



Port reception facilities and a regional approach: A bridge for abating plastic pollution in the arctic?

Lori Osmundsen^{1,2}

Scandinavian Institute of Maritime Law, University of Oslo, Karl Johans Gate 47, 0162 Oslo, Norway

ARTICLE INFO

Keywords:

Marine plastic pollution
Arctic
Shipping
Port reception facilities
Plastic waste
Regional action plans

ABSTRACT

The plastic plague impacting the world's oceans stretches to the polar regions, and has now been documented in all areas of Arctic marine environments from floating sea ice to the seabed floor. As shipping and other maritime activities increase in a warming Arctic, preventing ever more marine plastic pollution is a global and regional imperative. The current international legal regime, despite banning discharge of plastic waste from ships for many years, has failed to halt marine plastic litter from sea-based sources in the Arctic. This paper examines through textual analysis how port reception facilities (PRFs), a critical element of international legal and policy frameworks for keeping vessel-source plastics out of the marine environment, have been insufficiently defined and loosely characterized in global agreements. Assessment of regional instruments and initiatives with an Arctic focus or impact reveals concrete ways in which defining fundamental adequacy criteria of PRFs can be achieved. Regional solutions to filling gaps in the global PRF regulatory regime run the risk of adding to legal fragmentation and conflicting norms. Options for mitigating and managing these risks include regime collaboration and co-creation of standards, which could have relevance to integrating PRFs as plastic waste control mechanisms in a new global plastics treaty.

1. Introduction

The proliferation of plastics in the world's oceans continues to add several million metric tons annually to the estimated 150–400 million metric tons that have already accumulated since the 1950s [1–3]. No region of the planet is spared, and the Arctic has become an emerging hot spot of the global marine plastic problem. Recent studies have confirmed the presence of marine plastic litter in significant quantities in all sectors of the Arctic marine environment, including shorelines, sea ice, the water column, the deep sea floor, and marine sediments [4,5]. Arctic surface waters are now considered to hold the most plastics of any ocean basin [4].

While plastic leakage from land sources predominates globally, evidence suggests maritime activities have played a significant role in contributing to the plastic pollution problem in the Arctic [6,7]. Investigations have shown a correlation between increasing shipping activity and increasing densities of macroplastics and microplastics found in Arctic waters and coastal areas that are remote from any sizable land population centers [8–10]. Ship traffic in the Arctic increased 25%

between 2013 and 2019, and the distance sailed by bulk carriers increased 160% in the same period [11]. A continued upward trajectory in vessel traffic looms, in large part owing to climate change effects allowing for expansion of shipping routes and periods of navigability. Other sectors of maritime activity in the Arctic region that generate plastic waste — fisheries, aquaculture, cruise tourism and offshore resource development — are also likely to accelerate in the next decade.

Ships are conveyors and potential dischargers of plastics in various forms, including cargo straps, packaging, sheeting, crates, single-use containers of consumables, and even cargo itself (e.g., plastic pellets or nurdles for industrial production). Accidental discharge of plastics can occur through collisions, grounding or extreme weather conditions, but avoidable ship-generated plastic waste also enters the sea via illegal dumping, improper handling, inadequate procedures and storage facilities on board, unfiltered wastewater discharge, and lack of plastic waste reception facilities in ports.

Keeping plastics from shipping and other maritime activities out of the Arctic ocean environment starts with effective waste management practices on board vessels. Equally important are environmentally

E-mail address: lori.osmundsen@gmail.com.

¹ Present address: 2622 SE Yamhill Street, Portland, Oregon 97214, USA.

² Recently awarded LL.M. degree in December 2021 upon completion of maritime law program; this paper was researched in conjunction with the master's thesis for the LL.M degree).

<https://doi.org/10.1016/j.marpol.2022.105436>

Available online 13 December 2022

0308-597X/© 2022 The Author. Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

proper and operationally efficient methods for receiving plastic waste from vessels at ports. The two are interlinked. This article focuses on port reception facilities (PRFs), which are generally defined as any fixed, floating or mobile facility capable of receiving wastes and residues from ships [12]. Fixed PRFs are static collection points at a port, usually in a central or strategic location, with containers for plastics and other wastes [10]. Floating PRFs are normally barges that can be towed or self-propelled, and moved to ships for off-loading of wastes [10]. Mobile PRFs include land vehicles at wharves, and movable bins that can be shifted to berthing areas to receive wastes from ships for later pick-up by third party operators [10]. As noted recently by the UN expert group GESAMP, "[i]mproving PRFs for waste from ships, including its onshore downstream management, is the single most effective solution to preventing discarding of waste at sea" [10].

PRFs have been prescribed by international, regional and national laws for decades, yet are insufficient or absent in many areas. This article examines legal gaps and impediments to their deployment with a focus on the Arctic, and considers whether recent regional law and policy developments may assist in strengthening PRFs as an agent of marine plastic waste mitigation in Arctic waters. This question is viewed in the larger context of the issue of fragmentation and lack of coherence, a much-debated aspect of international environmental law connected to its overall effectiveness [13]. Fragmentation occurs when specialized and autonomous rule systems and legal institutions emerge that touch on the same subject, creating prospects for overlapping, disconnected and even conflicting norms [14].

The study employs doctrinal legal research and textual analysis to discern and critique the legal rules applicable to shipping-related plastic waste and PRFs. Present international treaty law linking control of sea-based marine plastic pollution and PRFs is examined, and its shortcomings assessed with focus on the definitional problem of what adequacy standards apply to PRFs. New 'soft law' and 'hard law' instruments concerning PRFs and marine plastic waste mitigation in the European Union (EU), the North-East Atlantic, and the Arctic are discussed as possible aids to addressing substantive limitations of the global regime, and suggestions offered for better defining PRF adequacy to suit the Arctic region. Merits and risks of formulating an Arctic-specific approach to defining PRF sufficiency are assessed in terms of coherence deficiencies of the existing global regulatory framework, and in relation to a new UN global plastics treaty currently in negotiations. The paper concludes that regional mechanisms defining PRF norms can bridge gaps in existing global instruments and contribute positively to reducing marine plastic pollution in the Arctic, but should be reconciled with existing and future international regimes.

2. International legal framework applicable to marine plastics and PRFs

2.1. Relevant treaties

Global control of marine plastic pollution at present derives from pieces of various international agreements supporting the notion that there should be no plastic inputs into any of the world's seas, including Arctic waters. Chief among these are the United Nations Convention on Law of the Sea (UNCLOS) [15], the London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter and its 1996 Protocol [16], the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal [17], and the International Convention for the Prevention of Pollution from Ships as amended by its 1978 Protocol (MARPOL) [18]. Relevant provisions of these instruments and their interrelationship gives rise to the current regulatory regime for funneling plastic wastes from ships to PRFs.

While not specifically referencing plastics or PRFs, UNCLOS imposes on states a general obligation under Article 194(1) "to prevent, reduce and control" all pollution of the seas from any source [15]. "Pollution" is defined in Article 1(4) as human-introduced substances or energy that

negatively impact the marine environment. Plastic waste is considered to come within this purview, consistent with Article 31(1) of the Vienna Convention on the Law of Treaties (VCLT) providing that treaties are to be interpreted in good faith according to the ordinary meaning of their terms in context, and in light of their object and purpose [19]. Of relevance to shipping and plastic litter, states are obligated pursuant to UNCLOS Article 194(3) to institute measures that are designed to minimize pollution from vessels to the fullest possible extent, and prevent intentional as well as accidental discharges [15]. Additionally, states are required under Article 211 to establish via competent international organizations or diplomatic conferences such international rules as are necessary to prevent, reduce and control pollution from vessels, and to adopt laws and regulations adhering to "generally accepted international rules and standards" to avoid pollution from vessels flying their flag of registry [15]. These "rules and standards" are not delineated in UNCLOS but have been commonly understood to include MARPOL and its Annexes [20].

A state's duty to establish suitable PRFs to receive ship-generated plastic waste can be said to follow consequentially from the duties prescribed by UNCLOS Articles 194 and 211. Protecting the marine environment from the global plastics problem, the extent of which was not recognized at the time UNCLOS came into force, is consistent with its overall purpose and objectives. Under emerging norms of treaty interpretation positing that multilateral environmental agreements are not static and should be interpreted in light of changing legal and factual circumstances [21,22], it is defensible to see establishment of PRFs for vessel-based plastic wastes as within the scope of UNCLOS obligations.

The London Convention and its Protocol ban the deliberate disposal ("dumping") into the ocean of wastes from ships, offshore platforms or other man-made structures, and aircraft. Wastes that result from normal operation of vessels are specifically carved out of the definition of "dumping" as they are considered the province of MARPOL, and therefore are not regulated by the London instruments. Plastics clearly qualify as "wastes," defined by Article III(4) of the London Convention and Article 1(8) of the Protocol as "material and substance of any kind, form or description" [16]. Additionally, Article IV(1)(a) and Annex I(4) of the London Convention prohibit intentional dumping of "persistent plastics" [16]. Article 4(1) of the Protocol requires parties to "prohibit the dumping of any wastes or other matter" except those listed in the Protocol's Annex I, which does not include plastics [16]. The London Convention and Protocol supplement UNCLOS Article 210 in terms of providing global rules and standards referenced therein for minimum thresholds of national laws to prevent marine pollution from dumping [20]. A logical corollary of these prohibitions against dumping of plastic waste at sea is that ships must have a disposal alternative. In this context, PRFs can be considered a legal necessity for states to be able to comply with their obligations under the London Convention/Protocol regime.

Plastic waste falls under the scope of the Basel Convention's framework for transnational waste shipment regulation provided it can be classified as either "hazardous wastes" by way of Annex I chemical constituents, Annex III characteristics, or states' domestic laws, or "other wastes" collected from households or residues of incineration [17]. Amendments to the Basel Convention which took effect as of January 1, 2021 establish clearer rules for the conditions under which plastic waste can be lawfully traded internationally, the circumstances when plastic trade is banned, and the scope of plastic wastes subject to the Convention's Prior Informed Consent controls [17]. The new rules comport with the Convention's reliance on the principle of proximity (i.e., wastes should be treated and disposed of as close as possible to their source of generation). This has the concomitant effect of reducing risk of leakage into the marine environment during sea transport, if such transport is substantially reduced. Basel Convention parties are also required under Article 4(2)(b) to ensure the availability of adequate disposal facilities for environmentally sound management of hazardous and other wastes. This provision could plausibly be construed to include PRFs, but as discussed below some potential for overlap and incoherence with the

MARPOL PRF regime exists.

MARPOL is the principal international legal instrument for controlling ship-based wastes, categorized in six annexes. Annex V concerns "garbage," which by definition in Regulation 1(9) includes "all plastics generated during the normal operation of the ship and liable to be disposed of continuously or periodically" [18]. Under Regulation 3(2) of Annex V, "discharge into the sea of all plastics, including but not limited to synthetic ropes, synthetic fishing nets, plastic garbage bags and incinerator ashes from plastic products is prohibited," except for certain exceptions under Regulation 7 [18]. The exceptions are narrow, and pertain to situations where discharge may be necessary for securing the safety of the ship and those on board, for saving life at sea, or instances of accidental loss provided all reasonable preventative precautions were taken.

Regulation 8(1) of Annex V requires parties to "ensure the provision of adequate facilities at ports and terminals for the reception of garbage without causing undue delay to ships, and according to the needs of the ships using them" [18]. As of May 2022, 155 states have consented to be bound by Annex V, including all countries within or bordering Arctic waters [23]. Hence all Arctic and near-Arctic states are obligated to provide PRFs to receive plastic shipping wastes. MARPOL parties are also required to maintain updated information on their PRFs and communicate this information to the International Maritime Organization (IMO), the UN specialized agency responsible for drafting and adopting the Convention, its amendments, and associated guidelines. The IMO has established a PRF database within its Global Integrated Shipping Information System (GISIS) for this purpose, and MARPOL parties are also required to notify the IMO of cases where PRFs are considered inadequate [24].

Three other aspects of MARPOL relevant to controlling marine plastic pollution in the Arctic warrant analysis. First, pursuant to Regulations 1(14) and 8(2) of Annex V, parties whose coastline borders a so-called "Special Area" must ensure as soon as possible that adequate PRFs are provided in all ports and terminals within the area [18]. These are places where for technical reasons and in light of oceanographic, ecological, and vessel traffic conditions, adoption of enhanced mandatory methods for preventing sea pollution by garbage is warranted. Eight such special areas are designated under MARPOL, but the Arctic is not one of them. This could be seen as a detrimental omission in terms of expanding the coverage and capacities of PRFs for plastics in the Arctic. However, the Special Area designation process is lengthy [25] and only takes effect upon certification by all riparian countries that adequate PRFs are already in place in their ports [26]. Therefore, pursuing Special Area status would not likely be an expeditious means to achieving the goal of more and better Arctic PRFs. Second, the Polar Code's environment-related amendments to MARPOL, which entered into effect in 2017, already require that ships must comply with stricter pollution prevention measures specific to harsh Arctic conditions and vulnerable ecosystems, thus having a similar effect to the benefits of Special Area status [27]. The Polar Code does not, however, include any references to plastic wastes and PRFs, and therefore cannot be said to supplement the existing MARPOL Annex V rules regarding those issues.

The third and most recent development is that amendments to MARPOL Annexes I, II, IV, V and VI and related IMO guidelines authorizing establishment of a Regional Port Waste Reception Facilities system in the Arctic are likely forthcoming. Up until now the Annexes have granted dispensation only to Small Island Developing States (SIDS) to satisfy their PRF obligations collectively through "regional arrangements," because of those states' unique circumstances and needs. The new proposed amendments, spearheaded by all Arctic states through efforts of the Arctic Council and its Working Groups, seek to add "States the coastline of which borders on Arctic waters, provided that regional arrangements shall cover only ports within Arctic waters of those States" [28]. The amendments also include updating the IMO's 2012 Guidelines for the Development of a Regional Reception Facilities Plan (RRFP) to encompass port areas adjacent to, as well as within, Arctic waters. This

will permit inclusion of larger, developed PRFs in near-Arctic locations that may be more practically suited to serve as designated hub locations termed Regional Ships Waste Reception Centers [29,30]. The proposed amendments have been vetted and approved by the IMO's Subcommittee on Pollution Prevention and Response in April 2022 and by the Marine Environmental Protection Committee (MEPC) in July 2022, and are on track for formal adoption at the MEPC's December 2022 session [31].

2.2. Limitations of the global treaties

Despite the foregoing legal foundations of PRFs and their indispensability for carrying out states' treaty obligations to prevent plastic discharge from vessels to the sea, few port areas across the Arctic region have well-functioning plastic waste reception and management infrastructure [27,32]. Establishing PRFs for plastic waste mitigation in the Arctic and elsewhere has been hampered by deficiencies in the international regulatory framework. A number of these impediments have to do with weak or missing compliance, incentive, and enforcement mechanisms. These are extensive topics in their own right and beyond the scope of this article. A prerequisite to resolving these other issues, however, is achieving legal coherence among the variety of norms applicable to shipping-related marine plastic pollution.

This lack of coherence plays out with respect to PRFs in several ways. First, while UNCLOS enjoys wide ratification and provides a global mandate for protecting the oceans from plastic litter, it functions as a general framework treaty that is intentionally sparse on specifications of what the required rules and standards should contain. Second, as discussed above some "rules and standards" referenced in UNCLOS to prevent vessel-source plastic pollution are provided by other instruments such as the London Convention/Protocol and MARPOL, but those treaty regimes have vastly different participation levels. Currently 87 countries are party to the London Convention and only 53 are party to the London Protocol [33], which means most of the world's nations are not party to either agreement. Third, even if states outside the London Convention/Protocol regime may be said to have an implied duty to comply with those agreements by virtue of UNCLOS Article 210 if they are UNCLOS parties [34], there are no PRF requirements or rules in either the London Convention or Protocol. Fourth, despite persuasive grounds for viewing the Basel Convention and MARPOL as related but mutually exclusive regimes, legal uncertainty remains over whether Basel, MARPOL, or the receiving port state's national law applies to the handling of a ship's plastic wastes after they are deposited at PRFs [35]. A related unresolved question is how or if PRFs should interact with any tradeable plastic waste import shipments that may be permitted under the new Basel rules.

Most relevant to the focus of this article, uncertainty as to what constitutes "adequate" PRFs for plastic wastes impedes their deployment [12]. As Ball notes, "[a]greeing on a standard definition for the term 'adequate' is important because no meaningful criteria for the identification of inadequacies can be developed without first deciding upon this issue" [36]. "Adequate" is not defined in MARPOL or any of the Annexes. Applying the 'ordinary meaning' interpretive rule of VCLT Article 31(1) does not add clarity, since common dictionary meanings of "adequate" — "satisfactory or acceptable in quality or quantity" [37], or "enough or satisfactory for a particular purpose" [38] — still beg the question of what criteria apply to determine whether a PRF is "satisfactory" or "acceptable." Broad and varying interpretations of adequacy by states, and even among different port areas within states, underscore a need for consistent, precise and coherent standards [36,39,40].

Clearer standards on adequacy should be developed by the MEPC and incorporated as amendments to MARPOL Annex V in order to have the widest binding effect [41]. So far, however, MARPOL parties have not pursued that option [42] and the IMO has instead issued sets of non-binding guidelines and best-practice suggestions as interpretive aids [12,43,44].

If no MARPOL amendments on adequacy are forthcoming, do the IMO guidelines help solve the uncertainty problem? The most directly relevant guidance posits that adequate PRFs are those which (a) mariners use, (b) fully meet the needs of the ships regularly using them, (c) do not provide mariners with a disincentive to use them, and (d) contribute to the improvement of the marine environment [12,44]. On the positive side, the guidance adds the components of usage and environmental benefit to the definition of PRF adequacy. A PRF can hardly be said to be "adequate" if no one uses it. Usage can be easily measured, and has two sub-components: functional ability to service the disposal needs of users/ships, and avoidance of disincentives. The latter is most clearly a product of (1) whether the PRF for plastic wastes is easy to access at the port, so that ships are not unreasonably inconvenienced or delayed, and (2) whether fees are assessed directly for offloading plastic waste at a PRF or indirectly as a universal port charge on all ships regardless of waste delivery. The environmental improvement component may be less easy to measure and not readily apparent on shorter timescales, but measurement metrics could be agreed upon with input from relevant NGOs and governmental experts. On balance the IMO guidance is a partial positive step forward but suffers from a continuing lack of details, for example how improvement to the marine environment should be gauged and over what time period, and what fee system options should be used to encourage usage. Also, the measures are couched as voluntary suggestions, subject to varying adoption or ignorance by MARPOL parties.

A further possibility for refining what PRF adequacy means with regard to marine plastic waste collection is resort to regional gap-filling solutions, a path the IMO guidance documents also suggest and one the Arctic is poised to follow with regard to pending MARPOL Annex amendments described in Section 2.1. However, this initiative and other measures with partial Arctic regional effect discussed below pose a tension with the legal fragmentation problem. On the one hand, region-specific solutions may well enhance the adequacy of PRFs tailored to conditions in that area. On the other hand, they will add to the diverse array of regulatory approaches to PRFs and ship-based plastic waste collection and thus may detract from overall coherence regarding this aspect of the global transboundary problem presented by marine plastic pollution. This dichotomy and options for reconciling it are explored in the next sections.

3. Regional measures impacting PRFs and marine plastics in the Arctic

3.1. Legal instruments with overlapping effect in the Arctic

The EU has been active in refining standards of PRF adequacy and plastic waste management. EU Directive 2019/883 on Port Reception Facilities (the *PRF Directive*) [39] and EU Directive 2019/904 on reduction of environmental impacts of single-use plastic products (the *SUP Directive*) [45] took effect in EU Member States (including Arctic nations Sweden, Finland and Denmark) as of July 2021. Norway and Iceland as European Economic Area (EEA) members are bound to implement EU directives through their national laws if the directives have been formally incorporated into the EEA Agreement [46]. The SUP Directive has been so incorporated [47], and the PRF Directive was approved for incorporation in June 2022 [48].

The EU first enacted PRF legislation over twenty years ago in the form of Directive 2000/59/EC, in part as a response to perceived ineffectiveness of the MARPOL regulations. In its updated form, the 2019 PRF Directive augments MARPOL PRF rules in several respects. Delivery of all ship-board plastic waste to a PRF is required when calling at an EU port, unless a ship can demonstrate it has "sufficient dedicated storage capacity" for all waste accumulated during the intended voyage, or the ship only calls at anchorage for under 24 h, or under adverse weather conditions [39]. The European Commission recently adopted an implementing regulation defining methods for calculating "sufficient

dedicated storage capacity" based on plastic waste generation rates per person per day, maximum on board waste storage space, and used waste capacity at the time of sending the ship's advance waste notification to the next port of call [49]. Adding numerical parameters to define what "sufficient storage capacity" actually means helps clarify when vessels must offload their plastic wastes to PRFs rather than elect to carry them onward to another port. Not-to-exceed thresholds are set for EU and non-EU destination ports, a model which should be replicated in regional Arctic PRF planning under the anticipated MARPOL Annex V amendments in view of the substantial distances typically involved between available ports. Notably, the Directive indicates that PRF "adequacy" encompasses environmental management requirements of EU waste law, including separate collection of plastic wastes from ships to assist in reuse and recycling schemes [39]. This addition to adequacy standards should also be extended to all Arctic PRFs receiving plastic wastes, with substitution of national waste legislation for EU law in Arctic ports of non-EU countries.

The PRF Directive is the most thorough template to date of requirements for PRFs and ship-to shore plastic waste management with binding effect in some parts of the Arctic region. Non-EU Arctic states Canada, the Russian Federation and the United States are not bound by it with respect to their own PRFs, although their ships would be subject to the plastic waste delivery requirements at PRFs of EU Member States.

The SUP Directive impacts control of marine plastic waste from sea-based sources in the Arctic indirectly. It imposes limits on placement on the market of certain SUPs in phases over the next several years, moving toward complete elimination [45]. The Directive's restrictions on SUPs, which constitute a substantial fraction of plastic litter found on Arctic beaches, can thus be expected over time to reduce the amount of SUP items carried on board many ships to zero. A cross-correlation with the PRF Directive is contained in Article 8, subsection 9, requiring Member States to ensure that fishing gear producers "cover the costs of the separate collection of waste fishing gear containing plastic" that has been delivered to "adequate" PRFs pursuant the EU PRF Directive, as well as the costs of subsequent transport and treatment [45].

The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) mirrors UNCLOS and the London Convention in requiring its Member States to take all possible measures to eliminate pollution by dumping or incineration at sea by ships and from offshore structures [50]. Arctic Council member states Norway, Finland, Sweden, Denmark and Iceland are parties to OSPAR [51], and the OSPAR Commission has observer status at the Arctic Council [52]. While the Convention itself makes no explicit mention of plastic, it has spawned a Regional Action Plan on Marine Litter (OSPAR RAP-ML) adopted in 2014 by the OSPAR parties as an "OSPAR Other Agreement," calling out plastic pollution as its primary focus [53]. The OSPAR RAP-ML targets marine plastics from sea-based and land-based sources, as well as litter already present in the marine environment. It applies to the entire OSPAR maritime area, of which Region I, sub-labeled "Arctic," covers part of the Norwegian Sea, North Atlantic waters surrounding Iceland and the eastern half of Greenland, and a wedge of the Central Arctic Area [54].

The OSPAR RAP-ML intersects directly with the EU PRF Directive through supporting regional coordination and development of consistent PRF standards [53]. This makes practical sense given the geographic and regulatory overlap, and in theory should enhance maximization of the amount of ship-generated plastic waste delivered to Arctic PRFs encompassed in the OSPAR Region I area. While no such standards are yet in place, the stated policy goal of cross-collaboration with the EU regulatory regime should be pursued in the next iteration of the OSPAR RAP-ML by all member states and the European Commission, with input from shipping industry stakeholders and relevant NGOs.

3.2. Arctic-specific rulemaking

There is no Arctic treaty system as exists for the Antarctic. Law-making in the Arctic region is largely the province of national governments whose coastlines and territories abut the Arctic Ocean. Differing political and economic interests contribute to a considerable degree of diversification in legal rules pertaining to Arctic-wide issues. Nonetheless the Arctic Council, an intergovernmental forum of experts and political representatives from Canada, the Russian Federation, Norway, Iceland, the United States, the Kingdom of Denmark including Greenland and the Faroe Islands, Finland, and Sweden, has been influential in developing regional policies addressing Arctic shipping and environmental concerns, as well as promoting regulatory changes to effectuate common policies [55]. The Council's Regional Action Plan on Marine Litter in the Arctic (Arctic RAP-ML) [56], adopted in May 2021, could extend this policy and regulatory influence with respect to PRFs.

The Arctic RAP-ML encompasses geographically all Arctic marine areas identified by its member states, including coastal zones and river basins connected to the oceanic environment. Its content concerns "actions to be taken in the Arctic, by Arctic States collectively and independently, designed to be complementary to, and cooperative with, efforts underway in other international and regional organizations and conventions, as well as their activities and programs" [56]. In this regard, the Arctic RAP-ML fits squarely within the 'soft law' functionality of action plans adopted by multiparty organizations or high-level conferences on sectoral environmental issues, i.e., while not having the force and effect of legally binding rules, the action plan can serve to interpret and apply existing global rules in a regional context, and spur subsequent legislation or regulations [13].

The Arctic RAP-ML correctly names ships and offshore structures as sources of marine plastic litter if they do not have the infrastructure and processes on board and on shore to effectively manage and dispose of it. Accordingly, Action Item 20 calls for focus "on the effectiveness of port reception facilities, including waste collection and recycling, and on prevention of cargo loss" [56]. The Plan provides support to Arctic Council member states in crafting Arctic-specific improvements to PRFs, including collection of regional data on current and projected plastic waste handling needs of all classes of vessels traversing Arctic waters [57]. These efforts can and should lead to refining the indicia of adequacy for PRFs in the region.

Coincident with developing the Arctic RAP-ML, the Arctic Council and its Working Groups served as a key incubator for crafting collectively the draft amendments to MARPOL PRF regulations currently before the IMO that will allow for an Arctic region-based approach to providing PRFs. If approved as expected, the Arctic states must jointly develop a Regional Reception Facilities Plan, including particulars of identified Regional Ships Waste Reception Centers as well as other Arctic ports with only limited facilities [28,30].

This presents an opportunity for member state representatives to the Arctic Council, the Working Groups, and Arctic nation IMO delegates drafting the Regional Plan to include Arctic-specific parameters for adequacy in terms of PRFs and plastic waste collection from ships. These should build on the IMO's PRF guidelines and mirror elements of the EU PRF Directive. The overarching objective of an Arctic Regional Plan should be improved collection of plastics from ships. Specifically, metrics of adequacy for Arctic PRFs for ship-based plastics wastes could include:

- Mandatory port waste management plans that are coordinated with national land-based waste management systems to ensure that the collected plastic wastes in ports do not subsequently end up in the ocean. Empirical studies in the UK, for example, demonstrated the value of such planning in improving coverage and quality of PRFs [36].

- Separation of plastic wastes from other garbage, and sorting of plastics by type (e.g., packaging, cigarette butts, fishing gear) to facilitate reuse or recycling.
- Compulsory delivery of plastic wastes to PRFs at each Arctic port of call, with appropriate narrow exceptions modeled after the EU PRF Directive.
- Incorporation of sustainable, measurable port-side plastic waste processing standards.
- Matching the type of PRF (e.g., mobile, fixed, floating) for plastic wastes suitable for each port or terminal in light of local conditions and types of vessels.
- Use of a transparent indirect fee structure based on ship class and size, so that a small fishing vessel would not be charged the same port fee as a tanker, but all users pay regardless of whether wastes are delivered. Complaints logged on the IMO's PRF database module under GISIS demonstrate that vessel operators — and the IMO itself — consider confusion over what fees to expect and how they are derived to be an indicator of inadequacy. [24].

The Arctic RAP-ML had been launched for only a few months when official meetings of the Arctic Council paused in early March 2022 following the Russian invasion of Ukraine. At present the future of intergovernmental collaboration among all Arctic States — previously a hallmark of the Arctic Council — is uncertain [58]. While progress with advancing the Arctic RAP-ML may be slowed somewhat, the Arctic Council has proven resilient over time in light of changing geopolitical and security circumstances in the region.

4. Discussion

4.1. Benefits of a regional approach

As studied by Ostrom and others, polycentric systems have a place in addressing global environmental challenges alongside global treaties [59]. This may be especially appropriate with regard to marine plastic pollution and its largely general treatment thus far in international treaties. Regional decision-making instruments that are aligned with the goals of framework international instruments can provide substantive content to fill in gaps. With respect to PRFs, the EU PRF Directive adds specificity to the broad strokes definition of adequacy in the MARPOL regime. The Arctic Council has promoted amendments to MARPOL Annexes which are expected to lead to creation of a highly detailed Arctic Regional Plan for PRFs. Regional measures to support PRFs as a nexus point for cost-effective and sustainable management of marine plastic litter in the Arctic can complement and assist the current and future regulatory framework for shipping and plastic control [60]. Positive effects of regime interaction in law-making include mutual learning and engagement which can lead, as Young describes with respect to international fisheries management, to articulation of standards and benchmarks with binding effect. [61] This result is anticipated, for example, from the OSPAR/EU collaboration on PRF standards.

4.2. Risks and options for reconciling them

When smaller groups of states create regional institutions and legal instruments to address global problems, the potential arises for inconsistent obligations faced by states and non-state actors with respect to other applicable regimes [62]. This may also engender regulatory leakages or transfer of the problem to somewhere else with milder requirements.

As argued here, however, similar difficulties arise with treaty provisions that are open to divergent interpretation. Several commentators have noted that fragmentation is an inevitable and irreversible consequence of international environmental law's continuing expansion of scope, and should be seen as something to be managed productively to

harness synergistic opportunities rather than eliminated [61–63]. One way to do so in standard-setting is through formal collaboration between convention bodies by way of MOUs [64], and between conventions and regional soft law instruments by way of stakeholder conferences and joint action plans [61,65]. An example of the latter is the iterative interaction between OSPAR, the EU and North Sea Conferences in co-creating more robust dumping control policies and regulations in the North Sea [65].

Solutions developed in a smaller, regional arena can be scaled up to inform the bigger, global regime on the same issue, and improved global measures in turn support implementation of regional measures [66]. The Baltic experience with regard to inadequacies of the global regulatory framework on sewage from passenger ships is illustrative. Formal interaction between the 'soft law' Baltic Sea Action Plan, a high level regional policy document, the Helsinki Convention on protection of the Baltic marine environment, and the Helsinki Commission's shipping expert groups led to development of common concepts of adequacy for PRFs for ship sewage in the Baltic, subsequent MARPOL Annex IV amendments, and MARPOL designation of the Baltic Sea as a Special Area subject to heightened sewage pollution controls. Similarly, Arctic regional initiatives to strengthen the criteria for PRF adequacy could provide a positive feedback loop and be integrated more broadly in the global regulation of ship-sourced plastic waste.

4.3. Might regional solutions assist the future global plastics treaty?

The March 2022 resolution by the UN Environment Assembly at its 5th general session green-lighted negotiations for a new worldwide plastics treaty embracing a holistic lifecycle approach, heralding hope that a more comprehensive binding system will become universally adopted in a few years [67]. A major focus of the new treaty will likely be measures to stem the upstream production flow of oil-derived plastics, as many legal experts have advocated [64]. Downstream sea-based source control should not be ignored or left out of the global instrument, however, as any comprehensive international plastics regime aiming at systemic change must not only reference other sector or region-based regimes, but also integrate them. Omitting PRFs and recovery of plastic waste from maritime industries would be a missed opportunity, since the new treaty could be well placed to bridge the tricky divide between international rules governing marine plastic wastes up to point of delivery to PRFs, and national laws governing the same wastes once on land.

In this regard, measures developed from the EU, the North East Atlantic and Arctic regions to better define standards of adequacy for PRFs as discussed in Section 3 should inform, and be complementary with, the new treaty. For example, incorporating defined environmental benefit parameters and sustainable waste management criteria within the rubric of PRF adequacy could substantially aid in protecting remote and vulnerable Arctic marine ecosystems from escalating plastic pollution. This function if scaled vertically could position PRFs as nodes for transitioning collected marine plastic waste to non-waste value components in a circular economy system, currently under consideration as an operating principle of the global plastics agreement. In drawing on substantive gap-filling elements from regional measures it will be necessary to include coordination mechanisms, such as through the treaty secretariat and other IGOs, to reconcile them with MARPOL, UNCLOS, the London Convention and Protocol, and the Basel Convention while still adding needed specificity to areas not defined in those treaties.

5. Conclusion

Arctic shipping, while steadily rising with each year of diminishing ice cover, should be a sector whose contribution to marine plastic pollution can be reduced to near zero. Existing international law requires ships to bring plastic waste to shore for handling, and requires

ports to ensure availability of adequate PRFs. Defining what makes a PRF "adequate" has not been sufficiently accomplished, however, within the international regulatory framework concerning ship-based marine plastic pollution. An Arctic regional approach to enhancing PRFs is emerging, aided by more precise standard-setting from overlapping regional regimes in the EU and to a lesser extent OSPAR. This approach adds value in providing a basis for more specific, coordinated PRF deployment than has been available under existing global instruments. In turn, regional solutions developed in the Arctic and elsewhere for improving PRFs as plastic waste management interfaces between sea and land could assist the future global plastics agreement by providing experiential learning, regulatory design improvements, and impact benefits at multiple scales. Risks of furthering negative aspects of fragmentation and undermining legal coherence can and should be addressed through concerted vertical and horizontal regime interaction.

Funding Statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

CRediT authorship contribution statement

The author certifies that she has participated sufficiently in the work to take public responsibility for the content, including participation in the concept, design, analysis, writing, or revision of the manuscript. Furthermore, the author certifies that this material or similar material has not been and will not be submitted for publication in any other publication before it appears in Marine Policy.

Declaration of interest

None.

Data availability

No data was used for the research described in the article.

References

- [1] J. Toyoshima, Marine plastic pollution in the arctic, *OPRI Perspect.* 10 (2020) 1–7. (<https://www.spf.org/opri-intl/global-data/report/perspectives/2021010763638974>). Accessed 29 November 2021.
- [2] J.R. Jambeck, G. Roland, W. Chris, R.S. Theodore, Plastic waste inputs from land into the ocean, *Science* 347 (62223) (2015) 768–771, <https://doi.org/10.1126/science.1260352>.
- [3] J. Boucher, D. Friot, Primary Microplastics in the Oceans: A Global Evaluation of Sources, IUCN, Gland, Switzerland, 2017, pp. 1–43, <https://doi.org/10.2305/IUCN.CH.2017.01.en>.
- [4] C. Katz, Why Does the Arctic Have More Plastic Than Most Places on Earth? National Geographic, 30 October 2019. (<https://www.nationalgeographic.com/science/article/remote-arctic-contains-more-plastic-than-most-places-on-earth>) (Accessed 2 September 2021).
- [5] M. Bergmann, F. Collard, J. Fabres, G.W. Gabrielsen, J.F. Provencher, C. M. Rochman, E. van Sebille, M.B. Tekman, Plastic pollution in the arctic, *Nat. Rev. Earth Environ.* (2022), <https://doi.org/10.1038/s43017-022-00279-8>.
- [6] A. Cózar, E. Martí, C.M. Duarte, J. Garcia-de-Lomas, E. Van Sebille, T.J. Ballatore, V.M. Ebuiluz, J.I. Gonzalez-Gordillo, M.L. Pedrotti, F. Echevarria, The Arctic Ocean as a dead end for floating plastics in the North Atlantic branch of the Thermohaline Circulation, *Sci. Adv.* 3 (4) (2017), e1600582.
- [7] M. Bergmann, B. Lutz, M.B. Tekman, L. Gutow, Citizen scientists reveal: marine litter pollutes Arctic beaches and affects wild life, *Mar. Pollut. Bull.* 125 (2017) 535–540, <https://doi.org/10.1016/j.marpolbul.2017.09.055>.
- [8] K.B. Parga Martinez, M.B. Tekman, M. Bergmann, Temporal Trends in Marine Litter at Three Stations of the HAUSGARTEN Observatory in the Arctic Deep Sea, *Front. Mar. Sci.* 7 (321) (2020) 1–16, <https://doi.org/10.3389/fmars.2020.0032>.
- [9] I. Peeken, S. Primpke, B. Beyer, J. Gutermann, C. Katlein, T. Krumpfen, M. Bergmann, L. Hehemann, G. Gerds, Arctic Sea Ice is an important temporal sink and means of transport for microplastic, *Nat. Commun.* 9 (1505) (2018) 1–12, <https://doi.org/10.1038/s41467-018-03825-5>.
- [10] GESAMP, Sea-Based Sources of Marine Litter, Report No. 108 of the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection, Working Group 43 (22 November 2021) 1–112.

- [11] PAME, Arctic Shipping Status Report #1, "The Increase in Arctic Shipping 2016–2019." (31 March 2020). (<https://pame.is/projects/arctic-marine-shipping/arctic-shipping-statusreports/723-arctic-shipping-report-1-the-increase-in-arctic-shipping-2013-2019-pdf-version/file>) (Accessed 30 September 2021).
- [12] IMO, Consolidated guidance for port reception facility providers and users (1 March 2018), MEPC.1/Circ.834/Rev.1, Annex, 4.
- [13] P. Sands, J. Peel, *Principles of International Environmental Law*, 4th ed., Cambridge University Press, 2018.
- [14] International Law Commission, Fragmentation of International Law: Difficulties arising from the Diversification and Expansion of International Law, UNGA Doc. A/CN.4/L.702 (2006).
- [15] United Nations Convention on the Law of the Sea (adopted 10 December 1982, entered into force 16 November 1994), 1833 UNTS 397 (1982). (Articles 192, 194, 210, 211).
- [16] London Convention on Prevention of Marine Pollution by Dumping of Wastes and Other Matter (adopted in 29 December 1972, entered into force 30 August 1975) 1046 UNTS 120, amended by London Protocol to the Convention on Prevention of Marine Pollution by Dumping of Wastes and Other Matter (adopted 17 November 1996, entered into force 24 March 2006), 36 ILM 1 (1997).
- [17] Basel Convention On The Control of Transboundary Movements of Hazardous Wastes And Their Disposal, opened for signature 22 March 1989, 1673 UNTS 57 (entered into force 5 May 1992); Basel Convention Plastic Waste Amendments, retrieved at (<http://www.basel.int/Implementation/Plasticwaste/PlasticWasteAmendments/Overview/tabid/8426/Default.aspx>) (Accessed 2 October 2021).
- [18] International Convention for the Prevention of Pollution from Ships 1973 (adopted 2 November 1973, entered into force 20 October 1983) 1340 UNTS 184, amended by Protocol of 1978 Relating to the International Convention for the Prevention of Pollution from Ships (adopted 17 February 1978, entered into force 2 October 1983) (MARPOL), 1340 UNTS 61.
- [19] Vienna Convention on the Law of Treaties (Adopted 23 May 1969, entered into force 27 January 1980) 1155 UNTS 331.
- [20] R. Churchill, Just a Harmless Fishing Fad—or Does the Use of FADs Contravene International Marine Pollution Law? *Ocean Dev. Int. Law* 52 (2) (2021) 169–192, <https://doi.org/10.1080/00908320.2021.1901342>.
- [21] N. Mileva, M. Fortuna, *Environmental protection as an object of and tool for evolutionary interpretation*, in: G. Abi-Saab, et al. (Eds.), *Evolutionary Interpretation and International Law*, Hart Publishing, 2019.
- [22] S. Dothan, *Traditional approaches to treaty interpretation*, *Fordham Int'l Law J.* 42 (3) (2019) 765–794.
- [23] Status of IMO Treaties, 26 May 2022, (<https://wwwcdn.imo.org/localresources/en/About/Conventions/StatusOfConventions/Status%20of%20IMO%20Treaties.pdf>) (Accessed 8 August 2022).
- [24] IMO, "GISIS/Port Reception Facility Database." (<https://gis.imo.org/Public/PRF/AllegedInadequacy.aspx>) (Accessed 6 November 2021).
- [25] IMO, Special Areas under MARPOL. (<https://www.imo.org/en/OurWork/Environment/Pages/Special-Areas-Marpol.aspx>) (Accessed 1 August 2022).
- [26] M. Wileška-Bien, S. Anderberg, *Reception of sewage in the Baltic Sea - The port's role in the sustainable management of ship wastes*, *Mar. Policy* 93 (2018) 207–213.
- [27] A. Chircop, The polar code and the arctic marine environment: assessing the regulation of the environmental risks of shipping, *Int. J. Mar. Coast. Law* 35 (2020) 533–569, <https://doi.org/10.1163/15718085-bja10033>.
- [28] IMO, Consideration and adoption of amendments to mandatory instruments, Draft amendments to MARPOL Annex V concerning regional reception facilities within Arctic waters and Garbage Record Book (6 July 2022) MEPC 79/3/1.
- [29] IMO Sub-Committee on Pollution Prevention and Response, Regional arrangements for port reception facilities in the Arctic - Proposed amendments to MARPOL and the 2012 Guidelines for the development of a regional reception facility plan, submitted by Canada, Denmark, Finland, Iceland, Norway, Russian Federation, Sweden and United States (28 January 2022) PPR 9/13.
- [30] IMO, Consideration and adoption of amendments to mandatory instruments, Draft amendments to the 2012 Guidelines for the Development of a Regional Reception Facilities Plan (6 July 2022) MEPC 79/3/4.
- [31] IMO, Provisional Agenda for the 79th Session of the Marine Environment Protection Committee (24 June 2022) MEPC 79/1.
- [32] M. Eriksen, et al., Mitigation strategies to reverse the rising trend of plastics in Polar Regions, *Environ. Int.* 139 (105704) (2020) 1–6, <https://doi.org/10.1016/j.envint.2020.105704>.
- [33] Ocean Dumping: International Treaties. (<https://www.epa.gov/ocean-dumping/ocean-dumping-international-treaties>) (Accessed 11 November 2021).
- [34] F. Wacht, *Article 210 pollution by dumping*, in: A. Proelss (Ed.), *United Nations Convention on the Law of the Sea: A Commentary*, C.H. Beck, Hart and Nomos, 2017.
- [35] G. Argüello Moncayo, Testing the boundaries between the Basel and MARPOL regimes: are they complementary or mutually exclusive?, *Transportation Research Procedia* 25 (2017) 233–250; cf. Revised legal analysis of the application of the Basel Convention to hazardous and other wastes generated on board ships, UNEP/CHW/OEWG.8/INF/18 (4 July 2012).
- [36] I. Ball, *Port waste reception facilities in UK ports*, *Mar. Policy* 23 (4–5) (1999) 307–327.
- [37] Oxford English Dictionary online, (<https://www.oxfordlearnersdictionaries.com/us/definition/english/adequate>) (Accessed 5 August 2022).
- [38] Cambridge Dictionary online, (<https://dictionary.cambridge.org/us/dictionary/english/adequate>) (Accessed 5 August 2022).
- [39] Directive (EU) 2019/883 of the European Parliament and of the Council of 17 April 2019 on port reception facilities for the delivery of wastes from ships, amending Directive 2010/65/EU and repealing Directive 2000/59/EC. Official Journal of the European Union L 151/116 (7 June 2019).
- [40] EFTA Surveillance Authority, Opinion concerning the incorrect implementation by Norway of Directive 2000/59/EC on port reception facilities, Case No: 71727, 10 July 2013. (<https://www.eftasurv.int/cms/sites/default/files/documents/gopro/2920-674349.pdf>) (Accessed 10 November 2021).
- [41] M. Gold, et al., *Stemming the tide of plastic marine litter: a global action*, *Agenda, Tulane Environ. Law J.* 27 (2014) 165–203.
- [42] G. Argüello, Environmentally Sound Management of Ship Wastes: challenges and opportunities for European Ports, *J. Shipp. Trade* 5 (1) (2020) 1–21. (<https://doi.org/10.1186/s41072-020-00068-w>).
- [43] IMO, Resolution MEPC.310(73), Action Plan to Address Marine Plastic Litter from Ships (Adopted 26 October 2018), MEPC 73/19/Add.1.
- [44] IMO, Guidelines for Ensuring the Adequacy of Port Waste Reception Facilities, Resolution MEPC.83(44) (Adopted 13 March 2000), MEPC 44/20.
- [45] Directive (EU) 2019/904 of the European Parliament and of the Council of 5 June 2019 on the reduction of the impact of certain plastic products on the environment. Official Journal of the European Union L 155/1 (12 June 2019).
- [46] Agreement on the European Economic Area. Official Journal of the European Union No. L 1 /3 (3 January 1994) (as amended 1 August 2016).
- [47] European Free Trade Association, "EEA Agreement," EEA-Lex Doc. 32019L0904 (<https://www.efta.int/eea-lex/32019L0904>) (Accessed 30 October 2021).
- [48] European Free Trade Association, "EEA Agreement," EEA-Lex, Doc. 32019L0883 (<https://www.efta.int/eea-lex/32019L0883>) (Accessed 11 August 2022).
- [49] Commission Implementing Regulation (EU) 2022/89 of 21 January 2022, laying down rules for the application of Directive (EU) 2019/883 of the European Parliament and of the Council as regards the method to be used for the calculation of sufficient dedicated storage capacity. Official Journal of the European Union L 15/1 (24 January 2022).
- [50] Convention for the Protection of the Marine Environment of the North-East Atlantic, (adopted 22 September 1992, entered into force 25 March 1998) 2354 UNTS 67.
- [51] OSPAR Commission, Contracting Parties (<https://www.ospar.org/ministerial/contracting-parties>) (Accessed 13 November 2021).
- [52] Arctic Council, Observers, Intergovernmental and Interparliamentary Organizations. (<https://arctic-council.org/about/observers/intergov-interpar/>) (Accessed 13 November 2021).
- [53] OSPAR Commission, Marine Litter Regional Action Plan. (<https://www.ospar.org/documents?v=34422>) (Accessed 17 November 2021).
- [54] OSPAR Commission, Region 1: Arctic Waters. (<https://www.ospar.org/convention/the-north-east-atlantic/i>) (Accessed 23 November 2021).
- [55] N. Loukacheva, The Arctic Council and 'Law-Making', *North. Rev.* 50 (2020) 109–135, <https://doi.org/10.22584/nr50.2020.005>.
- [56] PAME, Regional Action Plan on Marine Litter in the Arctic (May 2021). (<https://www.pame.is/document-library/pame-reports-new/pame-ministerial-deliverables/2021-12th-arctic-council-ministerial-meeting-reykjavik-iceland/801-regional-action-plan-on-marine-litter-in-the-arctic/file>) (Accessed 11 November 2021).
- [57] PAME Work Plan 2021–2023, (<https://pame.is/pame-work-plan>) (Accessed 12 November 2021).
- [58] T. Nilsen, March 3, 2022, "Arctic Council in pause mode as seven of eight member states condemn war," Barents Observer. (<https://thebarentsobserver.com/en/arctic/2022/03/arctic-council-pause-mode-seven-eight-member-states-condemn-war>) (Accessed 4 March 2022). The Arctic Council is currently chaired by the Russian Federation for the period 2021–2023.
- [59] E. Ostrom, *Polycentric systems for coping with collective action and global environmental change*, *Glob. Environ. Change* 20 (2010) 550–557.
- [60] N. Wienrich, L. Weiland, S. Unger, *Stronger Together - The role of regional instruments in strengthening global governance*, Institute for Advanced Sustainability, Stud., Potsdam (2021), <https://doi.org/10.48440/iass.2021.008>. Accessed 2 April 2022.
- [61] M.A. Young, Regime Interaction in Creating, Implementing and Enforcing International Law, in Regime Interaction in International Law - Facing Fragmentation (ed. M.A. Young), Cambridge University Press online, Ch 3 pp 85–110. <https://doi.org/10.1017/CBO9780511862403.005>.
- [62] E. Brown Weiss, International Law in a Kaleidoscopic World, *Asian J. Int. Law* 1 (2011) 21–32, <https://doi.org/10.1017/S2044251310000019>.
- [63] K.N. Scott, *International Environmental Governance: Managing Fragmentation through Institutional Connection*, *Melb. J. Int. Law* 12 (1) (2011) 177–216.
- [64] E. Kirk, N. Popattanachai, Marine plastics: Fragmentation, effectiveness and legitimacy in international lawmaking, *RECIEL* 27 (2018) 222–233, <https://doi.org/10.1111/reel.12261>.
- [65] J.B. Skjærseth, *Protecting the Northeast Atlantic: One Problem, Three Institutions*, in: S. Oberthür, T. Gehring (Eds.), *Institutional interaction in global environmental governance: synergy and conflict among international and EU policies*, MIT Press, 2006.
- [66] S. Oberthür, *Interplay management: enhancing environmental policy integration among international institutions*, *Int Environ. Agreem.* 9 (2009) 371–391, doi: 10.1007/s10784-009-9109-7.
- [67] Draft Resolution, End plastic pollution: Towards an international legally binding instrument. (2 March 2022) UNEP/EA-5/L.23/Rev.1