Large-Scale Disaster Response in the Arctic: Are We Ready?

Lessons from the Literature on Wicked Policy Problems

Rebecca Pincus

The cruise liner Crystal Serenity plans to conduct a cruise from Alaska to New York in August 2016. This will be, by far, the largest commercial cruise transit of the Northwest Passage ever attempted. The journey raises questions about the capacity of governments to respond to a large-scale environmental or human disaster in the Arctic maritime realm. Mass rescue operations in the Arctic are technically complicated by the extreme cold and enormous distances present in the region, and operationally complicated by governance challenges, including multiple and overlapping jurisdictions, networks of responders, and state-to-state variations in capacity, commitment, and funding schemes for disaster response.

The challenges of disaster response policy in the Arctic make this issue a "wicked" policy problem. Wicked policy problems pose special challenges to policymakers. This class of public policy problems involves a diversity of stakeholders holding varying interpretations of causes and solutions, and is closely interconnected with many other problems. The theory and literature that have developed around wicked problems offer a number of lessons about how actors and networks address these complex governance challenges.

This paper will address the challenge of effective disaster response in the Arctic, using the analytic framework of wicked problems. First, the wicked aspects of disaster response in the Arctic will be analyzed, using the Crystal Serenity as a case study; second, lessons from the literature that identify strategies for managing wicked problems will be identified; finally, the paper will draw practical conclusions about readiness in the Arctic.

Introduction

On August 16, 2016, the *Crystal Serenity* will depart Seward, Alaska, en route to New York City. The cruise liner will turn north, pass through the Bering Strait, and bear east through the Chukchi and Beaufort Seas before entering Canadian waters and the Northwest Passage.[1] With nearly 2000 individuals aboard (passengers and crew), this will be the first large cruise liner to transit the Arctic. The next-largest transit, just a quarter of the size of the *Crystal Serenity*, was made in 2012 by *The World*, which carried 508 passengers and crew (George 2012). The transit naturally raises questions about the availability and capacity of response services in the region, particularly those capable of responding to large-scale incidents.

Rebecca Pincus is Distinguished Visiting Professor of Maritime Policy at the United States Coast Guard Academy, and Fellow at the Center for Arctic Study and Policy, also at the Academy.

Outside of the Nordic area and some areas proximate to Russian ports, there is little infrastructure in the Arctic to support large-scale emergency response. As a result, any response will likely be delayed by the time required to transfer assets: by ship, air (fixed or rotary-wing aircraft), or surface transport. In addition, the scarcity of infrastructure will complicate this process. There are few ports in which to dock and unload ships; few airfields at which fixed wing aircraft can take off and land; few roads; few facilities that can serve as centralized coordination points for crews and equipment; few hospitals; and few hotels or other mass housing facilities.

Without infrastructure, the challenge of large-scale emergency response is magnified. The Arctic Council's 2009 Arctic Marine Shipping Assessment (AMSA) noted concisely that, "growth in Arctic marine tourism is outpacing infrastructure investment, development and support throughout the region" (AMSA: 172). Additionally, further complications arise from the nature of the Arctic region itself: intense cold, extreme weather, and rapid shifts in conditions add risk and delay. Paradoxically, the extreme conditions that hamper response efforts increase risk of mortality through exposure, increasing the urgency of response. In short, emergency response in the Arctic is both extremely important, given the harsh environment, and also extremely challenging, due to distance, conditions, and lack of infrastructure.

As ship and air traffic increases, governments are confronted with a policy problem: how to increase emergency response capacity in order to satisfy public need. At first glance, this might seem like a fairly straightforward policy problem: identify the problem (lack of adequate emergency response capacity); identify various options (different locations for infrastructure, funding mechanisms, implementing agencies); select the best option; and implement. All students of public policy will recognize this model.

However, upon closer scrutiny the question of improving emergency response capacity across the expanses of the North American (including Greenland) and Siberian Arctic regions is far more complex and difficult than a typical policy problem. This paper will argue that the challenge in fact comprises a "wicked" policy problem, and will apply lessons from the theoretical literature on wicked problems to explore more fully the challenge of emergency response in the Arctic region.

Wicked problems: theory and literature

The challenge of managing the increase in human activity in the Arctic can be understood as a " wicked" policy problem. Wicked policy problems pose special challenges (Rittel & Webber 1973; Roberts 2000; Bueren, Klijn, & Koppenjan 2003). A wicked problem seems to be endless, and endlessly difficult to define: "it is experienced as ambiguous, fluid, complex, political, and frustrating as hell. In short, it is wicked." (Roberts 2000: 2). Wicked problems proliferate across the policy spectrum, since by nature they challenge many public policy structures. Wicked problems are "cross-cutting", and therefore difficult to address through "narrow, vertical" arrangements found in governmental agencies (Ferlie et al 2011). Frameworks and theory of wicked problems have been applied to a diverse array of policy areas, including publicly financed dentistry (Quiñonez 2012), human tissue in medicine (Lewis 2008), and maritime security in Southeast Asia (Bateman 2011). This sampling indicates that wicked problems are found wherever there is "chronic policy failure" (Ferlie et al 2011).

Wicked problems, as Dryzek implies, are often found "at the intersection of ecosystems and human social systems", where the complexity of each system further challenges comprehension and effective management (Dryzek 2005: 9). The effects of global-scale changes like climate change or economic globalization may lead to wicked problems in which processes and actors at local scales are influenced by global-level changes beyond their control (Chapin et al 2008). Wicked problem theory has frequently been applied to human-environmental issues, including eutrophication (Thornton 2013), Alaskan wildfires (Chapin et al 2008), coral reef protection (Hughes, Huang & Young 2013), and the Yellowstone National Park (McBeth & Shanahan 2004; McBeth et al. 2010).

There are several ways of unpacking the complex nature of wicked policy problems. Although frameworks differ, the underlying elements of wicked problems are repeatedly identified. Wicked problems are hard to know: information may be inadequate, problems may be continually evolving, and the problem may seem like a "black box", without clear connections between contributing factors and resulting effects. Furthermore, the number and diversity of actors involved in wicked problems means that these problems are hard to manage: different actors may understand and define problems differently and desire different approaches. Given this complicated group of stakeholders, wicked policy problems demand careful management in order to minimize conflict and/or stalemate, and ensure that all actors are working together in a coordinated effort to manage the problem through time. The temporal aspect of wicked problems is important: since they can never be solved, creating structures to manage wicked problems over time may be an effective strategy. The following section will examine several different frameworks by which wicked problems can be understood.

Rittel and Webber's foundational work on the subject (1973) laid out ten "distinguishing properties" of wicked problems: there is no definitive formulation of a wicked problem; wicked problems are never solved; solutions are not true/false, but good/bad according to stakeholders; solutions to wicked problems will create "waves of consequences" that cannot be traced in advance; therefore, every solution is a "one-shot operation" and is "consequential"; there is also no "enumerable" set of potential solutions; every wicked problem is "essentially unique"; it can be considered a symptom of another problem; it can be explained in numerous ways; and given these stakes, policymakers seeking to address wicked problems have "no right to be wrong" (161-167).

Weber and Khademian (2008) identify three aspects: the unstructured, cross-cutting, and relentless characteristics that distinguish tame from wicked problems. Wicked problems are " unstructured": causes and effects are difficult to distinguish and the problem is dynamic, creating a constantly moving and evolving target. They are also "cross-cutting": involving a multiplicity of stakeholders, knowledge sources, and perspectives, and therefore containing a high probability of conflict. Wicked problems are "relentless": there is no final resolution to the problem, so the best outcome policy managers can hope for is the development of a long-term problem solving or management capacity (Weber & Khademian 2008).

Van Bueren, Klijn and Koppenjan (2003) point to three types of uncertainty that characterize wicked problems: cognitive, strategic, and institutional uncertainty. Cognitive uncertainty reflects the basic lack of technical knowledge about the "causes and effects" of wicked problems, and also about the causal relationships between issues involved (van Bueren et al 2003: 193). Strategic

uncertainty grows out the number of actors involved, who have differing perceptions of the problem, differing solutions, and therefore differing strategies for engaging with the problem. These differences can lead to conflict, stagnation, and potentially unexpected outcomes (van Bueren et al 2003: 193). Institutional uncertainty is a result of the "highly fragmented" institutional setting in which wicked problems are addressed. Decision-making is distributed across a variety of institutional arenas. "Often, decisions are only loosely coupled and sometimes not at all" (van Bueren et al. 2003: 194). Given these conditions, "dealing with wicked problems is—to a large extent—a problem of interaction" (Ibid).

Wicked problems are frustrating, complex, and pose special challenges to policymakers. They challenge assumptions about rational and logical approaches to addressing public policy problems.

Arctic emergency response: a wicked problem

All of the characteristics discussed previously as distinctive of wicked problems are in ample evidence in the maritime Arctic realm. Although May et al. (2005) use the label "policy incoherence", much of their analysis also characterizes wicked policy problems: they note the uncertainty and "limited shared basis for constructing definitions of problems" in the Arctic (2005: 4). The fundamental difficulty in the Arctic is twofold: responding to a rapidly warming regional climate and simultaneously managing an increase in human activity. Change is cascading through both human and environmental systems in the Arctic region, and the difficulty of managing and adapting to these changes is therefore significantly more challenging. The realm of emergency response is perhaps the most pressing challenge facing governments in the North American and Siberian regions of the Arctic, where increased human activity is occurring in the absence of fully developed infrastructure.

Although the policy solutions to inadequate emergency response infrastructure may appear simple—build infrastructure and increase staffing—this simplicity is deceptive. Construction and maintenance of infrastructure in the far North is complicated by the extreme climate, which requires special materials, techniques, and maintenance. These considerations multiply costs considerably. Seasonal limitations on construction exist. In addition, the costs of transporting construction materials to remote Arctic locations are significant. For example, while the price of a gallon of gas in the "lower 48" of the US was around $2.50 during April 2015, in Barrow, Alaska, it was approximately $7.00. While infrastructure development is a costly undertaking in any circumstance, the enormous additional costs of Arctic development pose challenges for policymakers.

Compounding the extreme cost of infrastructure development for emergency response in the Arctic is the uncertainty associated with ship traffic. If policymakers commit to public spending now in order to improve emergency response, and traffic does not increase, the money will be seen as going to waste. Conversely, if policymakers delay spending until traffic has increased to a level that demands enhanced response capacity, there is a chance that the spending will come too late—that a large-scale human or environmental disaster will occur, and the responsible government will be perceived to have failed.

This dilemma can be described in terms of two hypothetical scenarios involving the *Crystal Serenity*. In the first case, the US or Canadian government decides to enhance emergency

response in order to develop the capacity necessary to respond to a large-scale human disaster in the Arctic. This requires the expenditure of large sums to build deep water ports, airfields, hangars, communications, storage facilities, bases, and housing in remote Arctic communities, as well as staffing, equipment, and support services for these facilities, all of which are unavailable for other spending priorities farther south. The transit of the *Crystal Serenity* is uneventful, and the large expenditures are criticized as wasteful and misguided. In the second case, policymakers consider the overwhelming probability of a safe transit, and do nothing to enhance response capacity. An incident occurs, and the government is attacked for abdicating its responsibility.

Table 1: Policy dilemma: increase SAR capacity or not?

	No incident	Serious incident
Enhance capacity	X	✓
No additional capacity	✓	X

Beyond the immediate considerations of the *Crystal Serenity* lies the even thornier question of future passenger vessel traffic in the North American Arctic. Will more cruise ships follow the *Serenity*? How many? When? These difficult questions all shape policy solutions to the problem of emergency response in the Arctic region.

At the crux of the problem lies that fact that large-scale cruise ship disasters are vanishingly unlikely, but have devastating consequences—and these consequences are magnified in the Arctic. While it is very probable that the *Crystal Serenity*'s transit will be uneventful, regular reports of incidents involving cruise ships remind us that prevention cannot be a perfect cure. Furthermore, the regular incidence of large ferry disasters that kill many people, generally in developing countries, is a reminder that progress must continue to be made on maritime safety globally.[2]

In both 2011 and 2013, Carnival cruise ships experienced fire and engine failure. In 2010, 400 passengers aboard the *Celebrity Mercury* contracted norovirus (Cline 2013). Famously, the *Costa Concordia* ran aground in the well-charted waters of the Mediterranean in 2012, killing 32 (Povoledo 2014). This very brief list illustrates that leisure cruises regularly experience unforeseen incidents that can threaten human safety and environmental integrity. The sheer bulk of modern cruise vessels, along with the magnitude of passengers (which today can run well into the thousands), multiply the scale of any incident, particularly in precarious environmental situations. The harsh Arctic environment further increases risk to ships, since any incident will be compounded by the factors previously described. Risk of mortality, particularly if passengers end up in the water, is significantly higher in the Arctic due to low water temperatures.

Policymakers seeking to improve emergency response capacity in the Arctic must therefore weigh the very high cost of enhancement against the very low probability of a major incident; consider the unknown pace of increasing ship traffic (particularly high passenger volume ships like cruise vessels); balance competing demands from other sectors of government, including maritime emergency response; and prepare for potentially significant criticism should their

decision prove wrong. Here the wickedness of the problem can be seen more clearly. The wicked characteristics of Arctic emergency response can also be identified through the application of theoretical frameworks of wicked policy problems.

Applying theoretical frameworks to Arctic emergency response

While there are many frameworks for analyzing wicked problems, reviewing just one or two will be adequate to demonstrate that emergency response in the Arctic has all the characteristics of such a problem. Weber and Khademian (2008) identify three criteria: unstructured, cross-cutting, and relentless. Similarly, Van Bueren et al. (2003) note three types of uncertainty: cognitive, strategic, and institutional. These two frameworks highlight important aspects of Arctic emergency response.

Information is both inadequate and evolving, in both human and environmental spheres, in the maritime Arctic: ship traffic in the Arctic has been variable in recent years,[3] and the rate of change of both ship traffic and ice conditions is unknown. Cognitive uncertainty is clearly present; this problem can also be described as unstructured. The problem is dynamic, and it is not directly clear how various interventions affect outcomes.

The cross-cutting nature of wicked problems is closely linked to strategic uncertainty: both frameworks highlight the number of actors and different perspectives involved in managing a wicked problem. The involvement of many different actors implies a high probability of conflict, as each actor will have a different problem definition, objective, and preferred approach. Bringing many different viewpoints and styles to a manageable consensus is one of the great challenges inherent in addressing a wicked problem. This challenge can be seen in the Arctic, where different states, state agencies, local agencies, industry groups, and nongovernmental actors all define *adequate* emergency response differently, and may seek to manage it differently as well.

At this point, differences in the frameworks emerge. Weber and Khademian (2008) highlight the relentless nature of wicked problems: they persist and require long-term management. As the very nature of the Arctic continues to evolve far into the future, emergency response capacity must evolve as well: there is no solution that can be implemented in 2015 that will be appropriate in 2025 or 2050. Therefore, emergency response in the Arctic can be described as a relentless problem.

Van Bueren et al (2003), in contrast, emphasize the institutional uncertainty inherent in wicked problems. Decisions that pertain to the problem are dispersed widely, and decisions in one area or by one actor may not be linked to decisions by another. Institutional uncertainty can be combatted at the local and national level by coherent policy management. At the international level, the Arctic Council and the forthcoming Arctic Coast Guard Forum will play important roles in combatting institutional uncertainty pertaining to emergency response in the Arctic region, by harmonizing policy and linking decisions.

Taking a closer look: institutional uncertainty

The eight Arctic states are all parties to the 2011 *Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic* (hereafter referred to as SAR Agreement[4]) negotiated under the auspices of the Arctic Council, and are therefore bound to respond to a search and rescue

situation in accordance with the articles of that Agreement. However, the language of the treaty is deliberately vague: an "adequate and effective search and rescue capability" is left undefined, as is the nature of the promptness that is required in communications between parties. While tasking states with the duty to respond, the Agreement leaves a great deal of latitude. The case study of the Oryong 501, a South Korean trawler that sank in the Bering Sea under high seas in November 2014, serves to demonstrate that national SAR capacity and culture varies in ways that create institutional uncertainty and contribute to the wickedness of emergency response in the Arctic.

On November 30, 2014, the *Oryong 501* took a large wave onboard while hauling in pollock, and water flooded the boat's storage chambers.[5] The captain ordered the crew of 60 to abandon ship nearly 109 miles away from land. The incident occurred in waters delegated to Russian SAR responsibility under the 2011 Agreement, but near to the border with the US zone of responsibility.

According to reports and interviews, the designated Search and Rescue Mission Coordinator, the Russian Kamchatka Border Guard Directorate (KBGD), did not immediately respond to the incident. The US Coast Guard 17th District Command Center was notified of the incident by *Oryong 501*'s emergency locator beacon alert signals and immediately contacted the Russian Rescue Coordination Center in Vladivostok (Honings 12/19/14). Although the US Coast Guard offered assistance, Russia did not accept help until the next morning, December 1st, 2014. Throughout the search, Russia did not provide a base or aircraft support to aid what should have been an international search and rescue effort (Klint 2014).

Extensive assets were utilized throughout multiple search efforts by the United States Coast Guard and the South Korean Navy (Miller 2014). The US Coast Guard deployed US Coast Guard Cutter *Alex Haley*, US Coast Guard Cutter *Munro*, several C-130 Hercules aircraft based out of Air Station Kodiak, a MH-65 Dolphin helicopter from Kodiak, and two SAR planners from Juneau to assist South Korean Navy P-3 aircrews in Anchorage (Honings 12/15/14). US assets were requested to divert from their original missions to support the search. Additionally, Good Samaritan vessels played a large role in search efforts and the rescue of seven survivors. Of *Oryong 501*'s 60-crewmembers, seven survived, 27 crewmembers were recovered deceased, and 26 people remain missing in the waters. A week after the incident, the South Korean Navy aircrafts relieved the US Coast Guard of aeronautical searches. During its involvement in the search and recovery efforts, the US Coast Guard conducted 24 searches, covering more than 4,576 square miles (US Coast Guard).

The *Oryong 501* incident illustrates that, while the 2011 SAR Agreement may have been a step in the direction of greater coordination and reduced uncertainty, there is still work to be done in combatting institutional uncertainty in Arctic emergency response. At this point it should be noted that institutional uncertainty is the area in which the most effort has been expended to manage the wickedness of Arctic emergency response: the other criteria identified by the two frameworks employed above (unstructured/cognitive uncertainty; cross-cutting/strategic uncertainty; and relentless) are even less amenable to policy intervention.

The *Oryong 501* case study, as well as the earlier application of two frameworks for analyzing wicked problems, should make clear the wicked nature of Arctic emergency response. Rather than framing the issue of emergency response in the Arctic as a purely technical problem for

which a solution can be engineered using risk assessment techniques, and applying regulatory tools, it is important to recognize the unique aspects of wicked problems that are resistant to management efforts. What lessons can be drawn from the literature that may help policymakers as they seek to address this challenging issue?

Lessons from the literature on wicked problems

McBeth and Shanahan (2004) observe that wicked problems resist technical, scientific, and economic solutions. Technical approaches often "reignite" or cause additional conflict (2004: 322). Scientific evidence is "disputed, ignored, or manipulated" by stakeholders. While economic compensation often fails to reduce conflict intensity, economic arguments for adaptation also fail to move opinion, and market-based solutions are rarely employed (McBeth & Shanahan 2004: 323-4). Finally, they note that values often lead to unnecessary conflict: "Because of values and emotions that stand outside rational calculation of economic self-interest, policies get stuck in ideological cement even when technical, scientific, and economic arguments are plausible for both sides" (Ibid: 326). The failure of rationally grounded policy tools in the face of human factors like values and emotions demonstrates the political challenge of building consensus around the management of wicked problems.

Applying a wicked problem framework can yield insight into approaches that may defang some aspects of these problems. Chapin et al. (2008) lay out an approach to addressing wicked problems: first, by identifying "simple" solutions at the local scale that address the central problem as defined by many of the actors; next, determining linkages among processes and key intervention points to reduce impact; finally, by identifying and addressing secondary problems that emerge. Their approach "involves beginning with a central problem and incorporating only those additional layers of complexity that enable one to address or more inclusively define the central problem." (Chapin et al. 2008: 532). Chapin's approach emphasizes the importance of human factors, highlighting the need for shared problem definition and the acceptance of linkage to other processes and problems. However, Chapin's approach may seem, in its simplicity, to leave unanswered the basic challenge of wicked problems.

Roberts (2000) takes a realist approach, and identifies three types of solutions to wicked problems: authoritative, competitive, and collaborative. "Authoritative strategies are 'taming strategies'" (Roberts 2000: 4), which can only be employed by a small number of stakeholders who have (or have been given) the power to both define a problem and choose a preferred solution. The other stakeholders must acquiesce to the decision made by the small group. While this type of strategy holds the appeal of simplicity, "experts can be wrong", both in their understanding of the problem and in their chosen solution, and in a small group, learning is unlikely to occur (Roberts 2000: 4-5). Competitive strategies, on the other hand, spur innovation, as stakeholders compete for the power to define and solve problems on their own terms. While challenging the entrenchment of power, competitive strategies can produce undesirable outcomes, including stalemate, gridlock, and conflict (Roberts 2000: 5-6). Collaborative strategies seek to satisfy all stakeholders, avoiding the zero-sum approach present in competitive strategies. Collaboration can improve efficiency, reduce costs, and enable stakeholders to focus on their individual strengths and interests. However, collaboration is difficult, and raises transaction and

communication costs. In addition, "collaboration requires practice; it is a learned skill" (Roberts 2000: 7).

From this quick review of the literature, it appears there are few clear-cut strategies for managing wicked problems. In trying to improve emergency response capacity in the Arctic at the international level, no state can act alone nor compel action by other states; as a result, a collaborative approach is the only option. However, the task of building collaborative strategies across international boundaries is heightened by increased transaction and communication costs. Cultural differences may intensify challenges associated with human factors: values may differ widely between state agencies tasked with emergency response, which may have been demonstrated in the *Oryong 501* case; in addition, the political calculus of domestic politics may drive emergency response agencies in different directions.

The strategy described by Chapin et al (2008) does offer some promising avenues. Focusing on central areas where all or most actors share a common problem definition, and identifying key intervention points and linkages that will result in change, may be helpful strategies for Arctic states. The operational level of emergency response may serve as common ground around which consensus can be built. The forthcoming Arctic Coast Guard Forum may serve as a platform that can contribute to consensus around operational emergency response issues, and midwife emerging norms and best practices. Much as the Arctic Council has nurtured collaboration and the emergence of shared norms relating to environmental protection and sustainable development in the Arctic region, the Arctic Coast Guard Forum may prove to be a useful mechanism for building relationships at the operational level among Arctic emergency response agencies, which may lead to more consensus around problem definitions and may decrease the communication and transaction costs associated with collaborative solutions to wicked problems.

Are we ready for the *Crystal Serenity*?

Fortunately for the *Crystal Serenity*, the Arctic Council is planning on facilitating the execution of a large-scale international rescue exercise during late summer 2016, which will likely coincide with the cruise. According to the Department of State, in the summer of 2016, "we'll have an actual full-scale operational exercise for search and rescue".[6] Although details are not yet available, it is likely that this exercise will occur during the *Crystal Serenity* transit, providing a safety net for the voyage. In addition, the annual Arctic Zephyr exercise conducted by US DoD may coincide with the *Crystal Serenity* transit as well. U.S. European Command and U.S. Northern Command co-sponsor a regular multilateral tabletop exercise called Arctic Zephyr that focuses on search-and-rescue issues in the Arctic (Miles 2013). While the execution of this exercise remains tentative, it may provide another layer of security during the cruise. In light of these planned exercises, it is likely that the *Crystal Serenity* will have plenty of responders available, at least in US waters.

At this point, readers may be wondering about the recently adopted IMO Polar Code.[7] While the Polar Code does not go into effect until 1 January 2017, after the *Crystal Serenity*'s transit, it may be said that the requirements of the code are such that accidents will be prevented. However, as was noted earlier, accidents regularly occur despite regulatory guidance. While the Polar Code will decrease the likelihood of maritime disaster in the Arctic, the idea that regulation is capable

of achieving total prevention has little supporting evidence. Nicholas Taleb's famous body of work is not the only case for the importance of outlier, or "black swan" events, and the failure of predictive models to forecast the future.[8] Furthermore, by placing the burden on operators to prevent any incident, those who point to the Polar Code as a solution to the problem of emergency response in the Arctic effectively justify stasis on the part of response agencies: the idea that if an operator 'just follows the rules' then nothing bad can possibly happen. This dangerous logic ignores the reality that accidents can and do frequently occur. And accidents are not the only type of incident to befall cruise vessels, it is important to remember: a vessel in perfect compliance with the Polar Code may suffer engine failure, or the outbreak of infectious disease, or encounter a rogue wave[9]—all scenarios that have struck cruise ships in the past decade—and if emergency response agencies have not developed enhanced capabilities in the Arctic region, outcomes could be quite undesirable. The question is whether policymakers, confronted with daunting cost estimates for enhancing emergency response capacity, are willing to wait—and for how long.

Connecting the question of emergency response to theories of wicked policy problems highlights the challenges inherent in enhancing Arctic response capacity. It is vital that policymakers and scholars alike recognize that this challenge is more than technical. The evolving nature of conditions in the Arctic region, and of human behavior, challenge decision-making. The large number of actors makes consensus on even basic problem definition and solution identification difficult. The low-probability/high-cost nature of Arctic disasters raises the stakes for policymakers. Finally, this is truly a relentless problem, one that can never be solved—but only managed.

Once the wickedness of emergency response in the Siberian and North American Arctic is recognized, management informed by the literature on wicked problems may improve effectiveness by focusing on specific areas highlighted by this theoretical analysis: (1) specific analysis of maritime industry planning forecasts for Arctic traffic, particularly focusing on cruise vessels; (2) building consensus and streamlining decision processes and authorities; (3) targeting policies to address highest-cost outcomes; and (4) taking a long view that emphasizes ongoing management and communication rather than one-step policy delivery. While public policy theory may seem far removed from the operational reality of Arctic emergency response, careful application of theoretical analyses may offer practical strategic approaches to this Gordian knot.

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Notes

1. More information about the *Crystal Serenity* can be found on the website of Crystal Cruises, http://www.crystalcruises.com/northwest-passage-cruise/northwest-passage--6319.
2. For more information on the frequency and scale of ferry disasters, see Worldwide Ferry Safety Association, www.ferrysafety.org, or in-depth reporting in Mother Jones by James West, 3 June 2015; and Foreign Policy, by Elias Groll, 16 April 2014.
3. For a discussion of ship traffic in the Arctic, please see Allianz Safety and Shipping Review 2015 p. 27-28. The report is available here: http://www.agcs.allianz.com/about-us/news/shipping-review-2015/.
4. The full treaty is available: https://www.ifrc.org/docs/idrl/N813EN.pdf.
5. For more information on the sinking of Oryong 501, see the article by Sang-hun (NYT, 2014); Honings (19 December 2014 and 15 December 2014); Klint (KTUU, 2014); Miller (Juneau Empire, 2014); and US Coast Guard (27 January 2015).
6. "Background Briefing on Arctic Council Preview", Department of State, 24 April 2015. Available at http://www.state.gov/r/pa/prs/ps/2015/04/241067.htm
7. For more information on the Polar Code, see IMO, http://www.imo.org/en/MediaCentre/HotTopics/polar/Pages/default.aspx.
8. In books like *Fooled by Randomness* (2005) and *The Black Swan* (2010), and others, Taleb argues for the significance of outlier events not captured in predictive models, and points to the impact of chaos and human error.
9. For a fascinating look at rogue or freak waves, see the MAXWAVE project conducted by a German-led consortium based out of the Institute of Coastal Research, Geesthacht, Germany.

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