The Arctic Ocean: Regulating Shipping under uncertainty
Knowledge based decision-making?

Tore Henriksen

1. Introduction

This paper discusses the role of scientific research in regulating shipping in Arctic waters. Scientific research is a major provider of knowledge relevant to environmental protection, including that of the marine Arctic. Put bluntly, scientific research is essential in identifying an environmental 'problem', in providing an adequate diagnosis, and in prescribing solutions to the problem.[1] In other words, scientific research provides assessments of the scope and potential negative impacts of environmental threats. This knowledge then provides the basis on which to craft legal measures to resolve the particular problem.[2] Climate change is one such problem. Climate change is transforming the marine Arctic,[3] opening up, among other things, new shipping opportunities. However, according to Solan et al., the pace of change is "such that our understanding of the way in which Arctic systems are structured and function is outdated, and insufficient to inform management, mitigation, and adaptation efforts across the region."[4] Still, there is a need to regulate human activities, including shipping, even in face of these uncertainties.

Navigation in Arctic waters is subject to different hazards including sea ice, low temperatures, darkness, rapidly changing weather conditions, and remoteness to search and rescue and oil preparedness infrastructure. These hazards may cause or exacerbate accidents and subsequent marine pollution. States have recognised the need to address the special hazards inherent in Arctic shipping through the adoption, of The International Code for Ships Operating in Polar Waters (Polar Code) developed under the auspices of the International Maritime Organization (IMO).[5] However, a proposal to include a ban on transport and use of heavy grade fuel oil (HFO) in Arctic waters in the Polar Code was rejected on the basis that such a ban was

[1] Steinar Andresen and Jon Birger Skjærseth, 'Science and technology' in Daniel Bodansky, Jutta Brunnée and Ellen Hey (eds) *The Oxford Handbook of International Environmental Law*, (Oxford University Press 2007) 185-186.
[2] Ibid.
[3] Martin Solan et al., 'The changing Arctic Ocean: consequences for biological communities, biogeochemical processes and ecosystem functioning'2000 378 *Philosophical Transactions of the Royal Society A*, (2020) Issue 2180. <https://doi.org/10.1098/rsta.2020.0266> accessed 30 September 2021.
[4] Ibid.
[5] IMO: The International Code for Ships Operating in Polar Waters, Resolution MSC.385(94) and Resolution MEPC.264(68).

premature [6] as the scientific basis for supporting the need for such a ban was inadequate. A somewhat modified ban on transport and use of HFO was eventually approved and adopted in 2021.[7]

The process that resulted in the adoption of the Polar Code and the later ban on use and transport of HFO as fuel raises questions as to the role of scientific information in the protection of the marine environment. In general, the role of science can be analysed in two distinct phases: the extent to which scientific information identifies or introduces a 'problem' to decision-makers (agenda-setting); and the extent to which scientific information is used later in the decision-making process when deciding on/prescribing a solution to the problem. The importance of science in the agenda-setting phase is considered 'crucial' for several environmental protection regimes,[8] whereas the impact of science in the actual decision-making is not always clear-cut. Other factors may affect causality, including whether there is consensus or controversy over the available knowledge, the available solution is feasible or available, it is a neutral or value laden issue, or a low or high political conflict area.[9]

This chapter examines the work of the IMO in regulating shipping in the Arctic in the face of scientific uncertainty. More specifically, the role of science in the work of the IMO on the protection of the marine environment with particular reference to the role of science in adopting the Polar Code and in banning the use and transport of HFO as fuel in Arctic waters. In doing so, the chapter examines whether, as Elizabeth Kirk claims, "the role of science [in the IMO] is not in practice always as significant as one might hope."[10] Using the two phase model noted above, the chapter starts with an examination of whether the Law of the Sea Convention (LOSC)[11] provides any normative signals on the role of science in the protection of the marine environment and the extent to which this is left to the different regional or

[6] IMO: Report of the Marine Environment Protection Committee on Its Sixtieth Session, para. 21.9, MEPC 60/22.
[7] Resolution MEPC.329(76) Amendments to the Annex of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto: Amendments to MARPOL Annex I (Prohibition on the use and carriage for use as fuel of heavy fuel oil by ships in Arctic waters), MEPC 76/15/Add.2 Annex 2.
[8] Steinar Andresen, "The role of scientific expertise in multilateral environmental agreements: influence and effectiveness", in Monika Ambrus et al (eds), *The Role of 'Experts' in International and European Decision-Making Processes: Advisors, Decision Makers or Irrelevant Actors?* (Cambridge University Press, 2014) 105-125 (114-115).
[9] Ibid 121; Zhen Sun, 'Closing Gaps of Fuel Use Regulation of Arctic Shipping', *The International Journal of Marine and Coastal Law* 35 (2020) 570–595 (587).
[10] Elizabeth Kirk, 'Science and the International Regulation of Marine Pollution' in Donald Rothwell et al. (eds), *The Oxford Handbook of the Law of the Sea* (Oxford University Press 2015) 517 (530).
[11] United Nations Convention on the Law of the Sea (Montego Bay 10 December 1982, in force 16 November 1994, 1833 UN *Treaty Series* 3.

global sectoral regimes such as the IMO (section 2). It then turns to a discussion of the role of science in the decision-making processes of the IMO (section 3) and of the Polar Code (section 4). In doing so the chapter both clarifies the role of science in the development of the Polar Code, including the most recent amendment, and provides insight into the more general practice of the IMO. The chapter concludes (section 5) that while the adoption of the Polar Code signals a more pro-active role of the IMO prompted by science, the role of science within the IMO remains, nevertheless, unclear.

2. Science in the protection of the marine environment under the LOSC

The following sub-section, 2.1, investigates whether the LOSC requires states – including when collaborating through the IMO – to provide scientific information in complying with the duty to protect and preserve the marine environment. This is a necessary precondition both for the role of science in the agenda-setting (identifying the problem) as well as for stipulating possible solutions. Subsection 2.2 then investigates whether the LOSC provides any guidance on the influence of scientific information in the process leading to a decision on proscribing measures (the solution) to protect and preserve the marine environment.

2.1 A duty to provide scientific information

The general obligations under articles 192 and 194 of the LOSC do not provide any explicit requirement to initiate, design or to base preventive action on scientific information. In complying with their duty to conserve living marine resources, states are however explicitly required to "take into account the best scientific evidence available".[12]

Interestingly, under articles 211 and 234, which specify the obligation to prevent pollution from vessels, there are presumptions that regulations are to be adopted based on scientific information. A coastal State is required to submit scientific and technical evidence to IMO in support of the need for special protective measures within its EEZ.[13] Under article 234, a coastal State may adopt and enforce unilateral regulations for the prevention of marine pollution in ice-covered areas. However, such regulations shall be based on the 'best available scientific evidence'. In both cases, the burden of proof is on the state arguing for the need for measures that are more stringent than those adopted through the IMO. One of the purposes of the requirement of scientific evidence is to ensure that restrictions on navigational rights for the benefit of the protection of the marine environment are justifiable.

[12] LOSC, articles 61(2) and 119(1)(a).
[13] LOSC, article 211(6).

Part XII of the LOSC further includes obligations to promote scientific research as part of environmental protection obligations of states. Pursuant to article 200, States are obliged to cooperate directly or through competent international organizations in promoting scientific studies and undertaking scientific research as well as exchanging data on pollution. The duty includes participation in programs to "acquire knowledge for the assessment of the nature and extent of pollution, exposure to it, and its pathways, risks and remedies." The latter resonates with the role of science in environmental protection as helping to identify problems, diagnose causes, and provide for remedies or approaches to address them.

In addition to providing general scientific knowledge, states are required under article 204(1) not only to monitor the state of the marine environment, and the risks or effects of pollution of the marine environment, but also to measure, evaluate, and analyse the risks or effects. As these actions are to be based on "recognised scientific methods" they are clearly of a scientific and not a managerial or political character. This signals that science is to have an active and targeted role in the protection of the marine environment. Furthermore, the obligation underscores the dynamic nature of scientific knowledge, which may result in the need for re-examination of existing measures.

Both Article 200 and 204 require States to cooperate on scientific research either directly or through 'competent international organizations".

A third provision that presupposes the conduct of scientific research for the acquisition of scientific knowledge about the effects of pollution on the marine environment is Article 206 on the obligation to undertake Environmental Impact Assessment (EIA). This obligation comes into play where there are reasonable grounds for believing that a planned activity may cause substantial pollution or significant and harmful changes to the environment.[14] This involves undertaking "as far as practicable…", prior assessment of the potential effects of the planned activity on the marine environment and the obligation either to publish reports of the results obtained or to report the results of such assessments to the competent international organisations which should then make the results available to all States. The EIA obligation is clearly linked to, and informs, the due diligence duty to prevent damage to the marine environment and contributes to ensuring that any deliberation and decision to permit an activity with potentially negative environmental effects is based on scientific knowledge.[15]

[14] LOSC, article 206.
[15] Eike Blitza, 'Article 206 'Assessment of potential effects of activities' in Alexander Proelss (ed) *United Nations Convention on the Law of the Sea*. *A Commentary* (C.H. Beck, Hart and NOMOS 2017), 1369 (1370).

EIAs thus provide a knowledge basis for decision-making by the state under whose jurisdiction the planned activity is to be undertaken.

However, for a planned activity to be identified as a 'problem' that requires consideration there must be some indication or scientific information that it poses a risk to the environment. The use of the concept 'planned activities' suggests that the obligation applies to major industrial projects, the laying of submarine cables, and establishment and use of installations intended for renewable energy or aquaculture and geoengineering. It could also be envisaged that the possible environmental impacts of increased vessel operations in Arctic waters could enliven the obligation to conduct an EIA, which would then assist in assessing the need for additional regulatory measures. However, given the diverse nature of shipping operations they have traditionally not been considered "planned activities"; the activities of individual vessels, in general, not being considered to pose such risks that there is a need for a prior assessment procedure.[16] However, planned transport of ultrahazardous and nuclear cargos may require the undertaking of EIA and notification to relevant states.

The ambiguous formulation of the EIA obligation in Article 206 leaves states a broad discretion, in deciding on the threshold for its application, the scope of the assessment, the involvement of affected parties, and what activities are subjected to EIA.[17] Furthermore, an EIA obligation may be viewed as violating the freedom of navigation. As noted above, States arguing for stricter regulation of navigation are required to provide scientific and technical evidence. In addition, the fact that States are required under LOSC article 211 (1) to cooperate through the competent international organization for the establishment and re-examination of regulations to prevent pollution from vessels, suggests that shipping is subjected to a separate regime. In this context it would appear to be within the mandate of the IMO to adopt procedures for EIA to provide the basis for its decisions.[18]

2.2. Relevance and weight of science in decision-making

Having examined the obligations in respect of provision of science, this sub-section examines whether the LOSC provides any guidance on its application or influence in the decision-making processes. Pursuant to Article 211(1) of the LOSC states are required to "…establish

[16] Karin Andersson, Selma Brynolf, Hanna Landquist and Erik Svensson, 'Methods and Tools for Environmental Assessment' in Karin Andersson et al. (eds) *Shipping and the Environment. Improving Environmental Performance in Marine Transportation* (Springer-Verlag Berlin Heidelberg 2016) 265 (269).
[17] Neil Craik, *The International Law of Environmental Law of Environmental Impact Assessment: Process. Substance and Integration* (Cambridge University Press 2008), 88.
[18] See info available at <Environmental Impact Assessments | International Seabed Authority (isa.org.jm)> accessed 30 September 2021.

international rules and standards to prevent, reduce and control pollution of the marine environment" and to "re-examine [such rules and standards] from time to time as necessary". In other words, the rules, and standards for the protection of the marine environment adopted through the IMO are to be dynamic. This suggests that states are required to propose, review, and adopt new regulations or amendments to existing regulations through the IMO based on new scientific information or technological information. Pursuant to Article 201 States are further to cooperate directly or through competent international organization in establishing "appropriate scientific criteria" for adopting and developing such rules and standards. When read together with Article 200, this obligation has at least three implications. First, the measures taken to protect and preserve the marine environment shall be based on scientific information. Second, scientific information is a determinant for designing, scoping, and timing such measures. Third, states are expected to comply with this obligation to use appropriate scientific criteria when acting through the IMO. Article 201 is described as providing a "sound scientific basis for rules and regulations.[19]

What remains unclear, however, is how much weight scientific information should be accorded when deciding whether and if so which measures to adopt - including through the IMO. In the decision-making stage, scientific information is inevitably weighted against socio-economic and other relevant considerations. As explained by the ITLOS Seabed Disputes Chamber, the obligation on states is determined by the context of the situation and is dynamic, and the level of diligence is dependent on the risk of the activity and level of knowledge. How, then, does scientific uncertainty, affect the obligation of states to take decisions on measures to protect the marine environment? It is clear that new scientific or technological knowledge may require states to act.[20] However, may states await further and more certain scientific information to quantify a risk or causal links before they are required to act? The precautionary principle is a concept that informs how to deal with scientific uncertainty.[21] The most widely used articulation of the precautionary principle is found in Principle 15 of the 1992 Rio declaration, which states that "…where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for

[19] Tim Stephens, 'Article 201 Scientific criteria for regulations' in Alexander Proelss (n 15) 1344-1346 (1344).
[20] Responsibilities and obligations of States with respect to activities in the Area, Advisory Opinion, 1 February 2011, ITLOS Reports 2011, 10 (paragraph 117).
[21] The precautionary principle and the precautionary approach are often used interchangeably, see Sands and Peel with Fabra and MacKenzie *Principles of International Environmental Law* 4th ed (Cambridge University Press 2018), 230-240.

postponing cost-effective measures to prevent environmental degradation."[22] The precautionary principle does not involve an explicit duty of conduct but rather indicates when and what type of considerations states are to undertake in decision-making situations where there are concerns as to the negative impacts of an activity on the environment but there is scientific uncertainty as to the causal link and/or the magnitude of the impact.

The LOSC does not expressly refer to the precautionary principle, which was introduced to international law after the adoption of the LOSC.[23] However, it has been widely adopted and included in subsequent treaties such as the 1995 UN Fish Stocks Agreement (UNFSA) and is likely to be included in a legally binding agreement on conservation and sustainable use of biodiversity in areas beyond national jurisdiction.[24] The Seabed Disputes Chamber of ITLOS has stated that the precautionary principle is an integral part of the due diligence obligation to protect and preserve the marine environment.[25] The due diligence obligation is applicable in "…situations where scientific evidence concerning the scope and potential negative impact of the activity in question is insufficient but where there are plausible indications of potential risks."[26] Thus, even if the principle is not accepted as a stand-alone obligation under international law it may still inform the interpretation of existing obligations.

The requirement to utilise scientific information is a component of the obligation to protect and preserve the marine environment. It includes a duty to provide scientific information, to inform decision-making as to whether, when and what decisions are to be taken. There seems to be acceptance that the precautionary principle informs the obligation, requiring states to exercise prescriptive as well as enforcement jurisdiction in situations where there are environmental risks linked to human activities but the scientific information available is inadequate. However, the LOSC does not provide explicit directives as to the weight to be accorded to scientific information in the decision-making of states.

---

[22] Rio Declaration on Environment and Development, 14 June 1992, in Report of the United Nations Conference on Environment and Development, UN Doc. A/CONF.151/26 (vol. I), Annex I.

[23] Arguably it is implicit in the LOSC as well, see Rosemary Rayfuse 'Precaution and the Protection of Marine Biodiversity in Areas beyond National Jurisdiction' , *The International Journal of Marine and Coastal Law* 27 (2012) 773–781.

[24] Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (New York 4 August 1995, in force 11 December 2001 2167 UN Treaty Series 3); Revised draft text of an agreement under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction (note by the President), A/CONF.232/2020/3 article 5.

[25] Advisory opinion (n 20) paragraphs 131 and 132.

[26] Ibid. See also Pulp Mills on the River Uruguay (Argentina v. Uruguay), Judgment, ICJ Reports 2010, 14, 61 (paragraph 164).

3. IMO and knowledge-based decisions

3.1 General

This section examines the role of scientific information in the decision-making of the IMO. The purpose is both to assess the role of science in developing and revising IMO instruments in general and to provide background for assessing the role of science in developing the Polar Code, to be addressed in section 4. Section 3.2 examines how scientific information is provided and its effect on the agenda of the IMO, while section 3.3 examines how this information is used in actual decision-making.[27] First, however, an introduction to the IMO and the conventions that provide the legal basis for the Polar Code is necessary.

The mandate of the IMO includes maritime safety and protection of the marine environment.[28] It involves considering and adopting recommendations based on submissions by member States and other international organizations, as well as drafting conventions for the considerations of member States, and providing a machinery for consultation and exchange of information and for technical cooperation.[29] It may be asked whether the IMO qualifies as a competent international organizations under articles 200 and 204 of the LOSC as it does not have a distinct scientific function and it has not established any subsidiary body with scientific advisory functions.[30] However, it may provide a forum through which its member states may fulfil their obligations to exchange scientific information and suggest new research to be undertaken. IMO has made use of GESAMP (Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection). It was established in 1969 tasked with advising the UN system on scientific aspects of marine environmental protection.[31] GESAMP is involved in regional and global environmental assessments but may also undertake analyses and provide advice on specific topics.[32] GESAMP contributed to the legal definition of pollution now found in the LOSC and MARPOL 73/78.[33] It has produced studies inter alia evaluating environmental hazards of harmful substances carried by ships which are regulated by Annex II of MARPOL.[34]

---

[27] Andresen (n 8) 111-112.
[28] Convention on the International Maritime Organization (Geneva 6 March 1948, into force 17 March 1958, 289 UN Treaty Series 48, as amended), Art. 1(a).
[29] IMO Convention, article 2.
[30] Ibid article 11.
[31] Peter Wells, Robert A. Duce and Michael Huber, 'Caring for the sea – accomplishments, activities and future of the United Nations GESAMP (the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection)', *Ocean & Coastal Management* 45 (2002), 77-89 (79).
[32] GESAMP Work Programme, available at <Work Programme | GESAMP > accessed 30 September 2021.
[33] Wells, Duce and Huber (n 31) 80.
[34] Work Groups 1 and 34 of GESAMP, see < Our Work | GESAMP> accessed 30 September 2021.

Several of the IMO conventions are relevant for the protection of the marine environment, including SOLAS 74[35], MARPOL 73/78[36], Ballast Water Management Convention[37], STCW Convention[38] and the Anti-fouling Convention.[39] The Maritime Safety Committee (MSC) and the Marine Environmental Protection Committee (MEPC) of the IMO have treaty body functions under the SOLAS 74 and MARPOL 73/78 respectively.[40]

Under its mandate the MEPC may consider "…any matter within the scope of the organization concerned with the preservation and control of pollution from ships…"[41] In executing its function the MEPC shall "…provide for the acquisition of scientific, technical and any other practical information on the prevention and control of marine pollution from ships for dissemination to States, …"[42] The MEPC is thus responsible for coordinating the acquisition of relevant scientific information and sharing that information among its member States. The MEPC does not have the capacity to undertake scientific research itself but rather relies on input from GESAMP or/and the individual member States.

Neither SOLAS 74 nor MARPOL 73/78 include any explicit scientific or technical criteria for the adoption or amendment of maritime safety and marine protection regulations.[43] Nevertheless, the rules and technical standards are regularly reviewed on the initiatives of member States or industry representatives. In combination with the tacit amendment procedure,[44] this provides for flexibility and regular re-examination of rules and standards as also prescribed by the LOSC.[45]

---

[35] International Convention for the Safety of Life at Sea (SOLAS) (London 1 November 1974, in force 25 May 1980) 1154 UN *Treaty Series* 278.
[36] International Convention for the Prevention of Pollution from Ships, as modified by the Protocol of 1978 relating thereto (*MARPOL 73/78*) (London 2 November 1973 and 17 February 1978, in force 2 October 1983) 1340 UN *Treaty Series* 62.
[37] International Convention for the Control and Management of Ships' Ballast Water and Sediments, (London 16 February 2004 in force (September 2017), BWM/CONF/36.
[38] International Convention on standards of training, certification and Watchkeeping for seafarers, (STCW) (London 7 July 1978), UN *Treaty Series*, vol.1361, I-23001. Its annex has been amended , Adoption of Amendments to the Annex to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978 STCW/CONF.2/DC/1, 24 June 2010.
[39] International Convention on the Control of Harmful Anti-fouling Systems on Ships (London 5 October 2001 in force 17 September 2008), AFS/CONF/26, 18 October 2001.
[40] IMO Convention (n 28), arts 27–31 (MSC) and arts 37–41 (MEPC).
[41] IMO Convention (n 28), article 38.
[42] IMO Convention (n 28), art 38 (c).
[43] SOLAS 74 art VIII and MARPOL 73/78 art 16.
[44] The tacit amendment procedure is an alternative to the enter into force of an amendment when accepted by 2/3 of the contracting parties, which may take years to reach. The tacit amendment entails that an amendment enters into force at a specified date, unless before this date objections to the amendment is received from a specified number of contracting parties, see e.g., SOLAS 74 article VIII.
[45] Aldo Chircop, 'The IMO, Its Role under UNCLOS and its Polar Shipping Regulation' in Robert C. Beckman et al. (eds.) *Governance of Arctic Shipping. Balancing Rights and Interests of Arctic States and User States* (Brill Nijhoff 2017), 112.

3.2 The role of science in the agenda-setting of IMO

As noted at the outset, the availability of scientific information plays an important role in identifying and determining the nature of environmental problems and can strengthen the problem-solving capacity of a regime.[46] The more comprehensive and accepted the science, the better the chances of solving the particular environmental problem.[47] However, science may easily be politicised, weakening its value and legitimacy.[48] Andresen underlines the importance of ensuring the autonomy and independence of science from political or economic stakeholders.[49] He also highlights the importance of their involvement in the handling of the scientific information, which must be usable in practice.[50]

The procedures for providing scientific information in the agenda-setting phase are regulated in guidelines adopted by the IMO. A proposal for a new regulation or amendment of an existing regulation under SOLAS 74 or MARPOL 73/78 must first be included on the agenda of either the MSC or the MEPC before it can be considered by the relevant committee and its sub-committees.[51] The proposing member State(s), or NGO supported by a member State, is required to provide adequate information and documentation on the risks or hazards to be addressed by the proposal and to document the benefits as well as the costs of the proposal for maritime safety and environmental protection.[52] If the need for the proposed measure is adequately 'justified and documented', the proposal will be included in the agenda.[53] The burden of proof is on the proponent who is required to provide evidence demonstrating the need for the proposed measure, [54] and that it is directed at a risk that is considered necessary to address.[55] Depending on the type of risk the proposed measure is to address, the evidence may include scientific information. For example, the US, Canada and Australia have proposed the revision of the 2014 Guidelines for the reduction of underwater noise from commercial shipping to address adverse impacts on marine life based on references to new scientific

[46] Steinar Andresen (n 8) 112.
[47] Ibid 117.
[48] Peter M. Haas, 'Science policy for multilateral environmental governance' in Norichika Kanie and Peter M. Haas (eds) *Emerging Forces in Environmental Governance*, (United Nations University Press 2004) 115 (116-117).
[49] Andresen (n 8), 113 and 120-121.
[50] Ibid.
[51] IMO: MSC-MEPC.1/Circ.5/Rev.2 Organization and Method of Work of the Maritime Safety Committee and the Marine Environment Protection Committee and their Subsidiary Bodies.
[52] Ibid paragraph 4.6-4.12 and Annex 1 paras. 2,4 and 5.
[53] Ibid para. 4.15.3.
[54] MSC.MEPC.1 Circ.5/Rev.2 (n 73), para 4.6 and Annex 1, para. 2.2.
[55] Ibid para. 4.6 cf. Annex 1 Information Required in Submissions of Proposals for Inclusion of an Output, para. 2.1.

data,[56] and the MEPC has included the proposal on its agenda.[57] However, the burden of proof does not only include science or technological information.[58] The member State must also provide an assessment of the feasibility and proportionality of the proposed measure.[59] This include information on the balance between the benefits (such as maritime safety and protection of the environment) and the costs to industry, as well as on the urgency of the matter. This information then feeds directly into the decision-making processes of the relevant IMO body.[60]

However, the potential bias of scientific information being provided by only one or a limited number of member States, may lead to it not being perceived as neutral and the lack of consensus on the existence of a problem and the need for its resolution. [61] Furthermore, the scientific information may be overshadowed by the other political, economic, and social factors already in the agenda-setting phase.

3.3 Science as a premise for decision-making

Once a proposal has been placed on the agenda, the MSC or MEPC must assess whether the proposed new or amended measure is necessary, consistent, proportionate, fit for purpose, resilient and clear.[62] This assessment may be based on scientific information as well as other considerations.

The IMO has developed different methods or tools for evaluating proposals for new regulations to assist in the decision-making process. They include risk-based considerations, impact assessments and the precautionary approach. *Risk-based considerations* are used to analyse the implications of proposals.[63] This includes identification of hazards (including environmental impacts), risk analysis, options for controlling the risk and cost-benefit analysis of the options and recommendations for decision-makers. Possible damage to the environment is included in the cost-benefit analysis.

---

[56] IMO: MEPC 75/14 Work Programme of the Committee and Subsidiary Bodies: Proposal for a new output concerning a review of the 2014 Guidelines for the reduction of underwater noise from commercial shipping to address adverse impacts on marine life (MEPC.1/Circ.833) and identification of next steps, submitted by Australia, Canada, and United States
[57] MEPC 76/14, item 12.
[58] MSC.MEPC.1 Circ.5/Rev.2 (n 73), Annex 1, paras. 3-5 and 9.
[59] Ibid.
[60] Ibid, para. 4.15.
[61] Andresen (n 8) 121-122.
[62] IMO Assembly, Principles to be considered when drafting IMO Instruments, Resolution A.1103(29).
[63] IMO: MSC and MEPC, Revised Guidelines for Formal Safety Assessment (FSA) for Use in the IMO Rule-Making Process, MSC-MEPC.2/Circ.12/Rev.2; Anish A. Hebbar et al. 'The IMO Regulatory Framework for Arctic Shipping: Risk Perspectives and Goal-Based Pathways', in Aldo Chircop et al. (eds) *Governance of Arctic Shipping: Rethinking Risk, Human Impacts and Regulation* (Springer 2020) 229, 234.

The requirement of an *impact assessment* (IA) originated in the Initial IMO Strategy on the reduction of Green House Gases (GHG) emissions.[64] IA has been introduced in the most recent amendments of the Polar Code and will be addressed in section 4.3. A guiding principle is "…the need for evidence-based decision-making balanced with the precautionary approach…"[65] In contrast to EIA, the purpose of IA is not to assess the impacts of shipping on the marine environment but the impact of possible restrictions on shipping. Impact assessment, also known as policy assessment or regulatory impact assessment, is part of a general development in recent years that may involve a systematic *ex ante* appraisal of the social, economic, and environmental impacts of proposed regulations and other kinds of policy instruments.[66]

The *precautionary principle* was incorporated into the IMO's work through the 1995 provisional MEPC guidelines.[67] Under the 1995 guidelines the precautionary principle is to be applied both when developing policies or programmes and when taking concrete actions. One of its functions is to prevent environmental problems "…arising from any regulatory activities of IMO."[68] The guidelines recommend that decision-making should be preceded by environmental assessment and risk analyses to identify environmental impacts of proposed activities and alternative options.[69] Where the options involve uncertainty, all options are to be assessed consistent with the precautionary principle. This involves choice of cost-effective practises and practical solutions.[70] Uncertainties should be addressed by obtaining and providing baseline and other data, which may identify and explain environmental changes.[71] These guidelines, consistent with article 200 of the LOSC, promote national and international research, analysis and information programmes to identify, understand and disseminate information about threats to the environment.[72] The question is whether such research is being undertaken. This will be further explored under the discussions in section 4 on the Polar Code.

---

[64] IMO/MEPC, Procedure for Assessing Impacts on States of Candidate Measures, MEPC.1/Circ.885.
[65] IMO/MEPC, Initial IMO Strategy on reduction of GHG emissions from ships, guiding principles paragraph 3.2.4, Report of the Marine Environment Protection Committee on its Seventy-Second Session, MEPC 72/17/Add.1, in Annex 11 of the; Aldo Chircop, 'The IMO Initial Strategy for the Reduction of GHGs from International Shipping: A Commentary', *The International Journal of Marine and Coastal Law* 34 (2019) 482, (496).
[66] Camilla Adelle & Sabine Weiland, 'Policy assessment: the state of the art', *Impact Assessment and Project Appraisal* 30 (2012), 25 <DOI: 10.1080/14615517.2012.663256 > accessed 30 September 2021.
[67] IMO: Resolution.MEPC.67 (37) Guidelines on Incorporation of the Precautionary Approach in the Context of specific IMO Activities, Annex 10, MEPC 37/22/Add.1.
[68] Ibid paragraph 4.1.
[69] Ibid paragraph 4.5.
[70] Ibid 4.3 and 4.4.
[71] Ibid paragraph 4.6.
[72] Ibid 4.7.

Neither the IMO Conventions nor the supplementing guidelines and policy documents provide clear instructions as to the role of science in developing its regulations. Consequently, it may be difficult to determine whether, how and to what degree scientific information – on environmental considerations – constitute a premise for the adoption of new regulations or amendments to existing regulations or how scientific uncertainty is addressed in the decision-making, particularly as decisions are made through collective bodies with representatives of all member States. A two-thirds majority is needed to adopt an amendment to SOLAS 74 and MARPOL 73/78.[73] In practice, amendments are by consensus, after reaching a compromise on the changes.[74] Consequently, a proposal will only be included on the agenda, and hence lead to amendments of an IMO instrument, once there is consensus on the need for the regulation and the science.

Therefore, when proposing amendments to regulations, member States may be driven more by what is realistic to have accepted than by what is called for by the available scientific information.

4. Regulating shipping in Arctic waters

4.1 General

Having examined the role of science in the LOSC and the IMO, this section turns to a case study of the role of science in the development of the Polar Code with particular focus on the role of science in the adoption of a ban on use and transport of Heavy Fuel Oil (HFO) in the Arctic.

The Polar Code, or the International Code for Ships Operating in Polar Waters, adopted by the IMO in 2015, includes binding regulations and recommendations for vessels operating in polar waters, including both Arctic and Antarctic waters. Its two parts are directed at promoting maritime safety (Part I-A and I-B) and preventing pollution (Part II-A and II-B). The Polar Code aims at addressing the special risks of operating in polar waters such as sea ice and low temperatures, which are not adequately regulated through existing IMO instruments.[75] The inclusion of both maritime safety and environmental protection measures in the same instrument, means that the two goals are interconnected as the safety measures taken will reduce the risk of accidents, to the benefit of the environment.[76]

[73] SOLAS 74, article VIII(b) (iv) and MARPOL 73/78, article 16(2)(d).
[74] James Harrison, *Making the Law of the Sea. A Study in the Development of International* Law (Cambridge University Press 2011), 161; Aldo Chircop (n 45) 112.
[75] Polar Code (n 5), Preamble 3 and Introduction paragraph 3.
[76] Polar Code, Introduction paragraph 1, cf. Preamble 5.

The Polar Code itself is not a legally binding instrument. Rather, the mandatory status of the provisions of the Code is established through amendments to the relevant IMO Conventions: SOLAS 74 and STWC (Part I-A maritime safety measures) and MARPOL 73/78 (Part II-A pollution prevention measures) which entered into force 1 January 2017.[77]

The mandatory safety measures are organized in twelve chapters, supplemented by the recommendations of Part I-B. These measures range from requirements for ship construction to withstand pressure from sea ice to fire safety equipment that can operate in low temperatures, lifesaving appliances that may provide shelter at low temperatures and under sea ice conditions in areas distant from rescue capabilities to requirements for training of officers to be able to operate ships under polar conditions. The mandatory pollution prevention measures are organized in four chapters and are also supplemented by recommendations in Part II-B. These measures are aimed at reducing discharges of harmful substances through restriction of operational discharges (ranging from a ban on discharges of oil and oily mixtures to restrictions on discharges of sewage and garbage), and through structural requirements (e.g., separation of oil fuel tank from the bulk).[78]

The Polar Code is not the final regulation of polar shipping. As the legal framework of the Polar Code does not provide for mandatory application of its maritime safety measures to Non-SOLAS vessels, negotiations have been initiated to develop mandatory maritime safety measures applicable to these vessels, fishing, and other smaller vessels.[79] In addition, there has been negotiations on measures aimed at reducing the risk of use and transport of HFO in Arctic waters similarly to those already in place for Antarctic waters, to be addressed in section 4.3.[80]

---

[77] SOLAS 74: Report of the Maritime Safety Committee on Its Ninety-Fourth Session, Annex 7 Resolution MSC.386(94) – Amendments to the International Convention for the Safety of Life at Sea (SOLAS), 1974, As Amended (New Chapter XIV), MSC 94/21/Add.1; STCW: Report of the Maritime Safety Committee on Its Ninety-Seventh Session, Annex 8 Resolution MSC.416(97) Amendments to the International Convention On Standards Of Training, Certification And Watchkeeping For Seafarers (STCW), 1978, as amended and Annex 9 Resolution Msc.417(97) Amendments to Part A of The Seafarers' Training, Certification and Watchkeeping (STCW Code, MSC 97/22/Add.1; MARPOL 73/78: Report of the Marine Pollution Prevention Committee on its Sixty-Seventh Session, Annex 11 Draft amendments to MARPOL Annexes I, II, IV and V, MEPC 67/20.

[78] Analyses of the Polar Code are provided *inter alia* by Aldo Chircop, 'The Polar Code and the Arctic Marine Environment: Assessing the Regulation of the Environmental Risks of Shipping' *The International Journal of Marine and Coastal Law*, 34 (2019) 482; Øystein Jensen, 'The International Code for Ships Operating in Polar Waters: Finalization, Adoption and Law of the Sea Implications, *Arctic Review on Law and Politics,* 7 (2016) 1.

[79] IMO: Report of the Maritime Safety Committee on its Ninety-Eight Session, para. 10.29, MSC 98/23. See subsequent reports of MSC sessions: paras 7.13-7.16 of MSC 99/22, para 7 of MSC 100/20, para. 7 of MSC 101/24.

[80] IMO/MEPC: Report of the Marine Environment Protection Committee on Its Seventy-First session, para. 14.13, MEPC 71/17.

4.2 Scientific information and the Polar Code

The proposal for developing a mandatory Polar Code came at a time of heightened international attention to the Arctic, the impacts of climate change and prospects of increased vessel operations in the region. Two reports commissioned by the Arctic Council – the 2004 Arctic Climate Impact Assessment (ACIA) and the 2009 Arctic Marine Shipping Assessment (AMSA) were particularly influential in documenting/establishing the need of additional regulation of Arctic shipping.[81]

The main work on developing the Polar Code was carried out and coordinated by a sub-committee under the MSC.[82] During the early stages of the Polar Code negotiations, some delegations and environmental groups had broad visions of the environmental risks that should be addressed by the Polar Code.[83] However, these visions were not based on any specific comprehensive environmental assessment as recommended by the IMO guidelines on the precautionary approach.[84] They were rather grounded on general scientific knowledge about the polar waters and the known hazards increased shipping posed to the marine environment.

Illustrative was a hazard matrix developed at a 2011 workshop with participation of 15 IMO member States and observers from different NGOs that provided valuable 'technical input' to the drafting of the Polar Code.[85] The matrix mapped environmental risks related to operational discharges and impacts of accidents in polar waters. It identified potential hazards, their causes, impacts, amplification factors of polar waters and risk control measures/options. This risk assessment built on generalised information on the Arctic marine environment and its components and how it is affected by human activities. It is striking that in concluding, the workshop delegations identified a "wish list" of future information or system requirements.[86] The list included a desire for more detailed knowledge of the acute and chronic toxicity effects on polar organisms, and a need for better understanding of possible persistence and

[81] Arctic Climate Impact Assessment. ACIA Overview report (Cambridge University Press 2005); Arctic Marine Shipping Assessment 2009 Report (Arctic Council, April 2009, second printing).
[82] IMO Report of the Maritime Safety Committee on Its Eighty-Sixth Session, para. 23.32, MSC 86/26.
[83] Chircop (n 79) 548.
[84] IMO/MEPC, Guidelines on Incorporation of the Precautionary Approach in the Context of specific IMO Activities, (n 68), paragraph 4.5.
[85] IMO: Development of a Mandatory Code for Ships Operating in Polar Waters: Workshop on Environmental Aspects of the Polar Code (IMO Secretariat), DE 56/INF.3 Annex 3 Polar Code Hazard Identification Workshop Report, Tables 1 and 2.
[86] Sub-Committee on Ship Design and Equipment: Development of a Mandatory Code for Ships operating in Polar Waters, Workshop on Environmental Aspects of the Polar Code (Secretariat), Workshop Report, Annex 3 Polar Code Hazard Identification, para. 6.0. DE 56/INF.3.

biomagnification processes in polar waters.[87] It is an acknowledgment that there are scientific uncertainties regarding the impacts of maritime operations and need for more scientific information. But how is this scientific research to be conducted and by whom? Evidently, it will have to be the responsibility of individual member States. The dependency on initiatives of individual states, underscores the lack of coordination and a risk that some interests are highlighted.

Even if there was consensus on the need for a legally binding Polar Code, some of the proposed regulations were questioned. Some delegations were concerned that the analyses envisaged by the Norwegian paper[88] setting out the agenda for the environmental chapter were premature.[89] Representatives from the industry and some member States argued that the need for several of the proposals were not documented by actual environmental impact assessment, cost-benefit analysis or other scientific justification.[90] Russia was particularly alarmed by the proposal to ban the use and transport of HFO.[91] It was concerned that a ban would lead to a significant increase in shipping costs in arctic areas.[92] The proposal did not, argued the Russians, consider the relevance of the proposed structural protective measures (location of fuel tank) for the prevention of HFO spills.[93]

The MEPC concluded that it was premature to regulate the use of HFO on ships operating in Arctic waters while not excluding the future adoption of such regulations.[94] The reason for the postponement was not necessarily the quality of the scientific information, which inter alia had been collected and reviewed through work groups under the Arctic Council. Rather, it appears that the socio-economic effects of a ban had not been adequately assessed. This goes to show that scientific information is relevant but not necessarily the decisive factor in the decision-making of IMO.

---

[87] Biomagnification is the accumulation of a chemical by an organism from water and food exposure that results in concentration that is greater than would have resulted from water exposure only and thus greater than expected from equilibrium, see ScienceDirect, available at < Biomagnification - an overview | ScienceDirect Topics>, accessed 30 September 2021.
[88] Norway: Environmental aspects of polar shipping, MEPC 60/21/1.
[89] Report of the Marine Environment Protection Committee on Its Sixtieth Session, para. 21.8, MEPC 60/22.
[90] Report of the Marine Environment Protection Committee on Its Sixty-Fifth Session, para. 11.46, MEPC 65/22; Sub-Committee on Ship Design and Equipment: Report to the Maritime Safety Committee and the Marine Environment Protection Committee, para.11.43, DE 57/25.
[91] Report of the Marine Environment Protection Committee on Its Sixtieth Session, para. 21.9, MEPC 60/22.
[92] Sub-Committee on Ship Design and Equipment: Report to the Maritime Safety Committee and the Marine Environment Protection Committee, Annex 21: Statement by the Delegation of the Russian Federation (on Agenda item 10), DE 56/25
[93] Ibid.
[94] Ibid, 11.53

4.3 A ban on use and transport of HFO as fuel

As the Polar Code entered into force in 2017, the MEPC placed "measures to reduce risks of use and carriage of heavy fuel oil in the Arctic" on its agenda.[95] This item was initiated by seven member States including the US, Finland and the Netherlands.[96] Their concern was that accidental oil spills are the most significant threat from ships in the Arctic and that, with increased shipping in the region, the threat of such spills would increase.[97] Even if a global sulphur cap entering into force in 2020 meant that more vessels would shift from HFO fuel to marine distillate fuel, the proposers were concerned that this cap would not fully eliminate the use of HFO as fuel and there would thus still be a risk of accidental pollution.[98]

4.3.1 The scientific basis for the proposal

In complying with the guidelines on the organization and methods of work of MSC and MEPC (section 3.2), the proposers sought to demonstrate and document the need for the proposed agenda item in terms of the risks described.[99] Referring to the goal of the Polar Code to reduce the environmental impacts of shipping in Arctic waters, they argued that the Polar Code did not adequately protect against HFO spills following groundings, collisions, or similar incidents. They argued that that the potential environmental damage following HFO spills has been documented in several reports and studies made available to IMO.[100] Their arguments were based on several reports, in particular reports commissioned by Protection of the Arctic Marine Environment (PAME), one of the Working Groups of the Arctic Council.[101] Responsible for the follow-up of the 2009 AMSA Report, PAME has provided scientific and technical information on the use and carriage of HFO as fuel. In 2019 it estimated that 10% of

[95] Report of the Marine Environment Protection Committee on Its Seventy-First session, para. 14.13 MEPC 71/17. The mandate of the work was further specified, see Report of the Marine Environmental Protection Committee on Its Seventy-Second Session, para. 11.9, MEPC 72/17.
[96] Work Programme of the Committee and Subsidiary Bodies Measures to reduce risks of use and carriage of heavy fuel oil as fuel by ships in Arctic waters (Canada, Finland, Germany, Iceland, Netherlands, Norway, and the United States), para. 2, MEPC 71/14/4.
[97] Ibid para. 4.
[98] The sulphur content of any fuel on board ships was reduced to 0,50 % m/m from 1 January 2020, MARPOL 73/78 Regulation 14.1.3 of Annex VI.
[99] Organization And Method of Work of the Maritime Safety Committee and the Marine Environment Protection Committee and Their Subsidiary Bodies, para 4.3 and Annex 1, MSC-MEPC.1/Circ.5/Rev.2.
[100] MEPC 71/14/4, para 7 (n 97); Development of Measures to Reduce Risks of Use and Carriage of Heavy Fuel Oil as Fuel by Ships in Arctic Waters. Summary of the work undertaken by the Arctic Council's Protection of the Marine Environment Working Group on Heavy Fuel Oil (Canada, Denmark, Finland, Iceland, Norway), MEPC 72/INF. 14; Jiayu Bai and Aldo Chircop, `The Regulation of Heavy Fuel Oil in Arctic Shipping: Interests, Measures, and Impacts' in A. Chircop et al. (n 91) 265 (268-270) available at < https://doi.org/10.1007/978-3-030-44975-9_14> accessed 30 September 2021; Development of Measures to Reduce Risks of Use and Carriage of Heavy Fuel Oil as Fuel by Ships in Arctic Waters: Summary of the work undertaken by the Arctic Council's Protection of the Marine Environment Working Group on Heavy Fuel Oil (Canada, Denmark, Finland, Iceland, Norway), MEPC 72/INF. 31.
[101] See PAME web page for more information, <Heavy Fuel in the Arctic (pame.is)> accessed 30 September 2021.

vessels operating in Arctic waters as defined by the Polar Code used a type of HFO as fuel.[102] One of the reports commissioned by the PAME concluded that "…significant risk reduction will be achieved if the onboard oil is of distillate type rather than HFO".[103] This was due both due to the toxicity and slower decomposition of HFO. The risk of environmental damage by the use of distillate type oil is thus lower. The member States also referred to studies documenting that a spill of HFO would threaten Arctic marine environments and coastal ecosystems.[104] They proposed that the IMO develop measures aimed at reducing the risk of use and carriage of HFO as fuel.[105] Also environmental NGOs provided reports on the environmental risk of carrying and using HFO as fuel.[106]

4.3.2 Science as a premise in the adoption of the ban

The mandate for the IMO to consider "measures to reduce risks of use and carriage of heavy fuel oil in the Arctic" included deciding on a definition of HFO, developing guidelines on mitigating measures and the adoption on of ban on use and carriage of HFO as fuel.[107] The guidelines on mitigation measures, which could include routeing measures in Arctic waters, appear to have been added to accommodate Russian concerns that the risks of use and carriage of HFO were better managed by ships' routeing measures rather than a ban on its use and carriage.[108]

In spite of the scientific information - both the proposing member States and other member States – were concerned about the socio-economic effects of a ban. They emphasised that one should "…develop a pragmatic solution that effectively addresses environmental concerns, considers impacts on Arctic communities and economies, and facilitates transition for industry."[109] Germany, Finland and Norway, among others, argued for a ban on the use and carriage of HFO as fuel, but to delay its implementation in respect of Arctic communities and

[102] PAME, Heavy fuel oil (HFO)use by ships in the Arctic 2019, available at <HEAVY FUEL OIL (HFO) USE BY SHIPS IN THE ARCTIC 2019 (pame.is)> accessed 30 September 2021.
[103] DNV, 'Report Heavy Fuel in the Arctic (Phase 1)", Report No.DN Reg. No 2011-0053 referred to in MEPC 71/14/4 para 7 (n 97); Development of Measures to Reduce Risks of Use and Carriage of Heavy Fuel Oil as Fuel by Ships in Arctic Waters. Summary of the work undertaken by the Arctic Council's Protection of the Marine Environment Working Group on Heavy Fuel Oil (Canada, Denmark, Finland, Iceland, Norway.
[104] Ibid.
[105] MEPC 71/14/4 (n 97) paras 11 and 17.
[106] IMO/MEPC: Development of Measures to Reduce Risks of Use and Carriage of Heavy Fuel Oil as Fuel by Ships in Arctic Waters: Heavy Fuel Oil Use in The IMO Polar Code Arctic: Summarized by Ship Type (CSC, FOEI, Greenpeace, Pacific Environment and WWF). MEPC 72/INF.20.
[107] Report of the Marine Environmental Protection Committee on Its Seventy-Second Session, para. 11.9, MEPC 72/17.
[108] IMO/MEPC: Development of Measures to Reduce Risks of Use and Carriage of Heavy Fuel Oil as Fuel by Ships in Arctic Waters: Proposal for Possible Measures to Reduce Risks of Use and Carriage of HFO as Fuel by Ships in Arctic Waters (the Russian Federation), MEPC 72/11.
[109] MEPC 71/14/4 (n 97) paragraph 11.

industries to enable them to adjust their port and ship operations to the ban.[110] Consequently, there was an early recognition – at least among member States - that before adopting a ban the possible social, economic and other impacts on the Arctic communities in all costal States would need to be taken into account.[111] Environmental NGOs, however, were concerned that a delay in the implementation of a ban would not adequately reduce the environmental risks of the use and carriage of HFO as fuel.[112]

Consequently, the adoption of a ban on use and carriage HFO as fuel was premised on the prior undertaking of impact assessments (IA), as referred to in section 3.2 above. IA involves a systematic appraisal of the social and economic impacts of proposed regulations. [113] With different and potentially conflicting interests at stake it was important for the legitimacy of a ban that all benefits and costs related to it were identified and accounted for. The environmental NGOs argued for including all components – including the environmental impacts – in the assessment.[114]

The methodology for the IA was approved by MEPC in 2019.[115] Each Arctic coastal member State was charged with undertaking a comprehensive IA involving its societal costs and of its benefits inter alia for the protection of the marine environment.[116] The IA methodology included five steps.[117] Step 1: Defining the scope of the impact assessment (identifying the social, environmental, and economic considerations, adverse as well as beneficial impacts). Step 2: Identifying the policy objective of a ban (reduce risks of use and carriage of HFO as fuel). Step 3: Setting out the different policy options (such as developing on a fixed time scale

[110] IMO/MEPC: Development of Measures to Reduce Risks of Use and Carriage of Heavy Fuel Oil as Fuel by Ships in Arctic Waters: Proposal to ban heavy fuel oil use and carriage as fuel by ships in Arctic waters (Finland, Germany, Iceland, the Netherlands, New Zealand, Norway, Sweden, and the United States) para. 5, MEPC 72/11/1.
[111] Sun (n 9) 527.
[112] IMO/MEPC: Development of Measures to Reduce Risks of Use and Carriage of Heavy Fuel Oil as Fuel by Ships in Arctic Waters: Proposal to ban heavy fuel oil use and carriage as fuel by ships in Arctic waters (CSC, FOEI, Greenpeace, Pacific Environment, and WWF), MEPC 72/11/5.
[113] Adelle & Weiland (n 66), 25.
[114] IMO/MEPC: Development of Measures to Reduce Risks of Use and Carriage of Heavy Fuel Oil as Fuel by Ships in Arctic Waters: Comments on document MEPC 73/9 on "Report of the informal correspondence group on the determination of an appropriate impact assessment methodology"(FOEI, Greenpeace International, WWF, Pacific Environment and CSC), paras. 3 and 4. MEPC 73/9/3.
[115] IMO/MEPC: Report of the Marine Environment Protection Committee on Its Seventy-Fourth Session, para. 10.24, MEPC 74/18 and Draft Methodology to Analyse Impacts of a Ban on The Use and Carriage of Heavy Fuel Oil as Fuel by Ships in Arctic Waters, Sub-Committee on Pollution Prevention and Response: Report to the Marine Environment Protection Committee, Annex 16, PPR 6/20/Add.1.
[116] Leah Beveridge, 'Inuit Nunangat and the Northwest Passage: An Exploration of Inuit and Arctic Shipping Conceptualizations of and Relationships with Arctic Marine Spaces in Canada' in Aldo Chircop et al. (n 91) 137, (141).
[117] Draft Methodology to analyse Impacts of a Ban on the Use and Carriage of Heavy Fuel Oil as Fuel by Ships in Arctic Waters (n 116).

a ban or alternately developing a ban on an appropriate time scale considering other factors).[118] Step 4: An analysis of the impacts of a ban. (This entails assessing both costs and benefits of an HFO ban to indigenous and local communities, industries, economies, and the coastal and marine ecosystems of the Arctic.[119] It includes the impacts in terms of higher costs of transport of goods and impairment of availability of services. The benefits include the avoidance of potential loss of marine and coastal natural resources important to food security, loss of culturally important subsistence activities, or other adverse impacts to Arctic marine and coastal ecosystems, compared to a non- HFO-spill). Step 5: Comparing policy options and recommend preferred option(s), resulting in selecting one of the options.

The Arctic coastal States conducted and submitted their individual IA to the IMO.[120] The two major Arctic coastal States – Canada and Russia - highlighted the socio-economic costs to their indigenous communities and local industries.[121] Whereas Russia stated that the benefits of a ban were unclear, Canada emphasised the "… environmental benefits following a reduced risk of accidental pollution."[122] The Russian delegation reiterated that the proposed HFO ban was "… one more example when prohibitive measures - and this mainly concerns environmental restrictions - are developed without sufficient scientific and technical study, one could say in haste."[123] The Russian IA did not include any assessment of the environmental benefits of a ban. A delayed implementation of the ban would according to Canada mitigate the negative socio-economic effects as the fuel market would change following the 2020 sulphur cap. Norway on the other hand questioned whether a ban would reduce the environmental risk as there are uncertainties as to whether new fuels have less problematic behaviour than HFO.[124]

These three IAs illustrate that the scientific information on the environmental effects of HFO spills is accorded different weight or role depending on the coastal State, from being

[118] Ibid, Annex, para 15.
[119] Draft Methodology to analyse Impacts of a Ban on the Use and Carriage of Heavy Fuel Oil as Fuel by Ships in Arctic Waters (n 116), Annex.
[120] IMO/MEPC: Sub-Committee on Pollution Prevention and Response, Report to the Marine Environment Protection Committee, para. 14.9, PPR 7/22.
[121] Ibid., paras. 14.9- 14.11.
[122] IMO/MEPC: Sub-Committee on Pollution Prevention and Response (PPR): Development of Measures to Reduce Risks of Use and Carriage of Heavy Fuel Oil as Fuel by Ships in Arctic Waters (Canadian Impact Assessment), PPR 7/INF.16.
[123] IMO/MEPC: Sub-Committee on Pollution Prevention and Response: Report to the Marine Environment Protection Committee, Annex 22 Statement by the delegation of the Russian Federation, PPR 7/22/Add.1.
[124] IMO/MEPC: Sub-Committee on Pollution Prevention and Response: Development of Measures to Reduce Risks of Use and Carriage of Heavy Fuel Oil as Fuel by Ships in Arctic Waters (Norwegian Impact Assessment), PPR 7/INF.14.

considered inadequate, being balanced against the societal cost to being given higher weight. The assessments and positions of the coastal States were, clearly, heavily influenced by the societal impacts and costs of a ban.

In 2020, the sub-committee on Pollution Prevention and Response (PPR) of the MEPC agreed that a ban on use and carriage of HFO as fuel should include a "delayed phase-in period", giving consideration to all the IAs to "address the factors identified by the assessments as far as possible."[125] The sub-committee reached a compromise, agreeing on a ban on use and transport of HFO as fuel to enter into force 1 July 2024, but its implementation will be delayed for 5 years until 1 July 2029 in respect of vessels complying with the oil fuel tank protection requirements of the Polar Code.[126] Furthermore, the Arctic coastal States may, until 1 July 2029, waive the ban in respect of vessels flying their flag while operating in waters under their sovereignty or jurisdiction.[127] The waivers are to be granted taking into account guidelines to be adopted by the IMO which, it is expected, will primarily include vessels used for supplying the local communities. The compromise was approved and finally adopted by the MEPC in 2021.[128]

4.3.3 A science-based decision?

As noted in section 4.2, the negotiations on what resulted in the Polar Code were premised on scientific information on the need for additional and mandatory regulation of shipping in polar waters provided by member states. This included information on the risks of use and transport of HFO to the Arctic marine environment. However, due to concerns over the adequacy of the information contained in the proposal available at the time the Polar Code was negotiated, and, in particular, over the possible negative socio-economic effects of a ban, the initial proposal for a ban on transport and use of HFO was deferred.

However, the subsequent negotiations on a possible ban on use and transport of HFO as fuel, was as referred to above based on more extensive scientific documentation on, and justification for, the need for such regulation, provided inter alia through the work of PAME.

---

[125] IMO/MEPC: Sub-Committee on Pollution Prevention and Response: Report to the Marine Environment Protection Committee, para. 14.16, PPR 7/22.
[126] Ibid, para. 14.24 and Annex 12 Draft Amendments to MARPOL Annex I (Prohibition on the use and carriage for use as fuel of heavy fuel oil by ships in Arctic waters), Draft regulation 43A para. 2, PPR 7/22/Add.1. The relevant requirement of the Polar Code is found in Part II-A, chapter 1.2 on structural requirements requiring vessels to have oil tanks or to carry oil separated from the outer shell by a specified distance.
[127] IMO/MEPC: Sub-Committee on Pollution Prevention and Response: Report to the Marine Environment Protection Committee, Annex 12 Draft regulation 43A, para. 4, PPR 7/22/Add.1.
[128] Report of the Marine Environment Protection Committee on Its Seventy-Sixth Session, para. 3.35, MEPC 76/15. The regulation enters into force 1 November 2022 under the procedures of MARPOL article 16(2) (f) (ii). The text of the new Regulation 43A of MARPOL 73/78 Annex I is available in Annex 2: Resolution MEPC.329(76) to the beforementioned report.

As Bai and Chircop note, the Arctic Council provided that "background information on HFOs in Arctic shipping" and the IMO provided "the negotiation platform."[129] Information from PAME was considered along with the IAs MEPC had received from the individual Arctic coastal States. The acquisition and sharing of this further information together with the subsequent discussions, provides more insight into the process that resulted in the adoption of the HFO ban.

It should be noted that the 2020 cap on sulphur emissions was helpful in promoting the ban as HFO contains high levels of sulphur. Nevertheless, even though the IA methodology includes identification and assessment of the environmental aspects of a ban (in terms of the benefits to the environment and the local population), given that the ban is not to be effectively implemented until 2029, it is clear that it was the more short-term socio-economic considerations that came to the fore during the negotiations and were given more weight than the environmental factors. A contributing factor to this outcome was undoubtedly that the costs and benefits were mostly presented by the use of incomparable variables. Whereas the environmental benefits were described in general terms, the costs of a ban were calculated in monetary terms (higher fuel prices or transport costs). Thus, the cost would appear as more compelling than the benefits.

The compromise was, not unsurprisingly, subject to criticism from several environmental NGOs (including Greenpeace International and WWF)[130] who were concerned that the exceptions and the waiver would allow 74% of the HFO-fuelled fleet to continue the use of HFO until 2029.[131] The 2020 sulphur cap will lead to the transition to new types of fuel and the IAs conducted by the coastal States did consider the benefits or costs of alternative fuels. However, Norway, referring to reports prepared for the Arctic Council, raised concerns that if the same definition of HFO was used in the Arctic as has been used in the regulation on the use and carriage of oils in Antarctic waters,[132] the ban would not necessarily reduce the risk to the environment because some of the low sulphur marine fuel oils may pose similar

[129] Bai and Chircop (n 101) 269-270.
[130] IMO/MEPC: Marine Environment Protection Committee: Pollution Prevention and Response. Comments on document MEPC 75/10/Add.1, paragraph 3.5 on draft amendments to MARPOL Annex I to incorporate a prohibition on the use and carriage for use as fuel of heavy fuel oil by ships in Arctic waters (FOEI, Greenpeace International, WWF, Pacific Environment and CSC), MEPC 75/10/7.
[131] Ibid, para. 5.
[132] IMO/MEPC: Sub-Committee on Pollution Prevention and Response: Report to the Marine Environment Protection Committee, Annex 12 Draft regulation 43A with reference to paragraph 1.2 of Regulation 43, PPR 7/22/Add.1.

challenges to HFO with regard to spill clean-up, and there are still significant uncertainties as to their toxicity.[133]

Nevertheless, the same definition was adopted by IMO despite concerns that it was a premature decision because of uncertainties about the properties of the new fuel oils.[134] One can speculate that the reason for incorporating the Antarctic definition may well have been due to the currently ongoing technical and economic barriers to the use of new and more environmentally friendly fuels.[135]

In any event, what can be said about the IMO's decision-making process on the HFO fuel debate is that it was not characterised by a process where the environmental, economic, and social costs of use and transport of HFO, and the alternatives to a ban on HFO or the mitigating measures were assessed together. Scientific information was vital to maintain a HFO ban on the IMO agenda, assisted by the implications of stricter sulphur regulations. The environmental benefits of a ban – documented by science – was balanced against primarily socio-economic considerations. Future regulation of fuels, in Arctic waters will probably be more influenced by technology developments.

5. Concluding remarks

This chapter has examined the role of scientific information in the decision-making processes of the IMO, with a particular focus on the Polar Code and the HFO ban adopted in 2021. It has taken as its working premise that scientific information is vital to identifying problems, challenges, and threats to the environment, to identifying their causes, and to assisting in finding solutions. Science therefore has a natural function and self-evident position in a legal framework such as that provided by the LOSC, and the regulatory regimes adopted under the auspices of the IMO. To meet their environmental mandates, these legal frameworks should facilitate procedures for the initiation, collection, communication, interpretation, and use of scientific information for the protection of the marine environment.

Part XII of LOSC, on the protection and preservation of the marine environment, includes obligations of states to collect scientific information, to assess the status of the environment

[133] IMO/MEPC:Sub-Committee on Pollution Prevention and Response: Report to the Marine Environment Protection Committee, paragraph 14.9, PPR 7/22; PAME: Alternative Fuels in the Arctic, 19; DNV.GL 2019-0226, Rev. 0, 19 available at <file (pame.is) > accessed 30 September 2021; Christina Jönander and Ingela Dahllöf, 'Short and long-term effects of low-sulphur fuels on marine zooplankton communities', *Aquatic Toxicology* 227 (2020) 105592.
[134] IMO/MEPC: Sub-Committee on Pollution Prevention and Response: Report to the Marine Environment Protection Committee, paragraph 12, PPR 6/20.
[135] PAME (n 137); Sun (n 9), 593.

and use the information in decision-making. These are general obligations that necessarily need to be specified within the different regimes addressing threats to the marine environment. Indeed, the provisions of Part XII of the LOSC signal a role for science in the drafting and re-examination 'from time to time' of the regulations adopted directly or through the competent international organization, of which the IMO is the primary actor. There may be other reasons for re-examination of regulations, such as technology developments. However, that the adoption of regulations that restrict navigational freedoms and rights requires under LOSC an adequately documented scientific basis. This indicates a need to undertake balancing of interests – in the decision-making of IMO.

The IMO is mandated to provide for adoption of international regulations for the purpose of maritime safety and the protection of the marine environment. However, neither the IMO Convention nor the relevant conventions adopted through the IMO stipulate if and how scientific documentation is to be acquired or used in the decision-making leading to amendment of existing or adoption of new regulations. The IMO has adopted guidelines for the decision-making processes of the MSC and the MEPC, obviously to ensure that they are not overwhelmed and that all aspects of a proposal are addressed. Initiatives to amend or adopt new regulations are primarily the responsibility of the member States. They are also charged with presenting the necessary scientific and other documentation for the need of the regulation, its urgency, its costs, and proportionality. To what degree the proposing member State is successful is dependent on whether it is able to achieve consensus on the need for the proposed regulation, and whether the need is adequately scientifically documented. If it is put on the agenda, it is likely to proceed to acceptance and adoption by the MSC or MEPC. This is likely to influence how proposal is scoped, to accommodate what is realistically acceptable given the prevailing socio-economic factors.

The adoption of the Polar Code and the appurtenant amendments of IMO conventions was innovative, involving comprehensive regulation of shipping within the polar regions. Its scientific basis was based on a consensual understanding of the state of the marine environment of the polar waters and of the major threats of/to increased shipping. The Polar Code may be described as applying a precautionary principle as regulations were introduced in an early phase in the development of the industry and before more detailed scientific information on impacts of shipping was available. Even if the natural science was clear, the socio-economic aspects and the possible regulatory options were contested. This particularly concerned proposals relating to the pollution prevention measures, specifically the regulation

of the use and transport of HFO in Arctic waters as fuel. The states were only able to agree on these regulations by going beyond the natural sciences into socioeconomics and politics. Thus, while scientific information was important for the agenda-setting stage, other factors were more influential for the adoption of the measures. The outcome - the phased-in ban – is a result of balancing of interests of environmental protection and different socio-economic considerations

The Polar Code documents that the IMO may make use of scientific information provided through other international institutions such as the Arctic Council. The scientific information provided through the Arctic Council has been reviewed by scientists from different countries affecting its legitimacy and thus its potential impact in the decision-making of the IMO. However, the findings of this chapter concurs with the observation of Elizabeth Kirk that "the role of the role of science [in the IMO] is not in practice always as significant as one might hope." The existence of a scientific or expert advisory body within the institutional framework of the IMO could contribute to giving scientific and other technical information a clearer role at least in the agenda-setting and influence in decision-making. The challenge is that a scientific advisory body composed by representatives of the member states may easily become entangled in politics. Perhaps, it then is better to stick with the flexibility employed by IMO in responding to new scientific information?