals, seabirds and whales—all species that are essential for our spiritual, physical and cultural sustenance.

will mean more oil and gas and more health problems imposed on Indigenous Peoples.

HEALTH HAZARDS FROM PLASTICS

More than 16,000 chemicals are used in making plastics. A recent study by the PlastChem project found 4,200 chemicals in plastics that are known to present significant hazards to health and the environment and concluded that no plastic chemical can be considered safe.

A 2024 study published in the *Journal of the Endocrine Society* assessed the burden of disease and health-care costs associated with chemicals in plastics and found that plastics contribute significantly to health problems and associated social costs in the US—to the tune of about $250 billion in 2018. The study's author, Leonardo Trasande, said diseases due to plastics "run the entire life course from preterm birth to obesity, heart disease and cancers."

One recent estimate shows that thousands of tonnes of chemicals are transported along with floating plastics, with up to 7,400 tonnes accompanying plastic debris to the Arctic every year.

When plastic waste is discarded around the world, the accompanying waste and toxic chemicals are carried by atmospheric and oceanic currents to the Arctic, which acts as a "hemispheric sink" concentrating the toxic pollutants. This source-and-sink cycle results in increased health problems and food insecurity for Indigenous Peoples as traditional food sources become scarce or contaminated. When Arctic ice, glaciers and permafrost thaw, sequestered chemicals and microplastics are released into our environment and the food web.

As plastic waste disperses globally, microplastics and associated chemicals pose increasing threats to marine ecosystems, food security, health and the human rights of Indigenous Peoples, especially in the Arctic. A 2023 study found that microplastic levels are doubling in sediments of the Arctic Ocean every 23 years. Earlier this year, a story in the *Anchorage Daily News* noted that scientists had detected microplastics for the first time in the tissues of the Pacific walrus in the Bering and Chukchi seas. These animals are critical to the traditional diets of Indigenous Peoples in this region. Microplastics have also been found in our fish, seals, seabirds and whales—all species that are essential for our spiritual, physical and cultural sustenance.

Humpback whales blowing.

Photo credit: Crew and Officers of NOAA Ship FAIRWEATHER. Photographer Weston Renoud. Public domain

■ In March 2022, the UN Environmental Assembly convened in Nairobi, Kenya, to debate the global plastic crisis. In a historic move, 175 nations voted to adopt a global treaty governing plastic pollution, agreeing on an accelerated timeline so the treaty's implementation could begin as soon as 2025.

Since then, there have been four meetings of the Intergovernmental Negotiating Committee, with a fifth set to take place this November in South Korea. Follow-up negotiations leading to adoption of the agreement are expected in 2025.

A global, United Nations-led treaty could hold all countries to a high common standard on plastic consumption and create a clear path toward a future free from plastic pollution.

HOPING THE WORLD CAN AGREE

The world is currently negotiating a global plastics treaty intended to protect human health and the environment from threats associated with plastics and the toxic chemicals they spread globally through their life cycles. An ambitious treaty would control plastic production and eliminate the use of toxic chemicals. Such measures would begin to rectify the environmental injustices experienced by Indigenous Peoples, benefit fenceline communities (those adjacent to pollution sources), and protect all of us who are exposed to toxic chemicals from plastics.

Negotiations are slated to wrap up by the end of 2024—and Alaska and its inhabitants can't wait. The Arctic is warming nearly four times faster than the rest of the world, and in 2019, more than 70 of 200 Alaska Native villages were facing environmental threats from flooding, thawing permafrost and erosion. Alaska is home to 229 federally recognized tribes, and the linked threats of climate change, plastics, fossil fuels and petrochemicals imperil their cultures and livelihoods.

A global plastics treaty aimed at protecting our health and environment is a vital step in the drive to advance human rights and healthy communities. We must put an end to toxic plastic production and stop producing toxic petrochemicals before the planet is completely overwhelmed by plastic and chemical pollution. The world has an opportunity to move toward toxics-free solutions for a healthy planet. ●

ROSEMARY AHTUANGARUAK is an Iñupiaq scholar, activist and leader from Nuiqsut, Alaska.

VI WAGHIYI is a Yupik grandmother and member of the White House Environmental Justice Advisory Council from Sivuqaq, Alaska.

PAMELA MILLER is the executive director of Alaska Community Action on Toxics and co-chair of the International Pollutants Elimination Network.

Flocks of common murre (an Arctic bird species) gather on Farne Island, Northumberland, England.

Stopping microplastics

AN INVISIBLE THREAT TO ARCTIC BIRDS

Exactly how much plastic are we surrounded by? The answer is: quite a bit, but it's hard to quantify because so much of it is invisible. Unfortunately, the fact that we can't see it doesn't stop it from causing irreversible—sometimes fatal—harm to wildlife. As **DAVIDE TAUROZZI** explains, this problem is widespread in the Arctic, and birds are among the main victims.

Millions of birds and other animals are paying for our consumer choices with their lives.

Photo credit: Davide Taurozzi

AS ONE OF the most inhospitable places on Earth for humans, the Arctic has long been a well-preserved ecosystem characterized by areas with high biodiversity. But in recent years, the Arctic has been undergoing unprecedented change as it is exposed to a wide range of human pressures from climate change, maritime commercial activities, industrial fisheries, oil and gas platforms, plastic pollution and more. Some of these impacts have local sources, but others are regional or global in origin. The resulting pollutants find their way north with oceanic currents.

As a result, plastic pollution in the polar regions is a growing threat. Plastics—which are among the most dangerous of anthropogenic, or human-made, materials—can take anywhere from 20 to 500 years to decompose. While pieces larger than five centimetres (known as macroplastics) can be removed from the environment fairly easily, microplastics (0.1 micrometre to five millimetres in size) are almost impossible to eliminate.

More than 60 seabird species currently inhabit the Arctic, feeding and breeding mainly at sea—and they are harbingers of change in the environment. Generally, each bird species is associated with a particular habitat type, food resource, and optimum temperature and vegetation cover—and both their presence in an area and their general fitness levels are deeply influenced by changes in these ecological variables. Plastics represent one of the most high-impact anthropogenic pollutants for birds.

Threats to seabirds come mainly from two types of interactions with plastic: ingestion and entanglement, such as in fishing lines or nets, plastic bags, or plastic strings, bands and ropes.

THE EFFECTS OF A PLASTIC DIET

The smallest plastic particles—which are generally derived from the degradation of larger ones—can have a range of negative effects on wildlife. They can block the gastrointestinal tract, move from the intestines into other tissues, cause particle toxicity and oxidative stress, provoke inflammation, and damage immune cells like cytokines (molecules that protect against pathogenic bacteria).

I co-authored a 2024 synthesis of peer-reviewed literature published from the late 1980s to 2023 on seabirds' ingestion of microplastics in polar regions. As you would expect, it paints a troubling picture. Overall, 374 samples were investigated, including stomach contents, pouch contents, guano and pellets. The stomach contents represent what a bird had in its digestive system at the moment of death. Pouch contents are the foods that little auks and a few other birds store beneath their beaks during foraging trips. Guano is the complex excrement of seabirds, containing a mixture of food residues and metabolic waste products, with uric acid as the main component. Pellets are regurgitations of indigestible food.

Among all of the samples investigated, 90 per cent contained at least one piece of microplastic. Looking at stomach contents specifically, 82 per cent contained microplastics.

The northern fulmar is a case in point: the results showed that 200 individuals had ingested more than 2,500 microplastic particles. Northern fulmars are predators and scavengers, feeding on fish, squid and small crustaceans. This tells us that microplastic pollution can reach seabirds both directly (when they ingest water, soil or rocks) and indirectly (when they feed on contaminated food).

Arctic puffins.

Photo credit: Davide Taurozzi

Photo credit: Bo Eide, CC BY 2.0 via Flickr.com

"What's for dinner, Mom, other than plastic?" This northern gannet in Sørvågen, Norway was trying to fish and feed her chick with a piece of rope stuck to her beak.

CURBING OUR PLASTIC USE

This analysis doesn't tell us exactly when or where the seabirds ingested microplastics. Nor does it tell us the origin of the microplastics. Nevertheless, it makes it very clear that the plastic pollution emergency is extremely serious, even in the remote Arctic.

Plastic ingestion by wildlife correlates with human activities: for example, as shipping activities increase, seabirds ingest more plastics. Furthermore, seabirds have been declining globally in recent years, particularly in polar regions, mainly due to climate change, sea ice disappearance, and decreases in the availability or accessibility of prey. These threats could amplify the negative effects of microplastic pollution, severely affecting bird species' already precarious survival.

Threats to seabirds come mainly from two types of interactions with plastic: ingestion and entanglement, such as in fishing lines or nets, plastic bags, or plastic strings, bands and ropes.

Polypropylene (used in items like food containers and outdoor furniture) and polyethylene (used in bags, bottles, cling film and toys) are the main plastic polymers found in the environment. This tells us that microplastic pollution derives from items we use in our daily lives and eventually discard—like bottles, jars, yogurt and hot beverage cups, food packaging, tote bags, carpets and more.

Millions of birds and other animals are paying for our consumer choices with their lives. The historic global resolution adopted by the United Nations Environment Assembly in 2022 to develop an international, legally binding instrument on plastic reduction, including in the marine environment, is an important first step toward controlling the problem. By promoting zero-waste policies, it can help advance the goals and targets in the 2030 Agenda for Sustainable Development. However, more needs to be done to ensure that ongoing research into these impacts is reflected in policy, starting with our daily actions. We need to stop plastic at its source. ●

DAVIDE TAUROZZI is a biologist, ecologist and wildlife photographer at Roma Tre University in Italy who works to protect and conserve alpine ecosystems and migratory birds.

Sparking change

TAKING OUT THE TRASH IN WEST GREENLAND

Sisimiut, a city on Greenland's west coast, is known for its wide valleys and steep mountains. The picturesque coastal community is the country's main adventure travel hub, attracting nature lovers from around the world.

For more than eight years, **JAN BANEMANN** has been sharing the beauty of this area with visitors. As the owner of Sisimiut Private Boat Safari, he takes them out in his boat, showing off the wildlife and surrounding settlements. One thing he never wanted to show them was a coastline scattered with garbage—but it was getting harder and harder to avoid. Banemann, who won the 2023 Greenland Tourism Award, decided to take matters into his own hands by collecting the garbage. He spoke to *The Circle* about why he started scouring the coastline in search of waste and his desire to protect Sisimiut's natural beauty.

When did you start noticing more garbage along the coast where you live?
Many years ago. And when I was out with tourists, I would think to myself that it was not very nice that they come all the way to Greenland and see all that garbage—because Greenland is one of the most lovely places you can visit. And I'd think that I needed do something to clean it up because people spend a lot of money to come see the natural beauty of this country.

I also realized that all the plastic is not good for nature, either. I know a little bit about microplastics and the food chain, so I know it gets into the foods we eat. I decided I wanted to teach people here in Greenland that they need to take care of nature and not just throw things in the water when they are out sailing or fishing.

Since Jan began cleaning up garbage eight years ago, he has found plastic bags, bottles, oil drums and even chairs and mattresses discarded along the coastline.

Photo credit: Jan Banemann

What types of garbage were you seeing?
There is a lot of gear from people who fish, like nets, ropes and other gear. I can't understand why people who depend on nature for their living would throw so many things into the water. I was also seeing plastic grocery bags, bottles and even oil drums. We have even found things like chairs and mattresses. But I would say maybe 80 per cent of the stuff we find is coming from fishing boats.

When did you start collecting this garbage?
I started eight years ago, when I launched my business. I can only do it in the summertime, when there is no ice or snow. It really depends on the weather—there can't be any big waves, so I have to choose the right days to do the work. But I spend six days every summer out in my boat collecting plastic and other garbage. Then there are two days that I spend on land, sorting and separating it all so I can bring it to the right place. For example, I put all the rope in one pile and all the fishing nets in another one. The nets are all made of nylon, and the ropes and nets get shipped to Denmark, where they are reused.

It is a big job, but my daughter and wife help me every year. So does my wife's brother. The government here in Greenland also has a fund supporting the project, so I can pay people to work with me. That money also helps to pay for the gas for the boat. But I cover about 25 per cent of the costs of doing this myself.

I would say maybe 80 per cent of the stuff we find is coming from fishing boats.

Photo credit: Jan Banemann

Jan Banemann in a boat loaded with garbage from the coastline.

Photo credit: Nivi Banemann

Jan often finds discarded fishing gear during his clean-ups.

Photo credit: Jan Banemann

Jan's daughter, Nivi, helps him collect garbage along the coastline in August 2024.

How have you tried to prevent this waste from collecting in the first place?
For the past two years, I have gone into the schools and talked to the children about the problem. I have also invited the school to bring the children to my home after I have gone out collecting to see all the garbage and help count it. I talk to them about how they need to take care of nature, and about microplastics and the food chain. I explain how all the plastics end up in the smaller animals, which are then eaten by bigger animals, and how eventually we are eating these microplastics ourselves. I really want to teach young people so they can take care of nature too.

I have also called the prime minister of Greenland and invited him to come out with me collecting garbage. And he did, about four years ago, and he was also very angry to see what a problem we have here in Greenland. I have also invited the mayor of Sisimiut to come out with me to collect the plastic and other garbage, and he has. I am really working hard to make people understand what a problem we have.

How long will you keep doing this?
As long as I am fit and I can do it, I will. But I am hoping that someday, I won't need to. I have seen other people starting to pick up garbage when they are out in nature. And when people are out sailing or fishing, they are starting to make sure they bring all their garbage back home and put it in the right place. So, I think people are beginning to take more care of our nature now. ●

Shipping

MAKING "GREEN" ARCTIC SHIPPING CORRIDORS GREENER

Much has been made recently about the potential for green shipping corridors to help decarbonize the maritime sector, including its ships, ports and energy supply chains. But as **ANDREW DUMBRILLE** and **SIAN PRIOR** write, more work is needed because the concept of green corridors does not yet include solutions to the triple planetary crisis involving climate, biodiversity and pollution.

GREEN CORRIDORS are trade routes that have the potential for zero-emission shipping because the vessels plying them use low- or no-emission fuels and technologies. They are usually established through collaborations between governments, ports, shipping companies and other stakeholders.

For example, consider green methanol fuel bunkered by ships on dedicated routes between Alaska and Vancouver. Such ships would have an end-to-end supply of an alternative fuel capable of substantially reducing greenhouse gas (GHG) emissions.

There are, of course, significant questions about scalability, availability, cost, life cycle and community impacts in scenarios like this. Shipping isn't always a straightforward A to B trade—there can be geopolitical and regulatory challenges. Nevertheless, such scenarios show promise and could prove beneficial to the planet.

Beyond the potential climate gains from sustainable, zero-emission fuels, there is a need to ask: When we consider green corridors, shouldn't we also think about their broader sustainability, biodiversity and ocean health implications? If ships reduce GHGs, but travel on a dead ocean, does it matter? Of course it does—especially when a diverse and productive ocean is key to reversing the climate crisis through its immense capacity to soak up carbon. In fact, the ocean absorbs 31 per cent of global CO_2 emissions.

For these reasons, the Clean Arctic Alliance has developed a vision to ➤

Arctic green shipping corridors must require ships to eliminate the use of heavy fuel oil and switch to cleaner "polar fuels," such as distillates, until zero-emission fuels are widely available.

A tanker carrying liquid natural gas sits off the coast of Finnmark in northern Norway.

Photo credit: Amanda Graham, CC BY-NC-ND 2.0 via Flickr.com

reframe how green corridors are defined and implemented in the Arctic. The vision focuses on five key approaches.

1. DECARBONIZING ARCTIC SHIPPING

The first focus must be energy efficiency measures, such as slower speeds and optimized routes to reduce fuel use across all vessel types. Along with the use of wind power, this approach could help the world meet both short- and longer-term climate targets. Once fuel demand has been reduced (with associated cost savings), scalable and zero-emission fuels that avoid controversial energy forms—such as bio and synthetic methane or hydrogen produced from fossil fuels—should be considered.

Liquefied natural gas needs to be explicitly ruled out as an alternative fuel due to its high leakage of methane gas, impacts from fracking, and lifecycle greenhouse gas emissions.

2. REDUCING POLLUTING EMISSIONS

Black carbon (or soot) in exhaust emissions has a disproportionate impact on the climate, contributing to global heating and speeding up ice and snow melt in the Arctic. It is responsible for more than 20 per cent of shipping's global climate impact, and it is five times more potent when released in the Arctic because it darkens the ice and snow, reducing the reflectivity. Reducing black carbon emissions can reverse habitat loss, support food security and health for communities, and contribute to the world's ability to reach climate targets.

It is critical that Arctic Indigenous Peoples and coastal communities see direct benefits from green shipping corridors.

Arctic green shipping corridors must require ships to eliminate the use of heavy fuel oil and switch to cleaner "polar fuels," such as distillates, until zero-emission fuels are widely available, eliminating the need to install and use exhaust-cleaning scrubbers. The implementation of diesel particulate filters, such as those already used in land-based transport, would virtually eliminate black carbon emissions.

3. MITIGATING BIODIVERSITY LOSS

Underwater radiated noise from shipping disrupts communication and navigation for marine life and interferes with their ability to reproduce and forage. Ships have been identified as the top contributor of this noise globally and can play a major role in quieting our oceans. Arctic green shipping corridors should use route optimization in important marine wildlife areas to reduce strikes and noise exposure and implement suitable noise thresholds for all ships. Speed limits within green corridors need to be prioritized, and efforts to reduce shipping noise should be incentivized.

4. ADDRESSING OTHER SHIP POLLUTION SOURCES

Tanks, machinery, engine spaces and equipment are flushed and washed during routine operations at sea and in ports. Residues from these processes can contain hazardous chemicals and oils that end up in our oceans. A strict zero-discharge and zero-tolerance regime must be in place in all green shipping corridors to ensure limited impacts on ocean health. Sewage and greywater discharges from ships can reduce oxygen levels, spread bacteria and viruses, and raise nutrient levels. Advanced wastewater treatment systems, strict no-discharge zones, and mandatory on-board management planning are paramount.

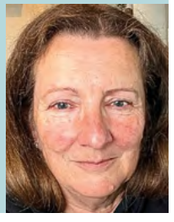
Shipping is also responsible for 60 to 90 per cent of the introduction of new, potentially invasive species through hull fouling and ballast water. Green shipping corridors in the Arctic must enforce strict ballast water management standards and mandatory application of the International Maritime Organization's hull-fouling guidelines, which include frequent testing, regular hull inspections, and cleaning.

5. SUPPORTING A JUST AND EQUITABLE TRANSITION IN SHIPPING

It is critical that Arctic Indigenous Peoples and coastal communities be able to participate in policymaking, have access to training and education, and see direct benefits from green shipping corridors. The transition to a holistic and comprehensive approach must be just and equitable, increase access to and funding for emerging renewable energy solutions, and ensure protection from the economic and social hardships due to employment loss that can result when new technologies are implemented.

The ability to protect ocean health, reverse the climate crisis, and avoid biodiversity loss and pollution are key components of a truly green Arctic shipping corridor. For the good of the Arctic and the planet, we invite everyone involved in the maritime and green corridors spaces to consider an approach that will deliver results at the nexus of the triple planetary crisis. ●

ANDREW DUMBRILLE is the North American advisor to the Clean Arctic Alliance and co-founder of Equal Routes, a non-profit organization that aims to create a sustainable and equitable marine shipping sector with a focus on communities and rights-holders.



SIAN PRIOR is lead advisor to the Clean Arctic Alliance, a coalition campaigning to persuade governments to take action to protect Arctic wildlife and people.

Photo: ARLIS Reference, CC BY-SA 2.0 via Flickr.com

Sea otter covered in oil from the Exxon Valdez *oil spill in Prince William Sound, Alaska.*

Oil spill response

SEARCHING FOR WAYS TO ADDRESS DISASTERS IN THE ARCTIC

Global warming is melting sea ice and enabling increased ship traffic in the Arctic, raising the risk of oil spills. As **ERIC COLLINS** and **GARY STERN** explain, the good news is that a state-of-the-art Arctic research facility is helping researchers and communities understand the risks.

SOME FOUR DECADES ago, 65 kilometres by sea from the community of Mittimatalik in Nunavut, Canada, a group of government and industry researchers intentionally dumped 30 tons of crude oil into a sandy lagoon. They were planning to study its effects on the Arctic marine ecosystem.

It was the 1980s, and the simulated oil spill was part of the Baffin Island Oil Spill (BIOS) project. Researchers discovered that while much of the oil dissipated naturally, more than a third remained on beaches two years later.

Periodic visits over the following decades revealed that, in most cases, harmful oil components still exceeded baseline levels.

Although the BIOS project provided valuable insights into the long-term effects of oil spills, conducting such studies is no longer ethically or politically feasible. But as our warming climate causes Arctic sea ice to melt, making room for ever more ships, the need to find ways to prevent and mitigate the effects of an oil spill in the Arctic has never been more critical.

GROWTH IN SHIPPING

Fast forward to 2024: It's a sunny summer day on the Churchill River estuary when an oceanographer hauls up a net full of algae, surprised at the rich haul. The net contains mostly single-celled diatoms, microscopic algae that are crucial for photosynthesis. These jewel-like microbes are food for zooplankton (tiny animals), which are in turn eaten by fish, eventually ending up in the bellies of whales (and people).

Moments later, a group of belugas swim under the boat while locals and tourists alike marvel at how curious and interactive they are.

Despite nearly a century of investment in the only deep-water port in the Canadian Arctic (and the ageing rail line that serves it), Churchill's economy is still driven mainly by tourism—the town is known as the "polar bear capital of the world."

But a new Indigenous-owned project, NeeStaNan, is poised to change this reliance. The project would export potash and petroleum products from the prairie provinces via rail and ship through Hudson Bay, which is home to more than a third of the world's belugas.

Regardless of whether this particular plan goes ahead, one thing is clear: Arctic shipping is set to grow. This raises concerns about oil spills and other threats to this fragile ecosystem.

A NEW FACILITY TO STUDY OIL SPILLS

The plan is to study how microbes break down oil in sub-zero temperatures.

When oil spills into water, its composition naturally changes over time through a process called weathering, or natural attenuation. Evaporation, sunlight, aggregation, sinking and microbial activity alter the oil's physical, chemical and biological properties, including its ➤

Photo credit: Katie Chalmers-Brooks / University of Manitoba

Oceanographer CJ Mundy (University of Manitoba) examines algae near the Churchill Marine Observatory.

toxicity. But the sea ice that is present for much of the year in Hudson Bay makes this process unpredictable—and human interventions, such as the use of chemical dispersants, add complexity.

With the BIOS project long gone, Canada has invested millions in the Churchill Marine Observatory (CMO), a state-of-the-art facility in the province of Manitoba designed to fill the gap. Located near hundreds of belugas (and a playful polar bear), the CMO was built to safely study processes to address oil spills. Opened in August 2024, it features tanks the size of swimming pools that can be filled with water from the Churchill River estuary to enable Arctic oil spill response experiments that were previously impossible.

The first experiments will take place in November 2024, co-led by us and funded by Genome Canada and the University of Manitoba as part of the GENICE II study. The plan is to study how microbes break down oil in sub-zero temperatures. Researchers have already shown that microbes are nature's first responders. For example, microbes cleaned up far more oil during the 2010 Deepwater Horizon oil spill in the Gulf of Mexico than human efforts did. By examining oil-degrading microbes in Hudson Bay and measuring their response in different spill scenarios, we aim to better understand the risks and limitations of current Arctic spill response plans—which, despite local concerns, remain unknown.

TAKING A CLOSER LOOK AT MICROBES

The Hamlet of Chesterfield Inlet's location on the west coast of Hudson Bay puts it at high risk of spills from ships navigating the fast-flowing, mostly uncharted Chesterfield Narrows, which run 300 kilometres to Baker Lake and the Meadowbank Gold Mine beyond. Since 2007, there have been four reports of vessel groundings in the area. A sea can full of Coast Guard equipment is stationed nearby, but local officials have not been trained to use it in the event of a spill.

To safeguard the ecosystem, we are collaborating with hunters' and trappers' organizations (such as the Aqigiq HTO in Chesterfield Inlet) and Indigenous Guardians Programs in the region to test genomics tools for monitoring environmental disturbances like oil spills. New technologies, like MinION—the harmonica-sized DNA sequencer from Oxford Nanopore Technologies—will enable real-time microbial monitoring by and for communities. Microbial diversity, a key biomarker of environmental health, will inform research that supports Inuit self-determination and the management of marine environments, including the creation of a marine protected area in the Southampton Island area of interest (at the opening of Hudson Bay).

Microbes play vital roles in the marine ecosystem, from supporting the food web to cleaning up oil spills. Monitoring microbial diversity will help researchers and Indigenous communities better understand the rapid environmental changes caused by global warming and better predict and prevent the potential impacts of oil spills on the Arctic marine environment.

Photo credit: Katie Chalmers-Brooks / University of Manitoba

Belugas in the Churchill River estuary, with the Churchill Marine Observatory's Ocean-Sea Ice Mesocosm (OSIM) facility in the background.

ERIC COLLINS and **GARY STERN** work at the Centre for Earth Observation Sciences at the University of Manitoba, Canada.

Collins is an assistant professor and Canada Research Chair in Arctic Marine Microbial Ecosystem Services.

Stern is an associate professor and the director of the Petroleum EnvironmenTal Research Laboratory (PETRL).

Photo credit: © Shutterstock / Shane Gross / WWF

Youth perspective

PLASTIC POLLUTION IS UPENDING INDIGENOUS WAYS OF LIFE

A growing plastic pollution crisis is threatening food security, human health and marine ecosystems in Indigenous communities across the Arctic. **JUSTIN LANGAN** sees it as a call to action for Indigenous Peoples of his generation.

Plastic bags and other trash float near the surface of the sea.

GROWING UP on the cusp of the Canadian Arctic as an Indigenous youth in the rural community of Swan River, Manitoba, I experienced firsthand the deep connection between our people and the land and sea. The Arctic is not just our home as Indigenous Peoples—it's an integral part of our identity and way of life. However, this pristine environment faces an insidious peril that knows no borders: plastic pollution.

This crisis intersects profoundly with our traditional livelihoods, affecting not only our food security and health, but the ability to preserve our cultures. It is now up to the next generation—my generation—to confront these challenges head-on and ensure a sustainable future for our communities.

A HAZARD ON THE MOVE

Carried by ocean currents from distant parts of the world, plastic waste finds its way into the Arctic, contaminating our waters and coastlines. This pollution directly affects marine life, which Indigenous communities rely on for sustenance and cultural practices. Seals, fish and marine mammals can mistake plastic debris for food and ingest it. This leads to malnutrition, poisoning and often death, disrupting the delicate balance of our ecosystems and threatening the primary food sources for many Arctic communities.

The health of our communities is intrinsically linked to the health of our environment. For centuries, the Inuit, Métis and First Nations Peoples of the Arctic have thrived on the sea's bounty for nutrition and as a cornerstone of our cultural identity. Hunting and fishing are more than survival tactics—they are sacred traditions that connect us to our ancestors and teach us invaluable lessons about respect for nature. Every piece of plastic found in a seal's stomach or caught in a fishing net is a stark reminder of how modern waste encroaches on these traditional practices, endangering our cultural heritage.

Food security in the Arctic is already a complex issue due to our remote geography and harsh climate. Traditional hunting and fishing practices help mitigate these challenges by providing reliable, nutritious, locally available food sources. However, as plastic pollution disrupts marine ecosystems, these food sources are becoming less dependable, forcing communities to rely more on expensive, imported goods. This strains our limited financial resources and distances us from cultural practices and traditional knowledge.

Traditional knowledge, passed down through generations, encompasses sustainable practices that have allowed Indigenous communities to thrive in the Arctic for millennia. My generation is facing the daunting task of preserving our heritage amid an ever-changing and increasingly polluted environment.

My generation is facing the daunting task of preserving our heritage amid an ever-changing and increasingly polluted environment.

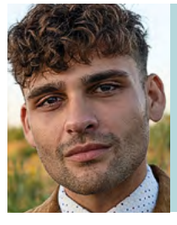
A THREAT AND AN OPPORTUNITY

I believe this crisis is both a challenge and an opportunity for young people living in the Arctic nations. Although the impacts of plastic pollution on traditional Indigenous livelihoods are immediate and severe, I also see significant potential for innovative solutions. We are at a critical juncture where we can advocate for policies and practices that reduce plastic waste and promote sustainable alternatives. This involves both local action and global cooperation to address the root causes of plastic pollution.

Education and awareness are pivotal. Indigenous youth must be empowered with knowledge about the impacts of plastic pollution and equipped with the tools to engage in environmental stewardship. This involves integrating traditional ecological knowledge with modern scientific understanding to create a holistic approach to conservation. Initiatives like beach clean-ups, plastic waste reduction programmes, and policy advocacy are just a few of the ways in which youth can actively contribute to mitigating the problem.

But in addition, the voices of Indigenous youth must be amplified in national and international forums. Our unique perspectives on environmental stewardship and cultural preservation offer valuable insights into sustainable living. By participating in global discussions of climate change and pollution, we can ensure that our communities are represented and our solutions heard.

The relationship between the Arctic and Indigenous Peoples is symbiotic. Respecting the land means respecting our communities. As a Métis youth, I see this as a challenge and a call to action for my generation. By embracing our roles as stewards of the land and advocates for sustainable change, we may still be able to protect the Arctic and its people for generations. The urgency of these issues demands our attention, innovation and unwavering commitment to a cleaner, healthier future. ●



JUSTIN LANGAN is a 25-year-old Métis youth from Manitoba, Canada.

Unauthorized dumpsites can emerge in communities that lack adequate infrastructure for waste disposal.

A community-based approach to waste

CLEANING UP RUSSIA'S KOLA PENINSULA

Cleaning up hundreds of tons of waste from these areas made a huge difference to these communities.

Photo credit: Saami Council

A metal tank dump in Kharlovka Village.

Photo credit: Saami Council

For many people, disposing of household waste is easy: you collect it and put it out at the curb. But in many remote Sámi communities, waste removal is not so easy. Many don't have the infrastructure to dispose of waste safely, and disposal facilities can be hundreds of kilometres away. This sometimes results in the emergence of unauthorized dumpsites, which can contaminate the local water and land, putting the health of residents and species at risk.

In 2018, the Arctic Council's Arctic Contaminants Action Program (ACAP) Working Group partnered with the Saami Council to launch the Kola Waste Project. The initial goal was to clean up 43 unauthorized dumpsites that were peppered across Russia's Kola Peninsula. As the project progressed, more sites were identified, bringing the total number of dumpsites closer to 60 by the project's close. **JULIUS MIHKKAL LINDI**, project adviser for the Saami Council's Arctic and Environmental Unit, spoke to *The Circle* about how the project has improved the ecological situation for Sámi communities and others in the region.

Why did you decide to launch this project?
A member organization from the Sámi community in the area had identified a serious need for waste removal there. There were a lot of unauthorized dump sites. People had complained about them for years, but no one had the capacity to do anything about them. Since the Sámi get most of their food from hunting and foraging, it was very problematic for their food security.

Julius Mihkkal Lindi.

What kind of waste was being dumped at these sites?
Much of the waste was construction materials, abandoned vehicles and industrial debris, including old oil drums, which often had hazardous substances still in them. Organic waste and general household trash were also common in many of the unauthorized dumpsites. So, it was a wide variety of waste, and it had collected over many years. I think one of the reasons for this was a lack of infrastructure to handle waste collection in the area. People would just go out to the wilderness and dump it there because that was the only way to get rid of garbage.

What risks did this pose to the Sámi communities in the Kola Peninsula?
A lot of this waste was near the town of Revda, which is on a river that flows through the Murmansk region. Many ➤

people there live off fish and foods that they forage for near the river, like mushrooms, which absorb what's in the ground. So, there was a large risk of having these toxins enter the food chain. This would pose a serious threat over time—not only to local wildlife but also to human health—by contaminating water sources and the food the Sámi rely on for sustenance. Having waste spread all over the place generally also ruined the nature and affected the local biodiversity.

We are incorporating the lessons learned into new waste management projects in Norway, Sweden and Finland.

How did you go about cleaning up these sites?

The first task was to identify the unauthorized waste sites. Our member organization in Murmansk started in the villages of Revda and Krasnoshchelye, working closely with the local Sámi people who helped pinpoint the locations of these sites. Since they were the ones complaining about the dumpsites, the Sámi would know where they were. We used GPS tools and visited the sites to make sure that those in the most remote areas were also documented.

Given the remote locations, we also needed a wide variety of equipment, including snowmobiles and trucks, to get access to the sites. Helicopters were also used to transport supplies and remove larger debris in some areas. We then contacted the appropriate authorities and professionals to extract the waste and bring it to proper handling facilities, where it could be treated and processed without endangering human health or wildlife.

How difficult was it to clean up these sites?

It was really challenging to extract the waste because these sites were in remote areas with no easily accessible roads. You couldn't just go in with a dump truck. You had to traverse them with a wide variety of vehicles. And in some cases, access was only possible in winter, when ice roads could be used.

It was a lot of hard work. But one of the reasons the project was so successful is that we managed to engage people at the local level to help with the clean-up efforts. We got funding so local Sámi and local volunteers could be paid to be part of the extraction efforts.

What difference has the project made for the community?

It has made a profound difference. The existence of these waste sites in Sámi communities was not only a significant health issue—it was also negatively affecting their mental health and overall well-being. Just seeing these sites all over the place and knowing they couldn't do anything about them must have been awful, honestly. Cleaning up hundreds of tons of waste from these areas made a huge difference to these communities. The waste management infrastructure also got better as a result of the project, so it did wonders not only for the Sámi people, but for all local residents.

With this sort of project, there is also an awareness-raising component, and it did make the local population realize that there are better ways to handle waste and that it is illegal to dump it in the wilderness. We hope this awareness might prevent new sites from forming.

What is happening with the project now?

The project officially concluded in July of 2022 with many significant clean-up efforts completed. This included the removal of hazardous oil tanks in Yonsky and waste clean-up activities in Lovozero and Kovdor districts. Some key contaminated sites were registered with local authorities to ensure that future clean-up efforts could be carried out safely. These efforts also helped protect local ecosystems and rivers, including important areas along the Voronya and Nivka rivers, where illegal dumping had been damaging nature.

While we are not able to continue the Kola Waste Project for now, we are incorporating the lessons learned into new waste management projects in Norway, Sweden and Finland. Sámis in these regions face similar waste management challenges, and the Saami Council is currently working with our member organizations to identify a pilot project that can address these issues. The Kola Waste Project will remain a role model for new solid waste management pilot projects within ACAP that focus on addressing waste in remote Arctic communities. ●

Photo credit: Saami Council

An old ship rusts in Umba, an urban settlement in the Kola Peninsula.

Something fierce

THE CLIMATE CRISIS IS FUELLING MORE INTENSE WILDFIRES

Around the world, the number and intensity of wildfires is on the rise, and the Arctic and sub-Arctic regions have been among the hardest hit. As **SUSANA HANCOCK** writes, these fires send some of the world's most dense carbon stores up in smoke, with ramifications for human health, the world's climate and the Arctic itself.

THESE MORE ENERGETIC fires have doubled in strength and size over the past two decades, consuming more fuel and releasing more heat. As a result, they are associated with both greater emissions and more social, ecological and economic losses, whether direct or indirect. In the Arctic and sub-Arctic boreal and temperate forests, the intensity of wildfires increased 7.3-fold and 11.1-fold, respectively, from 2002 to 2023 (as measured by the heat energy they release).

In Russia this year, notable fires were burning by early June. By mid-month, a state of emergency had been declared in Sakha and Tuva provinces. Elsewhere in Siberia, cumulative emissions from abnormally strong fires in places like Amur Oblast had already surpassed any June or July record in the 22 years of monitoring by the Copernicus Atmosphere Monitoring Service. These emissions triggered air quality warnings across Mongolia, China and Japan. The year 2024 is continuing a trend that has seen six of the most powerful wildfire years occur within the past seven.

Russia's emergency situations minister, Alexander Kurenkov, has stated that even though Siberia has experienced 30 per cent fewer fires this year than in 2023 (so far), the area burned is 50 per cent larger.

A REGION UNDER PRESSURE

The pace of climate change in the Arctic is eclipsing that of other areas in terms of warming and new patterns of heat and moisture. Higher temperatures and more arid conditions are making the region increasingly susceptible to large-scale wildfires with more significant emissions. Boreal forests are some of the most carbon-rich landscapes on Earth, with as much as 80 to 90 per cent of their carbon stored below ground. Much of the boreal carbon has been protected from past burns, but these hotter fires burn more deeply into the soil, releasing carbon that has been stored for millennia.

Recent studies highlight several climate trends that are driving these more powerful burns and indicate the reach of their influence. For example, some show connections between heat waves in continental Europe and large-scale fires throughout the circumpolar region. One study found that drier conditions as a result of human-induced climate change fuelled more than 50 per cent of the rise in fire activity in the United States.

ZOMBIE FIRES AND FEEDBACK LOOPS

Not only is the Arctic warming four times faster than the rest of the planet, but night-time warming is outpacing daytime warming—another change that fuels fires. ➤

Taiga burning near Krasnoyarsk, Siberia, Russia.

Smoke—like all forms of air pollution—is transboundary. It affects areas far beyond the source.

Photo credit: Jean-Daniel Paris, CC BY-SA 3.0 via imaggeo.egu

Overnight cooling periods traditionally allow fire growth to ebb, but fires are able to maintain more energy overnight as the temperature differential shrinks.

In addition to fires gaining ground overnight, an increasing number are overwintering. The carbon-infused soils feed holdover fires (also known as zombie fires), which smoulder throughout the winter—burning more of the stored carbon—before reigniting on the surface in the spring.

Emitting climate-altering gases like carbon dioxide, methane, nitrous oxide and others—which beget further warming and conditions conducive to burning—is one way in which wildfires stoke feedback loops in the Arctic. But researchers have described another feedback loop in which wildfire soot deposits on Arctic ice and snow speed up melt and lower their albedo. (Albedo is a measure of how much sunlight a surface reflects. When bright ice and snow are covered by dark soot, they absorb more heat and melt faster.)

And although the degree of causation remains unconfirmed, smoke from forest fires in Québec, Canada in 2023 reached southwestern Greenland. This coincided with an anomalous warm period in the region and significant melting of the ice sheet.

A HARM WITHOUT BOUNDARIES

Smoke—like all forms of air pollution—is transboundary. It affects areas far beyond the source.

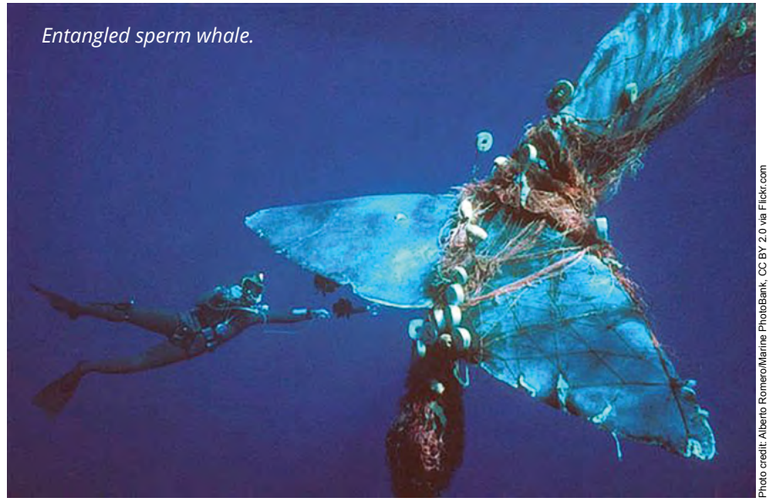
In addition to its consequences for ecosystems, wildfire smoke is toxic to human health. It comprises particulates, heavy metals, acids and other compounds that pollute waterways and farmland and harm air quality. In people, such pollution is linked with millions of premature deaths and a range of health conditions, including cardiovascular, respiratory and cognitive diseases.

Direct losses associated with fatalities in eastern Siberia and East Asia from Siberian fires alone have been estimated by researchers to exceed US$10 billion a year. Indirect health and economic costs, such as those associated with illness and lost productivity, could be much higher.

Extreme fires are just one of the rapid changes affecting the northern regions of the planet. With yet another consequential wildfire season underway in the temperate and boreal forests of Siberia, carbon once buried deep in the ground is on a trajectory to amplify pollution, with cascading impacts on health, ice and the atmosphere for years to come.

To stop the severe escalation in wildfires and pollution, the world must reduce its dependence on fossil fuels. Commitments to halving emissions by 2030 and reaching net zero by mid-century need to be enforced so we can reach the goals set by the Paris Agreement with little overshoot. ●

SUSANA HANCOCK is an interdisciplinary polar climate scientist.



Entangled sperm whale.

Photo credit: Alberto Romero/Marine PhotoBank, CC BY 2.0 via Flickr.com

International plastic treaty

A HISTORIC OPPORTUNITY TO END PLASTIC POLLUTION

Plastic pollution is a boundless poison that is infiltrating some of the most remote places on Earth, particularly across the Arctic region. As **EIRIK LINDEBJERG** writes, without robust and decisive global action during the final plastic treaty negotiations later this year, by 2040, the amount of plastic that ends up in the ocean will triple.

SINCE THE 1950s, the amount of plastic produced globally has increased from nearly two million tonnes to more than 460 million tonnes. Alongside this rise, we've seen plastic mutate from being a supplementary element in our lives to a compulsory one, whether we liked it or not. Since 2000 alone, global plastic waste has more than doubled.

Given that only a fraction of the plastic we have ever produced has been recycled, we now find ourselves facing a global catastrophe. Our rivers and oceans are being suffocated, our food, air and water contaminated, and marine and other wildlife are dying. The overproduction, use and disposal of plastic is also exacerbating the climate crisis and posing a major risk to human health and the world economy.

THE SINGLE-USE PROBLEM

While we acknowledge that plastic is essential in some aspects of modern life, such as in health care—especially if designed, used and managed responsibly—we are undeniably using it too much, often to produce pointless things. More than half of global plastic production is now geared towards single-use products. Despite what it may say on the label, many plastics are too difficult or dangerous to recycle, so are sent to landfill, burned or end up polluting our natural environment.

Single-use plastic now accounts for 7 per cent of plastic pollution in the ocean. Once in our shared ocean, plastic can reach almost any location on the planet, including the Arctic, which encompasses some of the most remote and fragile ecosystems on Earth.

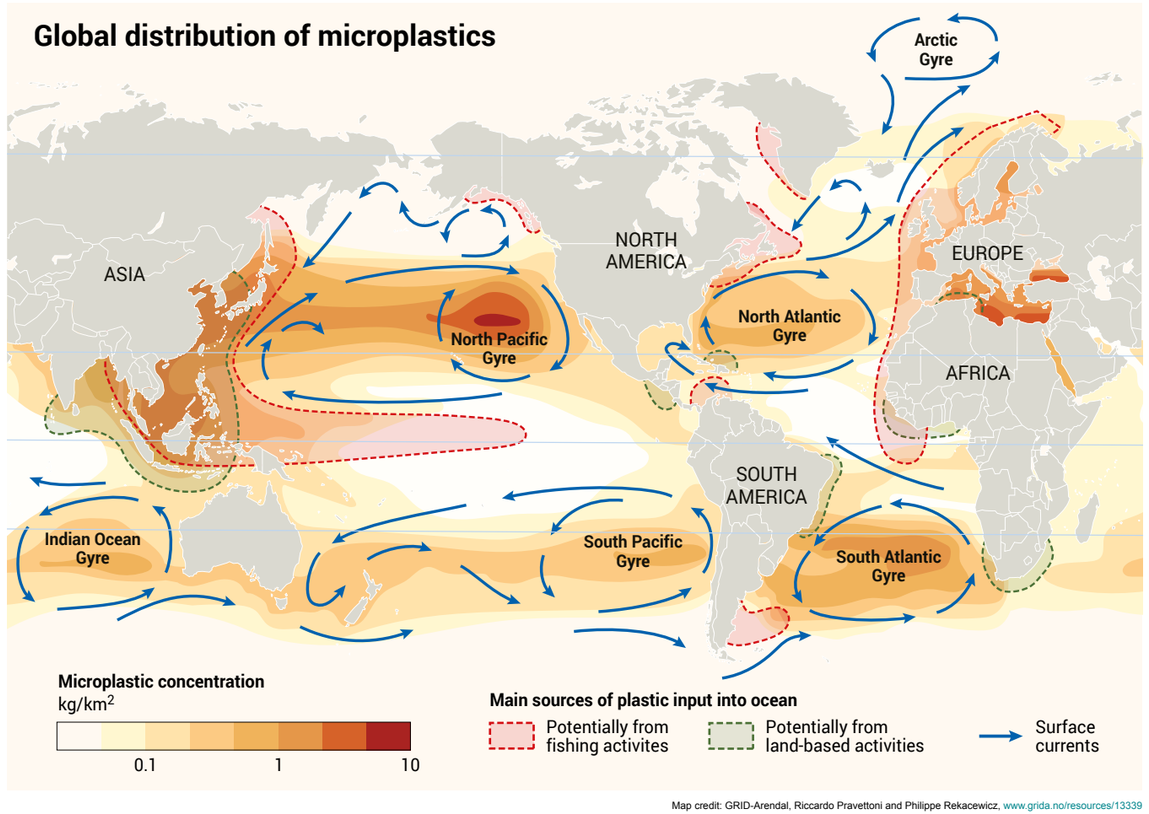
Perceived as pristine and untouched, the Arctic is actually a growing hotspot for plastic pollution. The ocean currents that have fed this region for thousands of years now transport poison in the form of plastics. Currents, atmospheric winds and human activity all contribute to the alarming increase of plastic in the region that is posing a major threat to wildlife, marine ecosystems and Indigenous communities.

Plastic pollution, especially microplastics (which are the result of larger plastic products breaking down into countless smaller, often microscopic pieces) can be ingested by a wide range of Arctic mammals, seabirds, fish and invertebrates, leading to malnutrition and even death. Through this route, plastic accumulates in the food chain, eventually affecting larger predators, such as polar bears and seals, and humans. Marine animals are also at risk of entanglement in larger plastic waste—such as fishing nets, known as ghost gear—leading to injuries and even death.

NEW MINDSET NEEDED

Despite national and voluntary initiatives to curb this crisis, production, consumption and pollution continue to increase. The plastic pollution crisis is a global problem that demands a global solution. It demands that we move beyond the voluntary mindset that has dominated our collective response over the last three decades and work together to end this crisis.

The Global Plastic Pollution Treaty represents a historic opportunity. So far, there have been four negotiation meetings, with the fifth and final one set for November in Korea. In the face of growing pressure from the oil and plastics lobby, we need our leaders to stay true to their promise to end the plastic crisis and build on the huge support they have been receiving from scientists, businesses, civil society and Indigenous communities for a strong and ambitious treaty.



Map credit: GRID-Arendal, Riccardo Pravettoni and Philippe Rekacewicz, www.grida.no/resources/13339

Essentially, the treaty must establish the binding international rules and regulations needed to spark the necessary market shift. Leaders must secure four key measures:

- Binding global bans and phase-outs of problematic and avoidable plastic products and chemicals of concern
- Binding global product design requirements and systems for the transition toward a non-toxic circular economy
- A comprehensive and sufficient financial package to support all nations in a just transition
- A decision-making mechanism to ensure the treaty can be strengthened over time and not blocked by future vetoes

REASON FOR HOPE

A majority of countries have already expressed support for the treaty to include these measures. The science is there to tell us which products and materials should be put on phase-out lists. And a large part of the industry has expressed support for civil society demands through initiatives such as the Business Coalition for a Global Plastics Treaty. We just need leaders to have the political courage to adopt the deal despite the predictable resistance from a handful of countries fuelled by petroleum interests.

A final agreement must offer a credible pathway towards reducing plastic production and consumption and include specific obligations to eliminate the most problematic elements of the plastics value chain and ensure that all plastics we continue to produce are safe to reuse and circulate.

We will make history in 2024. The coming round of negotiations can be the moment our leaders decide on bold, binding global actions across the entire plastics lifecycle to protect nature and human health. Or these leaders can go down in history for turning their backs on the planet, their citizens and the long-term prosperity of societies in favour of short-term gains and industry interests. ●

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The *Exxon Valdez* oil spill: 45 years ago

The Exxon Valdez ran aground in Prince William Sound, west of Tatitlek, Alaska, on March 24, 1989. The oil tanker spilled more than 41 million litres of crude oil into Arctic waters, killing an estimated 250,000 seabirds, 2,800 seas otters, 300 harbour seals, 22 orcas, and an unknown number of salmon and herring. It was one of the largest environmental disasters in US history.