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01

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SUMMARY

1. With a focus on microplastics, this Fact Sheet summarises recent advances in scientific research revealing the potential deleterious effects of ever-increasing concentrations and accumulation of microplastics in the marine environment, and the recognition of the Arctic Ocean as a marine plastic pollution hotspot where plastics in the world' s oceans would eventually accumulate.

2. In response to these scientific findings and acknowledging the fact that no specific international legal instruments exist that comprehensively address the modern challenges of marine plastic pollution, this Fact Sheet identifies relevant international legal instruments, concepts, tools, and precedents that will assist the design of future legal governance to address the emerging threat of marine microplastic pollution in the Arctic Ocean.

3. This Fact Sheet is based on academic presentations given during the 13th Polar Law Symposium in November 2020 and on further elaborations through collaborative research undertaken by the Research Programs on International Law and Marine Sciences under the ArCS II project and the Ocean Policy Research Institute.

FACT SHEET

1 The Arctic marine plastic problems: A scientific overview

(1) Marine plastic problems: Necessity for policy and legal responses

Marine plastic pollution has increased tenfold since 1980, affecting at least 267 species, including 86 percent of marine turtles, 44 percent of seabirds, and 43 percent of marine mammals. This can affect humans through food chains (IPBES, 2019). The increasing volume of plastics in marine environments poses several concerns. First, plastics are estimated to require several hundreds of years for complete decomposition in marine environments (Barnes et al., 2009). With an estimated 8–10 million tonnes of plastic released into the ocean annually (Jambeck et al., 2015), plastics accumulate in the marine environment, and the concentration of plastic will continue to increase (World Economic Forum et al., 2016). Second, some studies have reported that microplastics and nanoplastics may harm living organisms by inhibiting biochemical processes such as enzyme reactions (Ding et al., 2018), reducing growth and reproduction (Sussarellu et al., 2016), or causing behavioural disorders (Mattsson et al., 2017). Finally, harmful organic pollutants such as DDT and PCB are absorbed by plastic and might affect living organisms when ingested (Mato et al., 2001). For example, toxic chemicals were found to accumulate in the tissue of birds that had ingested microplastics, which could lead to bioconcentration and biomagnification (Yamashita et al., 2011).

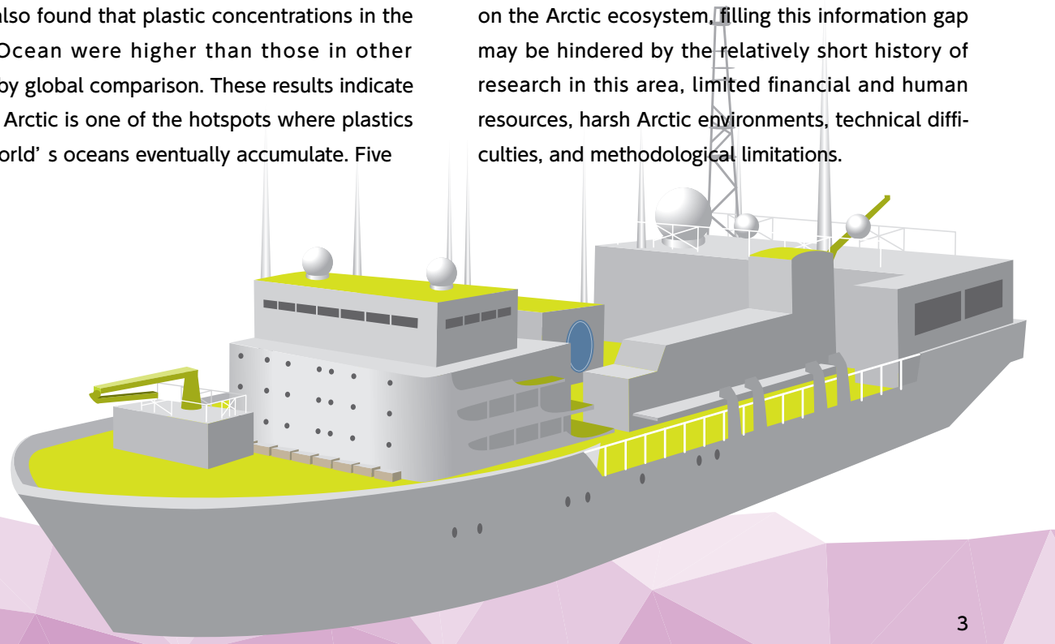
Among marine plastics, this Fact Sheet focuses on microplastics of less than 5 mm in length, because they pose particular problems necessitating international and perhaps global responses, as described below. Examples of microplastics in the marine environment include microbeads, fragments of synthetic fabrics (i.e. nylon and polyester), and scraps of miscellaneous larger plastic products. The identification of such microplastics could be important for policy and legal responses because it may lead to identification of their original sources. For example, microfibers are fragments of various synthetic textiles that are suspected to come from domestic laundry wastewater (Pirc et al., 2016). In addition, the type of plastic (nylon, polyester, polypropylene, acrylic, etc.) can also indicate the source of the plastic. Utilising the water circulation model in the Arctic Ocean, Ross et al. (2021) suggested that microfibers are delivered to the Arctic Ocean by water flow from the Atlantic Ocean.

It is estimated that around 60–80% of marine litter comprises various types of plastics (Derraik et al., 2002). There are two major sources of plastics in the marine environment: land-based plastic, which is consumed on land and discharged into the ocean, and ocean-based plastic, which is discharged from ships or fishing vessels. A large proportion of marine plastics is assumed to be land-based, although the actual proportion may vary depending on the location. Land-based plastics include various products including single-use plastic (i.e. shopping bags, disposable containers, plastic films, PET bottles, etc.). Meanwhile, ocean-based plastic debris is primarily associated with fishery activities and includes derelict fishing nets, ropes, lines, buoys, cages, and pots. These are collectively termed ‘abandoned, lost, or otherwise discarded fishing gear (ALDFG)’ . Although this Fact Sheet focuses on microplastics, it is also recognised that ALDFGs pose particular problems in the Arctic environment.

(2) Arctic Ocean as a potential marine microplastic hotspot

Recent advances in scientific research have revealed that the Arctic Ocean is no exception to marine plastic pollution. In fact, the Arctic Ocean may be plastic pollution hotspot, despite its distance from most industrial and populated areas on Earth. Cozar et al. (2017) reported high concentrations of plastic debris in the northern and eastern areas of the Greenland and Barents Seas, and computer modelling of seawater circulation also predicted the accumulation of plastic debris in this area. Obbard et al. (2014) reported that microplastic concentrations in Arctic ice cores were several orders of magnitude higher than those in highly contaminated surface waters, such as the Pacific Gyre. Barrows et al. (2018) also found that plastic concentrations in the Arctic Ocean were higher than those in other regions by global comparison. These results indicate that the Arctic is one of the hotspots where plastics in the world’ s oceans eventually accumulate. Five subtropical ocean gyres are known to serve as convergence zones for floating plastic debris; the microplastic concentrations in Arctic waters are comparable to those found in the North Pacific and North Atlantic Gyres (Lusher et al., 2015). Moreover, plastic pollution is ubiquitous in the Arctic environment not only in surface seawater, but also in the water column, ocean floor, sea ice, and snow (Lusher et al., 2015; Tekman et al., 2017; Peeken et al., 2018; Bergmann, et al., 2019).

The Arctic Ocean as a potential hotspot of marine plastic accumulation necessitates studies on the potential deleterious effects of plastics in the specific context of the Arctic. At present, the largest information gap lies in the impact of marine plastics on the Arctic ecosystem and biota. The Arctic ecosystem is speculated to be particularly prone to the effects of plastic pollution because it is fragile and supported by delicate natural balances. The ecosystem is already under stress from various anthropogenic phenomena such as atmospheric pollution, climate change, and ocean acidification. Although further studies are needed on the impacts of marine plastic on the Arctic ecosystem, filling this information gap may be hindered by the relatively short history of research in this area, limited financial and human resources, harsh Arctic environments, technical difficulties, and methodological limitations.



FACT SHEET

2 International law addressing the Arctic marine plastic problems

(1) Introduction

The current international legal framework contains rules that are relevant in the context of Arctic plastic pollution. However, these rules are either too general by their legal nature or too narrow in that they only partially apply to the problem of plastic pollution. The threat of Arctic marine plastic pollution, as described above, calls for streamlined regulatory efforts in both international and regional contexts. Some existing international legal precedents, concepts, tools, and initiatives may assist in the design of future legal governance to address the emerging threat of marine microplastic pollution in the Arctic Ocean.

(2) Plastics in the ocean as pollution and existing international legal regulations

The United Nations Convention on the Law of the Sea (UNCLOS) regulates marine pollution that is likely to have deleterious effects, such as harm to marine life and hazards to human health (Art. 1(4)). In addressing microplastic pollution, we address pollution that has already entered the ocean from different sources. Hence, both the *ex ante* and *ex post* perspectives must be considered. In other words, we must appraise the law' s approach to the problem *ex ante*, before plastics enter the marine environment (e.g. production and disposal), and the *ex post* perspective of the problem after discarded plastic has reached the ocean and impaired the marine environment (Goncalves and Faure, 2019).

UNCLOS obliges its parties to adopt laws and regulations to prevent, reduce, and control pollution of the marine environment from land-based sources. The regulation of land-based sources of marine pollution, including plastic pollution, is a universally recognised obligation. However, because the wording of these provisions is overly general and ambiguous, the parties must endeavour to establish internationally agreed rules and standards (Art. 207 (1) (4)). The United Nations has recognised that plastic pollution requires particular attention and requested that all UN members prevent and significantly reduce marine pollution from land-based activities by 2025 (UNEA, 2018).

Vessel-sourced marine pollution is also regulated by UNCLOS (Art. 211), and, through the efforts of the International Maritime Organization (IMO), some plastic-specific *ex ante* regulations have been enacted, including the prohibition of the dumping of persistent plastics and other persistent synthetic materials (London Convention, 1972, Art. IV (1)(a), Annex I 4) and of the disposal of plastic garbage from ships (MARPOL73/78, 1978, Annex V, Regulation 3.1, amended in 2011 as Regulation 3.2). Another recent implementation of *ex ante* regulation of plastics is through the environmentally sound management of plastic wastes, including regulations regarding their transboundary movements (Basel Convention, 2019, Annex II, Y 48).

(3) International legal tools focusing on the Arctic Ocean as a plastic pollution hotspot

The recent scientific findings indicating that the Arctic Ocean is a potential sink or hotspot of marine microplastic pollution require further examination of possible international legal concepts and tools to tackle the particularity of this problem. Because the Arctic region is very diverse and possibly unsuitable for a single set of solutions to address the plastic pollution problem (Balton, 2019), a strengthened regional coordination of efforts to gain further scientific knowledge on the issue and to inform legal, regulatory, and governance responses is particularly important in this context (PAME, 2019-a).

UNCLOS and its practices recognise the importance of regional approaches, particularly in the context of protection and preservation of the marine environment, including establishing 'regional rules, standards and recommended practices and procedures to prevent, reduce and control pollution of the marine environment from land-based sources, taking into account characteristic regional features' (Arts.197 (1), 207(4)). Although no agreement has characterised the Arctic Ocean as a semi-enclosed sea, the 'sinking' effect of microplastics in this particular sea may require strengthened cooperation among the states bordering the sea in coordinating their actions to protect the marine environment from microplastics, as well as their related scientific research policies (Art. 123).

One regional example particularly relevant for the Arctic Ocean is the 1992 OSPAR Convention. This is a legal instrument that guides international cooperation for the protection of the marine environment of the Northeast Atlantic. Its area of responsibility partially covers the Arctic Ocean, and it obliges its parties to prevent and eliminate pollution (Art. 2). OSPAR has also developed the Regional Action Plan for Marine Litter, running until 2021, to achieve the objective of significantly reducing the amount of marine litter (OSPAR, 2017). The OSPAR example provides two suggestions for the Arctic: first, a step-by-step approach to tightening the regulations, and second, utilising both binding and soft-law instruments wisely to address emerging issues. Another interesting regional effort to tackle specifically the microplastic pollution is from the other pole, the Antarctica. Acknowledging the majority of plastic found in Antarctica originates from outside of Antarctica, the Antarctic Treaty Consultative Meeting in a non-legally binding resolution encouraged those entering Antarctica to eliminate personal care products containing microplastic beads, recommended to identify methods to reduce microplastic release from wastewater systems, supported greater monitoring of plastic pollution in Antarctica, and declared its future plan to consider the issue of microplastic release in connection with any possible revisions of relevant Treaty obligations on prevention of marine pollution and waste management in the Antarctic (ATCM. 2019).

From a legal and regulatory perspective, much of the Arctic falls under the sovereign authority of the eight Arctic states and is thus largely governed through the respective legal regimes of these states. The Arctic Council (AC) is the leading intergovernmental forum for Arctic cooperation. Environmental concerns, especially combatting pollution, have been at the heart of Arctic cooperation since the establishment of the AC. One of its working groups, PAME, is developing a new regional action plan

(RAP) on marine litter in the Arctic that will address both sea and land-based activities, focusing on Arctic-specific marine litter sources and pathways. The new RAP will play an important role in facilitating Arctic states' efforts to reduce the negative impacts of marine litter, including microplastics, on the Arctic marine environment. The regional action plan may be regularly updated to address new and emerging information and priorities; therefore, the structure must be realistic and adaptable (PAME, 2019-b).

(4) Interfaces with global, long-range, and other regional legal initiatives

International, regional, European Union (EU), and national regulatory frameworks are all important in an Arctic context. Hence, regional governance approaches to the problem of Arctic microplastic pollution should be developed with close interaction with relevant global, long-range, and other regional legal initiatives, particularly because recent scientific studies have clearly suggested the longer-than-expected transboundary movement of microplastics flowing into the Arctic Ocean (see Section 1 (2) above). One international legal precedent in addressing long-range transboundary air pollution is the 1979 UNECE Convention on Long-Range Transboundary Air Pollution in the European region, which further extends to include the Russian Federation, Iceland, the United States, and Canada. At the time of its adoption, before the acquisition of conclusive evidence regarding the precise origin, pathway, and damage caused by air pollution in the European region, the parties agreed to establish a legal framework to exchange information, promote research on the issue, and strengthen monitoring to combat the future discharge of air pollutants. Over the past 40 years, the Convention has successfully adopted several protocols for specific air pollutants to address long-range transboundary air pollution (UNECE, 2021).

The EU has had a Marine Strategy Framework Directive (MSFD, 2008) in place requiring EU member states to ensure that, by 2020, 'properties and quantities of marine litter do not cause harm to the coastal and marine environment' . Most notably, in 2019, the EU introduced ambitious and legally binding measures to address the issue of marine litter from plastics. The Single-use Plastics Directive (SUPD, 2019) addresses the single-use plastic items that are most frequently found on beaches; it also covers lost and abandoned fishing gear. The new rules include a ban on certain products, consumption reduction targets, and obligations for producers as well as collection targets. Given the legal nature of the EU, the legal framework established by the SUPD is legally binding and enforceable in the 27 EU member states, including three of the Arctic states. This makes the directive relevant to the Arctic.

The interface with global legal initiatives, such as those on climate change, chemical regulations, and air pollution, is also important, especially because these legal initiatives could serve as models for possible interfaces with global and regional Arctic microplastic initiatives. Furthermore, considering the status of the Arctic as a hotspot that is particularly sensitive to the negative impacts of plastic pollution, together with the intensifying effects of climate change and other environmental burdens, the problem of plastic in the Arctic requires action that acknowledges other relevant regulatory interfaces.

3 Potential collaborative research between international law and marine sciences

The current landscape of legal and regulatory approaches to the problem of Arctic plastic pollution includes a combination of international, regional, and domestic hard and soft law measures, policies and action plans, and institutional actions. This broad governance framework is centrally influenced and facilitated by ongoing scientific research on this issue. The existing gaps in knowledge in these areas affect the further development of legislative, regulatory, and governance approaches. It is difficult to assess the best targets for actions and interventions because of this lack of scientific knowledge regarding the potential harmful effects of microplastics in general as well as in the specific context of the Arctic marine environment; future projections of their concentration and accumulation in the Arctic marine environment, living organisms, and their food chains reaching humans; the possible pathways and mechanisms by which these plastics and microplastics reach and accumulate in the Arctic Ocean; and the original sources, locations, and quantities of plastics that have reached the Arctic Ocean and accumulating as microplastics.

Addressing the problem of Arctic plastic pollution is hence a science-based quest that requires the mingling of scientific and regulatory processes. Therefore, the regulatory processes for handling the threat of plastic pollution necessitate an active and inclusive dialogue between the scientific and relevant regulatory communities, as well as other stakeholders.

■Relevant Information

13th Polar Law Symposium (November 2020) <https://2020polarlawsymposium.org>
ArCS II Research Programs <https://www.nipr.ac.jp/arcs2/e/goals/>

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