INTERNATIONAL SYMPOSIUM ON

PLASTICS IN THE ARCTIC

AND SUB-ARCTIC REGION

ONLINE EVENT MARCH 2-4 AND MARCH 8-9, 2021

SYMPOSIUM SUMMARY

Government of Iceland

Nordic Council of Ministers

Suggested citation
2021. *International Symposium on Plastics in the Arctic and the Sub-Arctic Region, Symposium Summary*. The Government of Iceland and the Nordic Council of Ministers.

Acknowledgements
We would like to thank Lisa Hymas, Thomas Maes, Kevin McGwin (primary author and notetaker) and Tina Schoolmeester from GRID-Arendal (Norway) and Katrin Vorkamp from the Department of Environmental Science at Aarhus University (Denmark) for making this report possible through their contributions and reviews.

Layout
GRID-Arendal, Norway

Front and back cover photos
Ministry for Foreign Affairs of Iceland

Published by
The Government of Iceland and the Nordic Council of Ministers

Government of Iceland | Nordic Council of Ministers

This report is available as an electronic document from https://arctic-council.org/en/explore/topics/ocean/plastics/

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Photo: Ministry for Foreign Affairs of Iceland

PREFACE

The Government of Iceland in collaboration with the Nordic Council of Ministers hosted the International Symposium on Plastics in the Arctic and Sub-Arctic Region on March 2-4 and 8-9, 2021 in connection with the Icelandic Chairmanship of the Arctic Council, which took place from May 2019 to May 2021. The symposium was organised in co-operation with 11 international partners that address marine pollution in various ways. Iceland had chosen the Arctic marine environment as one of four priority areas of work for its chairmanship and addressing plastic marine litter, and in particular pollution in the Arctic, became a high priority issue in the work programme of the Arctic Council.

The symposium was conceived of as a way to bring together scientists, practitioners, decision makers and other stakeholders for an exchange of information that would lay a foundation for science-based best practices that can improve the way we deal with the problem of plastics in the Arctic marine environment.

A scientific steering committee comprised of experts nominated by the partners was established to support the organising committee in setting up the agenda and selecting speakers and presenters based upon scientific abstracts.

The symposium was originally scheduled to take place in Reykjavík, Iceland, in April 2020, at the mid-point of the Icelandic Arctic Council Chairmanship. Iceland promoted discussion and action on the issue during its chairmanship period.

Due to the coronavirus pandemic, the symposium was moved online. Despite the delay and the change of format, it achieved its goal and will contribute to the Arctic Council's continued work on marine litter and plastic pollution.

This publication provides key points from the presentations and highlights from the discussions in a format that is accessible to policy makers and the general public. Recordings of all panel discussions, as well as the 55 presentations and 39 poster sessions, are available on the Arctic Council's website (https://arctic-council.org/en/explore/topics/ocean/plastics/). Additional information about the work of the Arctic Council to address marine pollution is available on the websites of its Protection of the Arctic Marine Environment (pame.is) and Arctic Monitoring and Assessment Programme (amap.no) working groups.

Based on the interest in and the successful execution of the symposium, Iceland is considering convening a second international symposium of this kind in the next two to three years, also bearing in mind the growing interest and activities in scientific research in the many different aspects of the problem.

Magnús Jóhannesson
Chair of the Organising Committee

Photo: Ministry for Foreign Affairs of Iceland

WELCOME

Dear reader,

In early March 2021, the Government of Iceland along with the Nordic Council of Ministers hosted the first International Symposium on Plastics in the Arctic and Sub-Arctic Region. The symposium was held in connection with the Icelandic Arctic Council Chairmanship which we have led under the overarching theme "Towards a Sustainable Arctic".

It may, or may not, come as a surprise to you that plastic litter can be found literally everywhere in our environment with most of it ending up in the ocean. It is estimated that over 150 million tons of plastic waste are floating around the world's oceans, and at the present rate it is expected that around eight million tons of plastic waste enter the ocean every year. A large part of the Arctic is covered by ocean and a vast majority of Arctic communities are not only shore-based but owe their livelihoods to ocean-based activities. Therefore, we found it imperative to focus on the Arctic marine environment as one of Iceland's four chairmanship priorities. Drawing on the Arctic Council's first desktop study on marine litter, we have highlighted plastic pollution in the Arctic marine environment during our chairmanship term. Together with the other Arctic states, we see it as our responsibility and duty to safeguard Arctic waters.

With a great team effort, the symposium was moulded into an online format to bring this timely and important event to life in these difficult times. It is about time that the threat of plastics in the oceans is brought to the world's attention. Thankfully, there is already a broad and fast-growing international consensus to act. We cannot continue down this path any longer. In our quest for solutions, we need to give support to our excellent scientists worldwide and facilitate dialogue. The symposium successfully brought together many of the world's leading scientists and knowledge holders on plastics in the ocean, providing an unprecedented platform to discuss this tremendously important issue. I believe that time will tell us that the symposium contributed greatly to the on-going and future work of the Arctic Council on this critical issue to us all.

I can say with certainty that we have failed when it comes to responsible disposal of plastic products and we need better stewardship to address this problem that is growing every day at an alarming rate. Not convinced? It is estimated that by 2050 there could be more plastic in the oceans than fish, if we do not act. Let that sink in for a minute. I realise that plastic pollution in the ocean truly is a complex challenge to resolve and there is no magic answer. However, just as with any other challenge, if we get our priorities right, success is achieved through trial and error. We have failed, but the answer is not to give up. By trying again, and again, we come closer to a solution.

Guðlaugur Þór Þórðarson
Minister for Foreign Affairs and International Development Co-operation

HIGHLIGHTS FROM THE OPENING ADDRESSES

After welcoming statements by Icelandic Foreign Minister Guðlaugur Þór Þórðarson and Chair of the Senior Arctic Officials Einar Gunnarsson, the Finnish Minister of the Environment and Climate Change, **Krista Mikkonen**, welcomed participants on behalf of the Nordic Council of Ministers.

In her address, Minister Mikkonen noted that the work being done in the Arctic and Nordic regions to address plastic pollution will contribute to an on-going global discussion of how to deal with the problem, and that this is in keeping with the theme of the Finnish chairmanship of the Nordic Council of Ministers, "Together We Are Stronger and Wiser Than We Are Individually".

Because no single country or region can successfully tackle plastic pollution alone, the Nordic countries, according to Mikkonen, support the adoption of a mandate at the United Nations Environment Assembly to negotiate a new global agreement to prevent plastic pollution.

"In the Nordic countries, we share a strong belief that we must continue a dialogue in these challenging times, and we must make bold decisions to solve urgent global environmental problems," she said.

Ultimately, reducing plastic litter requires a circular-economy approach to address all stages of the plastic lifecycle, she argued. "We need to rethink how we produce and use plastic products, and we need to build better systems for waste management to ensure plastics do not end up in the environment."

Inger Andersen, the Executive Director of the United Nations Environment Programme, delivered the symposium's keynote address.

While the pandemic has occupied much of our attention during the past year, nature and biodiversity loss, pollution and waste, and climate change – what she called "the three planetary crises" – have continued apace. Much of the focus has been on the effects of these crises on terrestrial ecosystems, but the oceans, she said, are "under attack from the same patterns of unsustainable consumption and production patterns that are causing such problems on land", and they need similar attention.

Making peace with nature, she believes, requires us to transform our relationship with oceans and waters, a part of which includes addressing marine litter and plastic pollution. She delivered five messages for how this can be done. Dealing with Covid-19-related waste is a vital first step, as failing to do so could negate any gains made in recent years to address disposable plastics, marine litter and microplastics.

Photos: Ministry for Foreign Affairs of Iceland

"In the Nordic countries, we share a strong belief that we must continue a dialogue in these challenging times, and we must make bold decisions to solve urgent global environmental problems."

– Krista Mikkonen, Finnish Minister of the Environment and Climate Change

"The oceans are under attack from the same patterns of unsustainable consumption and production patterns that are causing such problems on land, and they need similar attention."

– Inger Andersen, Executive Director of the United Nations Environment Programme

Next, a rising ambition level and commitment to do something about plastic pollution needs to be co-ordinated and funded. However, any plans that are adopted must be based on science and circularity and take local conditions into account. In addition, market conditions must immediately shift to change the game. Finally, we must take the chance we now have to protect our oceans.

"The Covid-19 response has shown that society can mobilise to find science-based solutions and resources to meet seemingly insurmountable challenges," she said. "We must apply the same steely determination to tackling plastics and take advantage of the opportunities this decade affords."

The symposium's closing remarks were delivered by **Guðmundur Ingi Guðbrandsson**, the Icelandic Minister for the Environment and Natural Resources.

The Arctic countries, he said, are shouldering their share of the responsibility to address the plastics problem by looking at the issue from the local and national levels. Similarly, the Arctic Council and its working groups are serving as crucial forums for scientific co-operation and monitoring, and for shaping policy and giving guidance.

But plastic pollution is a global problem, and there is only so much that individual countries in the region, or the Arctic Council, can do on their own. Iceland, according to Guðbrandsson, supports a global instrument to address the issue and the discussion of a global agreement on plastics pollution under the auspices of United Nations Environmental Programme. The hope, he said, is that conclusive action can be taken during the next session the United Nations Environmental Assembly, in February 2022.

"We need to act now or face a future of plastics entering the marine ecosystem in a way that is difficult or impossible to reverse," he said.

He felt the symposium contributed factual information that will be important for further discussions about plastic litter.

"You have sounded the Arctic alarm," he said. "We have designed many of the tools we need. Let us act on the science. Let us act on a global treaty on plastic pollution. Let us work for a healthy ocean – in the Arctic and everywhere on our blue planet."

Photo: Ministry for Foreign Affairs of Iceland

"We need to act now or face a future of plastics entering the marine ecosystem in a way that is difficult or impossible to reverse."

– Guðmundur Ingi Guðbrandsson, Icelandic Minister for the Environment and Natural Resources

Photo: PAME/GettyImages

DAY 1

SESSION 1: ARCTIC COUNCIL – MARINE LITTER AND MICROPLASTICS WORK UNDERTAKEN BY THE ARCTIC COUNCIL WORKING GROUPS

SESSION 2: SOURCES AND TRANSPORT OF MACRO-PLASTICS TO THE ARCTIC AND SUB-ARCTIC

DAY 1

SESSION 1: ARCTIC COUNCIL – MARINE LITTER AND MICROPLASTICS WORK UNDERTAKEN BY THE ARCTIC COUNCIL WORKING GROUPS

Moderator: **Magnús Jóhannesson**, Ministry for Foreign Affairs of Iceland
Panellists: **Elizabeth McLanahan**, NOAA Office of International Affairs, USA; **Eivind Farmen**, Norwegian Environment Agency; **Mark Mallory**, Acadia University, Canada; **Jennifer Provencher**, Environment and Climate Change Canada

Opening the discussion, moderator Magnús Jóhannesson, of the Ministry for Foreign Affairs of Iceland, noted that the Arctic Council is expected to adopt the Regional Action Plan for Marine Litter and the Monitoring Plan for Litter and Microplastics at its biennial ministerial meeting on May 19-20, 2021. This, together with the fact that litter is a topical issue addressed by five of the Arctic Council's six working groups, is a sign of the importance the Arctic Council places on marine litter and plastic pollution, making the Arctic a leading region in dealing with marine litter world-wide.

Jóhannesson began, therefore, by asking members of the first panel, all of whom are members of the Arctic Council working groups working on the Regional Action Plan or the Monitoring Plan, what are the main barriers to making progress and achieving the council's goals.

The most obvious – and something that expert groups working out the plans have sought to account for – according to Jennifer Provencher, of Environment and Climate Change Canada, is that different countries in the region will have different resource levels, while types of pollution vary from place to place.

In response to that, the Monitoring Plan, she said, has been created as a "toolbox" that leaves it up to the Arctic states to determine how best to design their monitoring efforts.

"There is not going to be a perfect set of tools, there is not going to be a perfect location," she said, "but we have to start implementing monitoring where we can."

The hope, she explained, is that, as more information is gathered, the more standardised and harmonised ways of monitoring and assessing plastic litter will become. "Perfection should not get into the way of action. We can adjust along the way," she continued.

Eivind Farmen, of the Norwegian Environment Agency, expressed similar sentiments, suggesting that the two plans are intended as a way to provide Arctic countries with guidelines that will make it easier for them to assess how much plastic litter is in their marine environment. He said that, because we knew very little about the effects of litter and microplastics, we should work from a precautionary point of view.

Elizabeth McLanahan, of NOAA, expressed that the Arctic environment made activities such as monitoring particularly challenging, while also noting that there are resource challenges. However, there is reason for optimism, in her view, given the widespread agreement about the need to take action.

There was consensus that countries could not solve the problem of plastic waste alone. Real progress on the issue will require collaboration, both amongst Arctic countries, as well as with countries outside the region. One specific example, according to McLanahan, is reception facilities for fishing gear in ports of the European Union. Arctic countries, she said, can learn from a European system that permits fishing vessels to offload derelict fishing gear they collect.

Describing the work in the region as an internationalised effort to prevent pollution that is being brought to the Arctic, as well as being produced there, Mark Mallory, of Acadia University, agreed that the only way forward is through collective action. "The expertise is in different countries," he said. "We're used to listening and learning from each other and applying those things, and in this case applying those things in an international fashion to solve common problems."

Provencher, however, pointed out that different solutions might be needed for different parts of the Arctic, depending on national and local priorities.

Should the plans be adopted by the Arctic Council, Jóhannesson suggested that it could put the region at the leading edge of addressing marine litter. Provencher reckoned that, given the level of detail of the two plans and the amount of effort that has gone into them, this would likely be the case. Multiple organisations, she said, have addressed marine litter and microplastics, but the monitoring plan goes beyond marine monitoring and encourages "ecosystem-level" monitoring.

"We know that we have put together a very technical document that we hope will spur even more effort on litter and microplastic monitoring, including questions of harmonisation and standardisation," she said. "So, I think that we've laid the groundwork for the Arctic Council and the Arctic nations to be leaders on this in several different ways."

DAY 1

SESSION 2: SOURCES AND TRANSPORT OF MACROPLASTICS TO THE ARCTIC AND SUB-ARCTIC

Moderator: **Kara Lavender Law**, Woods Hole Oceanographic Institution, USA
Panellists: **Melanie Bergmann**, Alfred-Wegener-Institute, Germany; **Kine Martinussen**, Keep Norway Beautiful; **Victor Onink**, University of Bern, Switzerland; **Valtýr Sigurðsson**, Náttúrustofa Norðurlands vestra, Iceland

The discussion about sources of macroplastic litter in the waters of the Arctic and sub-Arctic was, to a large degree, a discussion of what scientists do not know.

Although large items of plastic are generally easy to observe, according to Melanie Bergmann, of the Alfred-Wegener-Institute, it is only when they wash up on beaches and scientists can get their hands on them that they can be assessed with any degree of accuracy, and even this only provides limited information about their origin.

Markings can reveal where something was produced, and by extension, where it may have come from. Context can reveal further information (a large mayonnaise tub, for example, is more likely to come from a ship's galley than a household, and if it is found amongst waste that is predominantly from the fishing industry, that suggests it, too, came from a fishing vessel).

But what happened "at the littering moment" can never be known, according to Kine Martinnussen, of Keep Norway Beautiful. And without being able to assess how items end up in the water, she said, it is all but impossible to change the routines that lead to litter.

Not knowing litter's sources and pathways to the ocean and to the Arctic is another hindrance to prevention, according to Victor Onink, of the University of Bern. Did a piece of litter originate from a ship? Was it carried by a river? Or was it carried on the current from another ocean?

Knowledge gaps such as these, according to Valtýr Sigurðsson, of Náttúrustofa Norðurlands vestra, invite misinterpretation. For scientists, this may stem from having to make estimates in the absence of factual information. For the public, it may stem from media coverage that, in some cases, is either incomplete or emphasises one component of plastic pollution (consumer waste, for example) while overlooking the significance of others (like road paint and tyre wear).

> ***Read more** about the proceedings from the first day of the symposium at: https://arctic-council.org/en/news/highlights-from-the-international-symposium-on-plastics-in-the-arctic*

Photo: Bo Eide

DAY 2

SESSION 1: SOURCES AND TRANSPORT OF MICRO-PLASTICS TO THE ARCTIC AND SUB-ARCTIC

SESSION 2: METHODOLOGY FOR MICROPLASTIC

Photo: PAME/GettyImages

DAY 2

SESSION 1: SOURCES AND TRANSPORT OF MICROPLASTICS TO THE ARCTIC AND SUB-ARCTIC

Moderator: **Kara Lavender Law**, Woods Hole Oceanographic Institution
Panellists: **Claudia Lorenz**, Alfred-Wegener-Institute, Germany; **Dorte Herzke**, Norwegian Institute for Air Research; **Elisa Bergami**, University of Siena, Italy; **Chris Wilson**, National Oceanography Centre, UK; **Bonnie M Hamilton**, University of Toronto, Canada; **Lisbet Sørensen**, SINTEF, Norway

After an initial discussion of the techniques used to collect microplastic samples, panellists explained how plastics make their way to the ocean. The type of microplastics coming from different sources was also discussed; urban runoff, for example, differs significantly from runoff from agriculture areas, which again differs from wastewater from Arctic settlements released unfiltered into adjacent waterways.

Photo: PAME/GettyImages

Microfibres from clothing were identified as a significant source of microplastic pollution. Ways to reduce the amount of microfibres from clothing include treating fabrics so they shed fewer fibres during washing or adding filters to washing machines. Another solution would be to improve wastewater treatment in Arctic communities.

The panellists agreed that much remains unknown about microplastics in the Arctic, and that there is a need to get a better understanding of how they break up and become nanoplastics and then degrade further into yet smaller particles.

Other key areas of study include developing better ways to determine how plastics are being transported to the Arctic. Similarly, improved laboratory facilities and techniques would make it easier for scientists to assess the impact of microfibres.

Photo: PAME/GettyImages

DAY 2

SESSION 2: METHODOLOGY FOR MICROPLASTIC

Moderator: **Sara Dewey**, Belfer Center for Science and International Affairs, USA
Panellists: **Anne de Vries**, University Centre of the Westfjords, Iceland; **Jennifer Cocking**, Scottish Association for Marine Science, UK; **Georg Hanke**, Joint Research Centre, European Commission

During the discussion, panellists described how beach surveys, aerial surveillance using drones and studies of fish can be used to assess levels of plastic litter and discussed the strengths and weaknesses of each method.

All three panellists agreed that the aim of monitoring is to provide policy makers with the information they need to develop measures to reduce marine litter.

"Policy needs evidence," said Georg Hanke, of the European Commission's Joint Research Centre. "Whatever action you take, it has a cost, so decisionmakers need to be sure what the right thing to do is."

As an example of a successful policy, he pointed to "triggers for action", threshold pollution levels that require a response from authorities.

He predicted that thresholds will continue to play an important role in policy makers' work with litter.

Jennifer Cocking, of the Scottish Association for Marine Science, identified ensuring that data that is timely, easily collected and readily accessible as important steps to improve assessments and ultimately to reduce marine litter.

Anne de Vries, of the University Centre of the Westfjords, suggested it was necessary to deal with plastic litter before it reached the ocean.

"The best idea would be not to use plastic at all," she said, "but that's not possible because we still need it in so many different ways. But the best way to limit the input into the oceans is to look at the rivers that discharge the most and start cleaning up from there, because those are going to be the main transport routes into the oceans."

***Read more** about the proceedings from the second day of the symposium at: https://arctic-council.org/en/news/highlights-from-the-international-symposium-on-plastics-in-the-arctic*

Photo: PAME/GettyImages

DAY 3

SESSION 1: METHODOLOGY FOR MICRO- AND NANO-PLASTICS

SESSION 2: OCCURRENCE OF PLASTICS IN THE ARCTIC

Photo: PAME/GettyImages

DAY 3

SESSION 1: METHODOLOGY FOR MICRO- AND NANOPLASTICS

Moderator: **Chelsea Rochman**, University of Toronto, Canada
Panellists: **Jes Vollertsen**, Aalborg University, Denmark; **Vegard Stürzinger**, Norwegian Polar Institute; **Fabiana Corami**, Italian National Research Council; **France Collard**, Norwegian Polar Institute

It's not difficult to get people to agree that more money will help to address a problem. And, indeed, during the closing remarks of the session, the four panellists nodded in agreement to the comment by moderator Chelsea Rochman, of the University of Toronto, that coming up with a solution to the "methodology problem" takes "more people, more resources and more money".

More money would no doubt be welcome, but would it help scientists end something that, in essence, is a lack of consensus about how to measure the amount of plastics found in the environment? It was frequently pointed out during the symposium that the method scientists use to assess microplastics depends on the question they want to answer, the equipment that is available and the individual scientist's training.

Similarly, during the panel discussion, Jes Vollertsen, of Aalborg University, argued that while it is indeed necessary to be able to compare results with other studies, this is not always the case.

He added that there might be questions that research is trying to answer that are not included in a standard approach – things like the type of polymer, or the shape or age of a piece of plastic.

"You pick your analytical approach to suit the objective of your study," he said.

That, according to Vegard Stürzinger, of the Norwegian Polar Institute, may be the case, but in the current situation it means that much research cannot be compared.

A lack of standards, he worried, has led to a blurry picture of just how much plastic is in the environment. "It seems like every time we sample a place, we are finding more and more particles, but what we are finding is smaller and smaller particles."

Photo: PAME/GettyImages

DAY 3

SESSION 2: OCCURRENCE OF PLASTICS IN THE ARCTIC

Moderator: **Hrönn Ólína Jörundsdóttir**, Icelandic Food and Veterinary Authority
Panellists: **Jennifer Provencher**, Environment and Climate Change Canada; **Alise Vianello**, Aalborg University, Denmark; **Amy Lusher**, Norwegian Institute for Water Research; **Douglas Causey**, University of Alaska Anchorage & Belfer Center for Science and International Affairs, USA; **Ásta Margrét Ásmundsdóttir**, University of Akureyri, Iceland

Photos: Ministry for Foreign Affairs of Iceland

Moderator Hrönn Ólína Jörundsdóttir, of the Icelandic Food and Veterinary Authority, opened the discussion with a question about what has caused a surge in the amount of research into the effect of microplastics on wildlife in the past decade.

Jennifer Provencher, of Environment and Climate Change Canada, suggested that the reason is likely a greater public awareness of plastics in their own lives, coupled with pictures circulating online of marine life that had become ensnared in plastic litter in some way.

"This is something we can see," she said. "Microplastics and nanoplastics might be the problem, but people can see plastics in their homes and see where it goes."

With increasing public awareness comes greater attention by policy makers. And that, in turn, has created a need for scientists to provide them with the information they need to make informed decisions.

"Policy is being made in real-time, and we are having to try to deliver science step-in-step, and that is pushing the field forward," Provencher said.

Wastewater release from public sewage systems in the region was identified multiple times during the symposium as a major local source of microplastics in the waters of the region.

Asked whether communities should invest in wastewater filtering, Ásta Margrét Ásmundsdóttir, of the University of Akureyri, answered that even though filters would not make microplastics disappear they would allow authorities to control where they ended up.

"We know that if we want to mitigate this environmental issue, we have to reduce the input of plastic into the marine environment. Treating the wastewater is quite important," she said.

Wastewater-filtering is expensive, and it was discussed that local authorities might be averse to spending money on a problem that cannot be seen. But Alvise Vianello, of Aalborg University, suggested that the cost should be weighed up against the problems microplastics cause.

"The Arctic region relies on the sea as an economic resource, so we need to somehow protect it," he said. "Preventing microplastics from entering the environment by trapping them is a really effective measure."

> ***Read more** about the proceedings from the third day of the symposium at: https://arctic-council.org/en/news/highlights-from-the-international-symposium-on-plastics-in-the-arctic*

Photo: PAME/GettyImages

DAY 4

SESSION 1: MONITORING OF PLASTICS IN THE ARCTIC

SESSION 2: IMPACT OF PLASTICS (TOXICOLOGY AND ECOTOXICOLOGY)

DAY 4

SESSION 1: MONITORING OF PLASTICS IN THE ARCTIC

Moderator: **Hrönn Ólína Jörundsdóttir**, Icelandic Food and Veterinary Authority
Panellists: **Peter Murphy**, NOAA Marine Debris Program, USA; **Liz Pijogge**, Nunatsiavut Government, Canada; **Jakob Strand**, Aarhus University, Denmark; **Georg Haney**, Marine & Freshwater Institute, Iceland; **Marc Schnurawa**, BioConsult, Germany; **Max Liboiron**, Memorial University of Newfoundland, Canada

Photo: PAME/GettyImages

Moderator Hrönn Ólína Jörundsdóttir, of the Icelandic Food and Veterinary Authority, started the discussion by noting that most international recommendations for monitoring marine plastic litter have not been developed with Arctic conditions in mind. She asked the panel whether they found it necessary to adapt these guidelines to their work. The consensus was that, in the vast majority of cases, it is.

The most obvious reasons are the remoteness of the region and the fact that it is inaccessible for long periods of the year. This, according to Jakob Strand, of Aarhus University, means that surveys cannot be conducted the recommended number of times each year. Similarly, physical characteristics such as rocky coastlines and highly variable weather require scientists to adapt monitoring methods, according to Max Liboiron, of Memorial University of Newfoundland. For research to be comparable, scientists must estimate what the results would have been had they been conducted using standard methods.

Liboiron analyses marine plastics that are collected by Liz Pijogge, who is based in Nain, Nunatsiavut. They have realised that local and foreign researchers want to study different things. People in the North want to know how plastics affect a species like char because it is an important source of food for them. Those from outside the region, meanwhile, prefer to look at the northern fulmar because, as a migratory seabird that is known to consume plastics, it has been deemed a reference standard by scientific groups.

"That is not inherently bad," Liboiron said, "but they don't harmonise."

Another issue of specific concern to the region that Jörundsdóttir asked panellists to comment on was the abundance of fishing gear found in the marine environment. Are there specific policies Arctic regions should be pursuing?

Georg Haney, of the Marine & Freshwater Institute, emphasised that policies are being implemented in the region, including a requirement to mark fishing gear so that it can be traced back to the vessel that lost it. The panellists agreed that such measures are valuable, though not without their shortcomings.

"It's really difficult to differentiate between fishing material from the 1990s and fishing material from today," he said. "That makes it hard to tell what are old sins and what are new sins and how effective our policy efforts from today are."

Another limitation to national requirements is that fishing gear can be carried to the region on currents or lost by foreign fishing vessels that do not mark their gear.

DAY 4

SESSION 2: IMPACT OF PLASTICS (TOXICOLOGY AND ECOTOXICOLOGY)

Moderator: **Bjørn Einar Grøsvik**, Institute of Marine Research, Norway
Panellists: **Sinja Rist**, Technical University of Denmark; **Rocío Rodriguez Torres**, Technical University of Denmark; **Gunn-Britt Retter**, Saami Council; **Lauren Divine**, Aleut Community of St Paul Island, USA; **Katrin Vorkamp**, Aarhus University, Denmark

The discussion began with a review of research into the effects of microplastics on copepods, as well the limitations of current methods for assessing the risk to marine life of microplastic contamination and chemicals associated with microplastics.

Important to the discussion was the way individuals view items made of plastic, and whether their image as low-quality, disposable products has desensitised people to the impact of pollution.

Plastics, as was noted repeatedly during the symposium, are too useful to eliminate entirely, but one proposal, put forward by Lauren Divine, of the Aleut Community of St Paul Island, Alaska, was to push for plastic products to be made more durable, so people value them more.

The proposal that fishing gear should be made traceable was brought up repeatedly during the symposium.

Chemicals transported to the Arctic by microplastics have not received much attention, even though they can be consumed by animals through the food chain. In general, we still know very little about the effects of microplastics or their associated chemicals on plant and animal life in the Arctic.

Asked how their particular field can help reduce the impact of plastics on the environment, panellists gave a variety of answers.

Several dealt with improving guidelines for research, so that findings about the effects of microplastics can be applied to the entire Arctic ecosystem, rather than individual species. In doing so, argued Sinja Rist, of the Technical University of Denmark, science can lay the foundation for regulations that have a long-term impact. Similarly, Katrin Vorkamp, of Aarhus University, highlighted the importance of reliable and comparable methods. Furthermore, there are risks associated with chemicals in microplastics that we do not currently understand.

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Other answers echoed the sentiment that it is important to address the way consumers view plastic, and indeed the environment as a whole.

"We have to produce quality products, rather than producing waste. Because now, it is cheap and mixed products that are easy to throw away," said Gunn-Britt Retter, of the Saami Council. "If we want to avoid something from becoming waste, it has to have high quality, so we can reuse it and be able to use it for different purposes."

> ***Read more** about the proceedings from the fourth day of the symposium at: https://arctic-council.org/en/news/highlights-from-the-international-symposium-on-plastics-in-the-arctic*

DAY 5

SESSION 1: WAYS FORWARD – PART I

SESSION 2: WAYS FORWARD – PART II

SESSION 3: WAYS FORWARD – PART III

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DAY 5

SESSION 1: WAYS FORWARD – PART I

Moderator: **Thomas Maes**, GRID-Arendal, Norway
Panellists: **Heidi Savelli**, Global Programme of Action, UN; **Hermanni Kaartokallio**, SYKE, Finland; **Eva Bildberg**, Keep Sweden Tidy Foundation; **Michael Mannaart**, KIMO International, UK; **Egor Vorobiev**, Tomsk State University, Russia; **Yulia Frank**, Tomsk State University, Russia; **Aleke Stöfen-O'Brien**, World Maritime University, Sweden

After teasing out more details about the work of the panellists, ranging from the impacts of what essentially amounts to hoovering the seabed to remove plastics (potentially catastrophic for organisms living there, and therefore something that should only be used in highly contaminated ports) to what can be done to prevent smokers from throwing their cigarette butts on the ground (not much, reckoned one panellist), moderator Thomas Maes, of GRID-Arendal, asked them to discuss ways that marine plastic litter can be reduced.

Heidi Savelli, of the Global Programme of Action, suggested things like better research and a global vision for litter reduction, but she also highlighted that any work – current and future – requires co-ordination at the international level.

"There is amazing work being done, but we're not that good yet at trying to bring it all together," she said.

Reiterating the message of previous discussions, Yulia Frank, of the Tomsk State University, recommended that scientists come to an agreement on which methods should be used to study plastic litter.

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Aleke Stöfen-O'Brien, of the World Maritime University, meanwhile, suggested that, instead of pursuing new initiatives, decisionmakers should work to make process on existing agreements.

"We should really just work towards consolidating and implementing what we have and actually seeing it through to the end."

Eva Bildberg, of the Keep Sweden Tidy Foundation, reiterated that message. She said methods of stopping plastic litter at the source already existed, but that without local and national action they will remain underutilised.

Noting that voluntary fishing-gear collection schemes are in the process of becoming mandatory, Michael Mannaart, of KIMO International, struck a similar note. He said schemes exist to reduce plastic litter from fishing gear, but successful implementation and expansion requires adequate funding and administrative support.

Egor Vorbiev, of Tomsk State University, suggested limiting inputs through improved water purification.

Hermanni Kaartokallio, of SKYE, put forward a proposal that was based on the results of his research: better biodegradable plastics.

DAY 5

SESSION 2: WAYS FORWARD – PART II

Moderator: **Halla Hrund Logadóttir**, Harvard Kennedy School, USA
Panellists: **David Balton**, Wilson Center Polar Institute, USA; **Melissa Nacke**, Association of Arctic Expedition Cruise Operators, Norway; **Herminia Din**, University of Alaska Anchorage, USA; **Julia Hager**, Mountain to Ocean, Germany; **Erica Nuñez**, Ocean Conservancy, USA

Moderator Halla Hrund Logadóttir, of the Harvard Kennedy School, opened the discussion by asking panellists to name an innovation they felt would contribute to addressing marine plastic litter. The answers made it clear that no single development can stand alone.

Eliminating plastics is neither feasible, nor, it was pointed out repeatedly, desirable. But using plastics invariably creates plastic litter. How to address that? David Balton, of the Wilson Center Polar Institute, suggested substituting products made of a traditional form of plastic with products that are easier to recycle or can biodegrade if left in the environment.

Yet, even if new plastics do enter the market, the mess we have already created will still need to be cleaned up, Erica Nuñez, of the Ocean Conservancy, pointed out.

But collecting plastic litter is not enough either, Melissa Nacke, of the Association of Arctic Expedition Cruise Operators, argued. Without proper waste-management facilities, the rubbish collection organised by its members or efforts to phase out plastic items are for nought. In one instance she related, a cruise-ship operator had replaced plastic yoghurt containers with glass containers only to find that the recycling facility where the ship offloaded its waste did not recycle glass.

Despite the immense amounts of plastic litter or, perhaps because of it, suggested Herminia Din, of the University of Alaska Anchorage, there is value in teaching people of the cumulative effect of individual action. An educational programme for children she has developed, stresses this idea with the mantra "use one less".

"One less plastic water bottle per person, for example, is millions of water bottles not being used," she said.

Along the same lines, Julia Hager, of Mountain to Ocean, argued that proper messaging – which she described as "reaching out to the hearts of people" – is a way to encourage people to take action on an issue they know is important, but which they may not be inclined to speak up about.

The panellists broadly agreed that there is a range of initiatives underway to reduce plastic pollution, but they also cautioned against assuming that there is one single measure that we can rely on.

Balton, for example, said experience shows that a proposed international treaty on plastic waste was unlikely to be a "panacea". In the first place, a treaty would take time to draw up and then to enter into force (during which time plastic litter would continue to pile up, and would thus require continued attention). Moreover, a treaty would require action by regional and local authorities, who would ultimately be left with the burden of addressing plastic littler that, in most cases, cannot be traced to a polluter or country of origin.

Nacke, meanwhile, said firms are willing to adopt products and methods that generate less litter. But these efforts, she said, often strand when they discover there is no alternative.

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DAY 5

SESSION 3: WAYS FORWARD – PART III

Moderator: **Magnús Jóhannesson**, Ministry for Foreign Affairs of Iceland
Panellists: **Ingrid Giskes**, Global Ghost Gear Initiative; **Michail Papandonnaikis**, European Commission; **Áslaug Hulda Jónsdottir**, Pure North, Iceland; **Atsuhiko Isobe**, Kyushu University, Japan, **Carola van Rijnsoever**, Ministry of Foreign Affairs of the Netherlands

The final panel of the symposium continued the discussion of how countries in the Arctic can clean up existing litter while working to eliminate sources of pollution. The discussion addressed how a product's design, to a large extent, determines whether it ends up as waste, and potentially as litter.

Echoing the calls of the previous panel for producers to develop products that generate less waste, the panellists emphasised the need to create what Áslaug Hulda Jónsdóttir, of Pure North, described as "smart products", which continue to be seen as something of value to consumers and producers even after they are no longer serviceable.

Such thinking, according to Carola van Rijnsoever, the Dutch Arctic ambassador, supports the aim of "fewer products ending up in the bin, and fewer products ending up in nature".

For the EU, thinking disposal into product design has become a central tenet of its approach to waste, according to Michail Papadoyannakis, of the European Commission.

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Producers, he said, will be required to assume much more responsibility for the disposal of their products, which marks a significant change from the conception of waste management as primarily a public service.

Making producers accept responsibility for the disposal of their products had been unthinkable until recently, Papadoyannakis added. EU regulation and national initiatives such as tax incentives have driven the change to some extent, but he also credited producers for accepting that they have a responsibility to ensure that their products are disposed of properly. The cost of replacing an item could also be a reason for users to seek to extend a product lifespan.

Using the fishing industry as an example, Ingrid Giskes, of the Global Ghost Gear Initiative, explained that, while gear loss is common, intentionally dumping nets and other equipment at sea is rare, due to the cost of replacing it. This, she explained, has created an opportunity for her organisation to work with the industry and fishing communities to come up with ways to reduce gear loss and increase their capacity to retrieve lost gear.

A separate concern is worn out fishing gear. But here, Giskes explained, schemes to require producers to accept products that are no longer serviceable, as well as marking guidelines, have shown their worth in countries where such measures have been implemented.

Surprisingly, some parts of the Arctic Ocean contain as much microplastics as parts of the ocean closer to more populated areas. According to Atsuhiko Isobe, of Kyushu University, this may be due to fishing gear. However, he said scientists know too little about the issue to be certain. This, he suggested, highlights the need to continue to collect and share scientific evidence and to standardise the procedures for how microplastics are monitored.

"Without a reliable data set of the sort that is being developed in Japan, it would be impossible to get a full picture of plastic pollution and what needs to be done to address it," he said.

> ***Read more** about the proceedings from the final day of the symposium at: https://arctic-council.org/en/news/highlights-from-the-international-symposium-on-plastics-in-the-arctic*

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Photo: Bo Eide

CONCLUSION

The symposium achieved its goal of bringing together scientists, practitioners, decision makers and other stakeholders for an exchange of information. The **KEY FINDINGS** below will lay the foundation for the science-based best practices that are needed if we are to improve the way we deal with the problem of plastics in the Arctic marine environment. However, as the symposium also revealed, there is much that needs to be learned and accomplished if we are to be equipped to fully address this pressing problem. These are reflected in the **GAPS & NEEDS**.

KEY FINDINGS

- The Arctic marine environment is affected by plastic pollution
- Much marine litter is carried to the Arctic, but some of the litter that washes up on beaches enters the water in the region
- Waste management and wastewater treatment in the Arctic come with significant challenges
- Abandoned, lost and discarded fishing gear is a major component of plastic litter in the Arctic, and wildlife risks getting entangled in it
- Microplastics arriving from other regions on currents accumulate in the Arctic
- Arctic species have been found with plastics in their stomachs
- Plastic litter can transport non-native species to the Arctic
- The Arctic Council's Arctic Monitoring and Assessment Programme has produced a comprehensive Monitoring Plan and technical guidelines for monitoring microplastics and litter in the Arctic
- The Arctic Council's Conservation of Arctic Flora and Fauna working group monitors the levels and effects of plastics in seabirds
- The Arctic Council's Protection of the Marine Environment working Group has developed the first Regional Action Plan to address marine litter in the Arctic

GAPS & NEEDS

- Increase temporal and spatial monitoring
- Come to a consensus on methods, terminology and definitions for use in the field and the laboratory
- Improve the accuracy and comparability of analytical methods that are used within the region and beyond
- Assess the impacts of plastic litter on the Arctic from an ecological, economic and social perspective
- Enhance study design and reporting to develop assessments
- Engage stakeholders and encourage people to change their behaviour to avoid plastic litter
- Set up a way forward for implementing the Regional Action Plan on Marine Litter in the Arctic
- Assess the effectiveness of current and future measures
- Define local solutions and existing best practices
- Involve the private sector through dialogue and collaboration
- Facilitate knowledge transfer and information sharing (in the form of an international Arctic conference or the like)
- Connect with groups and forums outside the Arctic for knowledge exchange
- Contribute to global initiatives to reduce the plastic problem

Photo: Bo Eide

The Government of Iceland in collaboration with the Nordic Council of Ministers hosted the International Symposium on Plastics in the Arctic and Sub-Arctic Region on March 2-4 and 8-9, 2021 in connection with the Icelandic Chairmanship of the Arctic Council, which took place from May 2019 to May 2021. The symposium was organised in co-operation with 11 international partners that address marine pollution in various ways. Iceland had chosen the Arctic marine environment as one of four priority areas of work for its chairmanship and addressing plastic marine litter, and in particular pollution in the Arctic, became a high priority issue in the work programme of the Arctic Council.

This publication provides key points from the presentations and highlights from the discussions in a format that is accessible to policy makers and the general public.

Government of Iceland

Nordic Council of Ministers