COOPERATION AMONG STAKEHOLDERS FOR A PREVENTATIVE AND RESPONSIVE MARITIME DISASTER SYSTEM: THE MITIGATION OF AN ARCTIC WICKED PROBLEM

A Thesis

by

LAWRENCE CLIFTON GHORAM III

Submitted to the Office of Graduate and Professional Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF MARITIME ADMINISTRATION AND LOGISTICS

Chair of Committee,	Joan P. Mileski
Committee Members,	Kris Joe Knox
	Wyndylyn von Zharen
Head of Department,	Joan P. Mileski

May 2015

Major Subject: Maritime Administration and Logistics

ABSTRACT

In a marine region once relatively remote, the melting Arctic ice cap creates opportunities for many in the international marine community. Shipping companies now have much shorter, more commercially viable sea routes between Europe and Asia for one to two summer months a year. Resources, such as oil, may now be easier to extract, and it is reported that the reserves under the Arctic polar cap are vast. Further, tourism to the region has increased. With the escalation of maritime traffic associated with these activities, there is also an increased risk of marine or maritime mishaps and disasters; hence, the need for an effective maritime plan for prevention and post mishap response.

The impact of pollution and environmental catastrophes are heightened because of the fragile Arctic marine environment. In events such as an oil spill, the cleanup efforts may be more complex due to harsh, unpredictable weather conditions, varying stakeholders, differing political systems from the border countries and the accountability of who bears the cost. Further, the difficulty and complexity in accessing the region may result in increased pollution and loss of life in a maritime mishap/disaster. This complexity of interdependencies of stakeholders, environmental conditions, social/cultural/political concerns, and economics risk is known as a "wicked problem" which means planning for Arctic disaster is difficult or impossible to solve because of incomplete, contradictory, and changing requirements that are often difficult to recognize. This type of disaster can have dramatic negative consequences on marine ecosystems, indigenous people and their cultures, and involved organizations and

governments operating in the Arctic. While law and policy have been put into place to promote unity and risk awareness, enforcing regulations governing the Arctic states has been an issue. How can collaboration to protect against and respond to marine and maritime mishaps/disasters be encouraged to become the norm among the various Arctic stakeholders in a complex "wicked problem" scenario?

A model of cooperation among involved Arctic stakeholders is proposed as the most effective mechanism for an appropriate plan for prevention and response. Cooperation will not only increase effectiveness, but increases the speed of response. Two theory streams of cooperation are integrated into the model: Axelrod's Art of Cooperation theory; and the Theory of Strategic Alliances. The proposed model addresses the conditions and incentives for cooperation and the handling of "free rider" potential. The model includes all stakeholders including but not limited to the eight Arctic states, nongovernmental organizations such as indigenous culture councils and environmental groups, and commercial enterprises. Stakeholders face a "prisoner's dilemma" from the wicked problem scenario in the Arctic which contributes to the need for incentives for cooperation among stakeholders to prevent mishaps and disasters in the region. Further, potential solutions for collaboration to avoid negative outcomes in the Arctic are proposed.

DEDICATION

My thesis is dedicated to my loving sister, Sierra Ghoram, who passed due to cancer right before reaching the tender age of two.

ACKNOWLEDGEMENTS

I would like to thank my committee chair, Dr. Joan Mileski and my committee members, Dr. Wyndylyn von Zharen, and Dr. Kris “Joe” Knox, for their guidance and support throughout the course of this research.

Thanks also go to my friends and colleagues and the department faculty and staff for making my time at Texas A&M University a great experience.

Finally, thanks to my family particularly my parents, siblings, and the Saucers for their continuous encouragement, love, and support.

NOMENCLATURE

NASA	National Aeronautics and Space Administration
NSIDC	National Snow and Ice Data Center
EEZ	Exclusive Economic Zone
IMO	International Maritime Organization
SOLAS	Safety of Life at Sea
MARPOL	International Convention for Prevention of Pollution from Ships
MERC	Marine Environment Protection Committee
UNCLOS	United Nations Convention on the Law of the Sea (1982)

TABLE OF CONTENTS

Page

LIST OF FIGURES

Page

LIST OF TABLES

Page

I. INTRODUCTION

The Arctic ice is receding at a faster rate than expected. According to the National Snow and Ice Data Center (NSIDC) and National Aeronautics and Space Administration (NASA) researchers, the length of the melting season has been growing (See Figure 1) and continues to grow by several days each decade since roughly 50 to 100 years (Bond *et al* 2015). Navy scientists expect ice-free conditions for a full month each year by the mid-2030s, and two to three months ice-free by the year 2050 (US Navy 2014). As the Arctic ice melts, more opportunities are presented to visit the region, extract resources, and impact the local populations. Further, as these events increase, competition among stakeholders is triggered creating disputes among traditional Arctic states and non-Arctic stakeholders (Hong 2012).

Arctic Environment

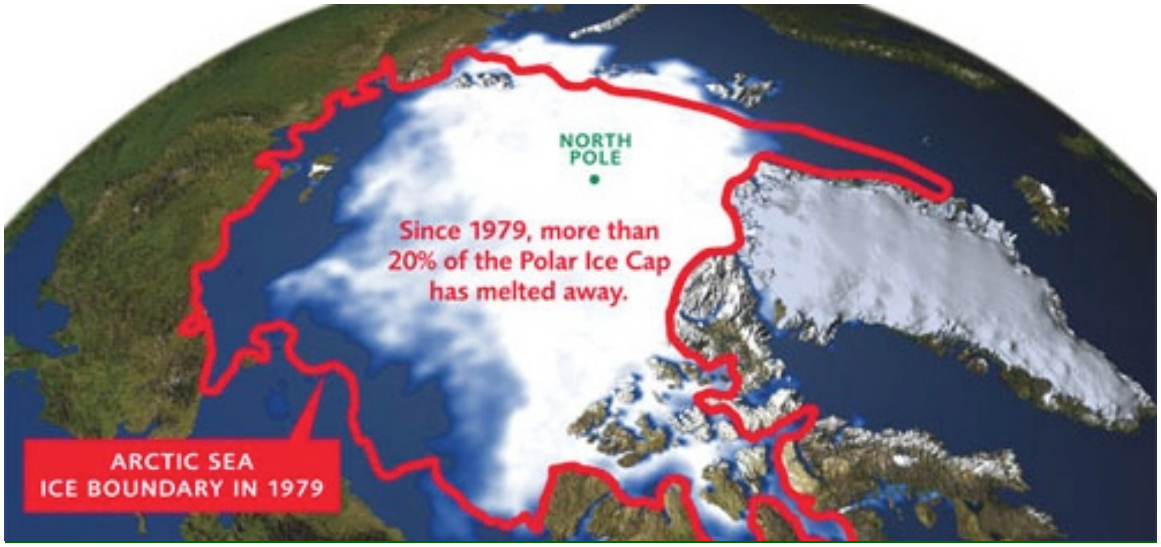

Figure 1. Artic Sea Ice Boundary Changes

Source: *Dunbar, 2005*

For the maritime industry, shorter shipping routes from Europe to Asia mean reduced inventory costs for shippers and fuel savings for shipping companies (Keil 2014). If canal fees and other variables are included to determine freight rates, these shortcuts could cut the costs of large container ships traversing the Arctic by billions of dollars a year (Hong, 2012). Some shippers have already begun transit through the Bering Strait using two main Arctic routes: the northern sea route along the Russian coast and the Northwest Passage through Canada (Lasserre 2012).

For the maritime tourism industry, several Arctic regions as well as Greenland and Svalbard continue to grow as destinations (Snyder 2007). As populations age in western economies (Department of Economic and Social Affairs 2015), consumers seek

experiences rather than goods (Diener and Biswas-Diener 2002). Travelling to unusual destinations is an attractive way to create these experiences (IMO 2014). As the Arctic becomes more easily accessible, tourism traffic is predicted to exponentially increase (Snyder 2007)

The fishing industry has a major economic stake in the Arctic and continues to grow as Norway, Russia, and Greenland try to maximize the value of fish stocks (Lasserre 2012). Overfishing has presented many problems for nations, leading to piracy and civil unrest in other parts of the world, which could in the future take place in the Arctic (Carchidi and Mileski 2013). In an effort to seek new fishing areas and access fish species that are limited currently in traditional fishing regions of the Arctic, fishing traffic will increase as the Arctic becomes more accessible (Knapp 2014).

The most significant industry with the largest potential impact on the Arctic region is the oil and gas industry (See Figure 2). The US geological survey in 2008 estimated that nearly one-quarter of the world's oil and gas reserves lie beneath the Arctic waters (Harsem *et al* 2011). In addition to hydrocarbon exploitation, land-based mining in the Arctic has also contributed to the increased traffic by bringing supplies and machinery to the mines, and transporting valuable minerals back to their markets (Reuters 2011).

As the maritime traffic associated with these activities continues to increase in the Arctic, so does the risk of disaster in the fragile Arctic marine environment (Cunningham 2012) including ship strikes of whales, noise perturbation, chronic pollution, and an unknown magnitude of consequences if other disasters take place

(Huntington *et al* 2015). The fishing safety of the indigenous people, the protection of the indigenous peoples' heritage and culture, the displacement of animals, and the impact to food security from contaminants are all at risks (Huntington *et al* 2015).

ARCTIC OPPORTUNITIES

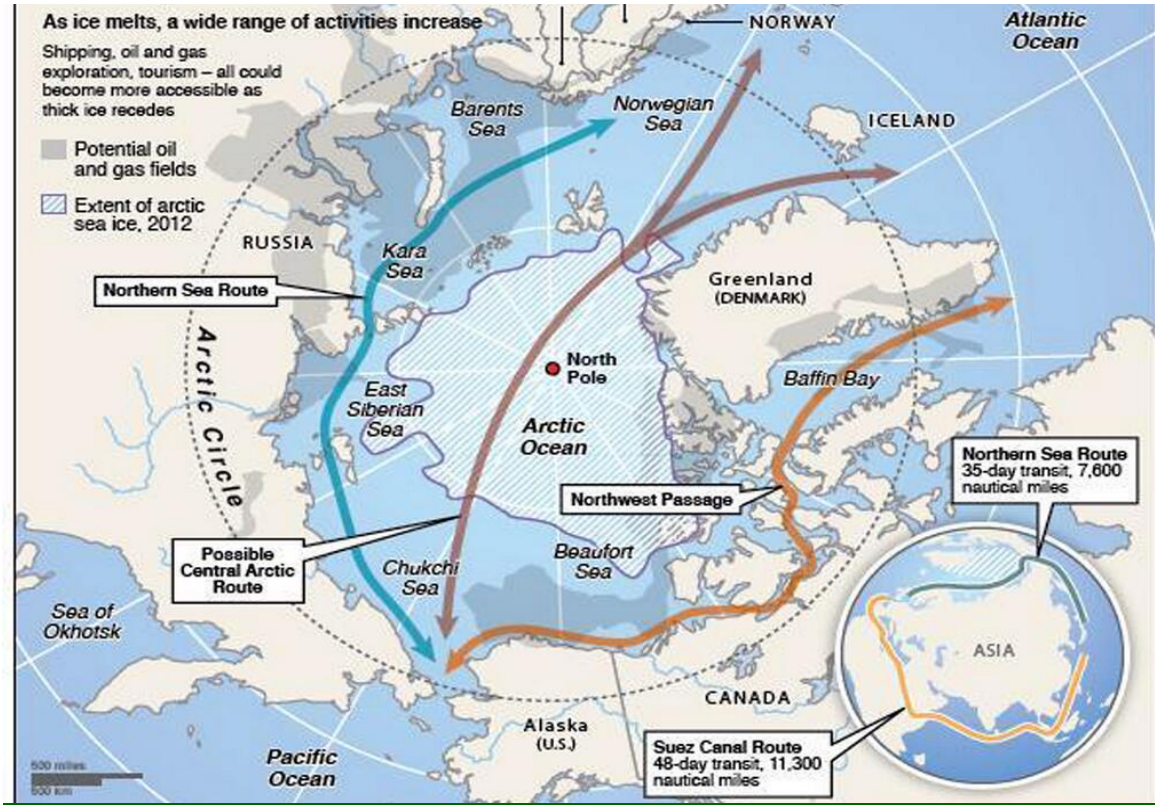

Figure 2. Arctic Opportunity and Activity
Source: *Bender, 2014*

Effective planning and improved techniques are needed in order to effectively prevent and respond to disaster. For example, potential oil spills from oil extraction in ice covered waters require enhanced techniques in terms of accessibility, pollution prevention, and response, especially in areas such as the Alaskan outer continental shelf.

Current methods of oil spill response in ice-covered waters would face increased logistical and technical barriers to ensure maritime safety and environmental protection, all while respecting local culture (Wilkinson *et al* 2015). Overcoming barriers such as these, require collaborative action. Developing rules to best manage these risks in the Arctic will require action and cooperation locally, nationally, and internationally (Cunningham 2012).

Managing for all the potential consequences of and impacts from increased maritime traffic stemming, from fishing, oil and gas exploration, maritime mining and extraction, and other kinds of high-environmental-impact activities is a "wicked problem." A wicked problem is one where the planning for adverse events is difficult or impossible to solve because of incomplete, contradictory, and changing requirements that are often difficult to recognize. The purpose of this paper is to illuminate the wicked maritime problem of the Arctic, to highlight the unique difficulties and consequences for states in pursuit of the Arctic's growing opportunities and untapped resources, and to propose a solution through a model of corporation among Arctic stakeholders in order to effectively plan for prevention and post mishap response.

II. LITERATURE REVIEW

2.1 Arctic and Its Unique Maritime Environment

The Arctic environment is vast and considered the most unique ecosystem on the planet (The Arctic Environment 2014). The "Arctic" refers to the northernmost region of the Earth and is north of the Arctic Circle. As of March 24, 2015, it runs approximately 66 degrees, 34 minutes north of the Equator (Webster 2000). The Arctic region includes of parts of Alaska (United States), Canada, Finland, Greenland (Denmark), Iceland, Norway, Russia, and Sweden (Nsidc.org 2015). What makes the region unique includes, among other traits, is its treeless tundra or permafrost, its midnight sun in the summer (sun does not set on the summer solstice), and its polar night (sun does not rise on the winter solstice) in the winter. The north of "tree line" defines this region with an average daily summer temperature not exceeding 10 degrees Celsius (Nsidc.org 2015). Another unique characteristic is cultural: the Arctic is home to indigenous people who have adapted to its cold and extreme conditions such as the indigenous Inuit population (Freeman 2001).

Information on the marine environmental systems of the Arctic is limited, and the impact of human activity is currently unknown compared to non-Arctic environmental systems (Bard 1999). This lack of information and underestimation of human activity may lead to the rapid degradation and changing circumstances of the Arctic environment (Abramov *et al* 2014). For example, there is a relative lack of good ship charts,

communication systems, and other navigational aids for mariners (IMO 2014). Further, disaster from maritime activities can result in ripple effects, impacting the indigenous populations, the environment and other stakeholders as well as raising other social, political, economic, and legal concerns. For example, disaster may pollute food sources of indigenous people, which may cause legal action to perpetrators.

The combination of the unique environment and the remoteness of Arctic increases the difficulty in handling maritime logistics including shipping, tourism, fishing or resource extraction (Ehlers et. al 2014; IMO 2014). For maritime operations, the remoteness combined with fog, darkness, and ice brings about challenges with visibility and infrastructure, or the lack thereof (Ehlers et. al 2014). Further, emergency response is critically limited by the paucity of infrastructure, the distance to travel, the weather, and the harsh operating conditions (Hong 2012). The Arctic environment's drifting sea ice caused by multi-year ice (IMO 2014) and icing of equipment brings other challenges, which may shut down communication and evacuation systems to vessels (Ehlers et. al 2014). In addition to the harsh weather and remoteness of the Arctic, additional challenges occur due to maritime activities. For example, noise from the seismic surveys ships conducted during oil exploration can injure non-human animals (such as whales) that are in close proximity and, in turn, may lead to fatalities (Cunningham 2012). Further, these animals such as marine mammals use sound not only to sense their environment but also to communicate with one another (Huntington et. al 2015). In addition to noise pollution, maritime activities can contribute to other types of

pollution. Air quality in the Arctic can also be impacted: emissions are predicted to grow by 150 to 600 percent by 2025 (Azzara and Rutherford 2015).

A social concern created by increased maritime activities within the Arctic region is overcoming challenges involving the indigenous people. The culture of the indigenous people may be jeopardized in many ways. The nomadic culture of some indigenous people active off shore would be significantly changed by large vessels maneuvering in their natural habitat (Huntington *et al* 2015). Food supplies could be disrupted due to changes made by increased activity. The large commercial ships competing for the same water routes with small boats used by the indigenous people may impact the peoples' ability to hunt and fish safely. This would impact their economic viability as a culture as well because of the potential significant loss in food supplies or trade. Further, the increased presence on non-indigenous people due to the increase in maritime activities may profoundly impact the indigenous culture by uprooting groups and tainting traditional practices all for economic gain (Grant 2009).

From a legal and political perspective, the disappearance of the Arctic sea ice raises sovereignty issues among the circumpolar states. However, the Arctic Council includes non circumpolar states such as Denmark (Hong 2012). Unlike the Antarctic, which has a treaty system to regulate international relations with respect to the Antarctic region treaty, the Arctic is not covered by a treaty that governs the region as a whole (Jensen 2007). The United Nations Arctic Council is an inter-governmental forum established by means of a non-legally binding declaration formed to foster cooperation and dialogue among the indigenous people and Arctic Nations (Koivurova and Molenaar

2009). The Arctic Council is the primary international governing body consisting of the eight Arctic States: Canada, Greenland (Denmark), Finland, Iceland, Norway, Russia, Sweden, and the United States (Koivurova and Molenaar 2009). The Arctic Council currently has two treaties on Cooperation as it relates to disaster. The first legally binding treaty signed by Arctic Council members in 2011 is: "The Agreement on Cooperation Aeronautical and Maritime Search and Rescue in the Arctic (AMSRA)" (Huebert et. al 2012). The second legally binding agreement signed by the Arctic Council in 2013 is: "The Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic (Arctic Council 2013). These treaties promote unity and increases awareness; however, the problem of enforcing laws governing the Arctic states remains a difficult task.

The International Maritime Organization (IMO), also a UN body, has produced guidelines for maritime traffic in Arctic waters. The International Code for Ships Operating in Polar Waters (known as the Polar Code) was adopted in November, 2014 as an amendment to the International Convention for the Safety of Life at Sea (SOLAS) to protect seafarer and passengers in the harsh environment of the waters surrounding the two poles. The provisions of the Polar Code include both safety and environmental related provisions. These provisions will become mandatory under SOLAS and the International Convention for the Prevention of Pollution from Ships (MARPOL). The expected date of entry into force of the SOLAS amendments is January 1, 2017; however, ships constructed before this date will need to meet certain requirements. The

IMO's Marine Environment Protection Committee (MERC) has approved the draft of the amendments to make the Polar Code provisions mandatory under MARPOL.

The Polar Code provisions cover the full range of shipping-related matters relevant to navigation in waters around the two poles such as ship design, construction and equipment; operational and training concerns; search and rescue; and the protection of the unique environment and eco-systems of the polar region from increased maritime activity. Ships intending to operate in the defined waters of Antarctic and Arctic must have a Polar Ship Certificate. Further, ships would need to carry a Polar Water Operational Manual, which provides the owner, operator, master, and crew with detailed information regarding the ship's operational capabilities and limitations. Among many goals and requirements, there are provisions to prevent pollution from oil, noxious liquid substances, sewage, and garbage (IMO 2014). Yet, enforcement of these provisions continues to be a critical issue.

In addition to the Arctic Council and the IMO, the United Nations also provides a legal framework under United Nations Convention on the Law of the Sea 1982 (**UNCLOS**), also called the Law of the Sea Convention or the Law of the Sea treaty. However, not all Arctic Council members have ratified UNCLOS (UN, 2015). The United States is the only country with claims to the Arctic who has not ratified UNCLOS. One of the major features of the UNCLOS is its Exclusive Economic Zone (EEZ). The EEZ establishes a coastal zone extending 200 nautical miles from the coastal baseline over which the coastal state retains exclusive economic rights, including the right to explore, exploit, and manage all living and non-living resources. Territorial

waters extend 12 NM from the baseline (e.g., low-water mark) of a coastal state and is the state's sovereign territory except for innocent passage of foreign vessels (See Figure 3); the contiguous zone extends from the territorial sea up to 24 NM and a coastal state can exert limited control over such areas as customs and immigration: the EEZ extends form the territorial sea, includes the contiguous zone, and out to 200 miles (unless there is an overlap) and may include the continental shelf, depending on the latter's location (See Figure 4).

Various countries have policies related to the Arctic (See Table 1). For example, the U.S. 2013 National Strategy for the Arctic Region guides, prioritizes, and synchronizes the three priorities for the Arctic national and homeland security interests; responsible stewardship and international cooperation.

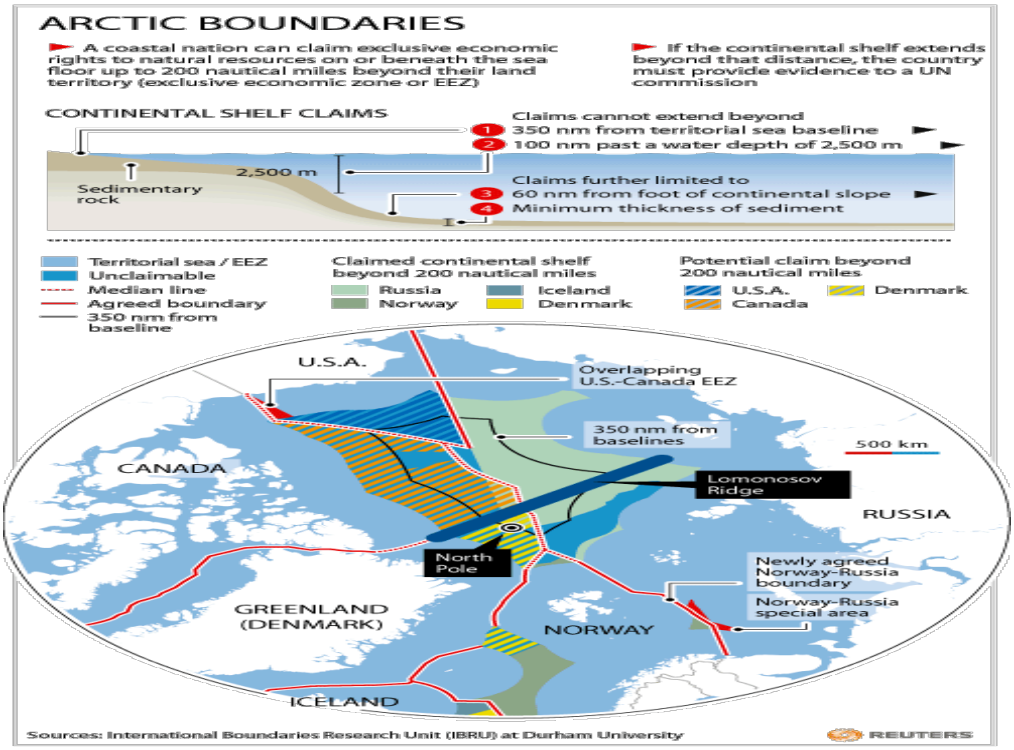

Figure 3. Arctic Boundaries
Source: *Council on Foreign Relations, 2015*

Countries	Laws	Policy
Canada		• Canada's Arctic policy includes plans and provisions for regional governments.
Norway		• Norway's policy on Arctic governance gives priority to the following FIVE areas: • International cooperation, • Development knowledge-based business sector • Knowledge development • Infrastructure • Emergency preparedness and environmental protection
United States (Alaska)	• National Security Presidential Directive 66 • Homeland Security Presidential Directive 25	• Freedom of Navigation • Protecting the Ocean Environment • Maritime Security Policy • National Strategy for Maritime Security
Russia		• Russian Federation in the Arctic for the period 2020 and beyond • Maritime Doctrine of the Russian Federation for the period up to 2020
Greenland (Denmark)		• Denmark's policy is to work for a peaceful, secure, and safe Arctic with self-sustaining growth and development with respect for the Arctic's fragile climate, environment, and nature in close cooperation with international partners

Table 1. Arctic Law & Policy

Finland		• Finland's Arctic policy is to enhance its involvement in the region.
Countries	**Laws**	**Policy**
Iceland	• Iceland's policy 12 principles promoting: • Arctic Council securing position • Understanding of the region, resolving differences under the United Nations Convention on the Law of the Sea • Increasing cooperation, • Supporting indigenous people rights • Cooperation • Prevent human induced climate change • Safeguard security • Develop trade relations • Advancing knowledge Increasing domestic cooperation within Iceland	
Sweden		• Policy seen through three priorities: • The climate and the environment • Economic development • Human dimension

Table 1. Continued

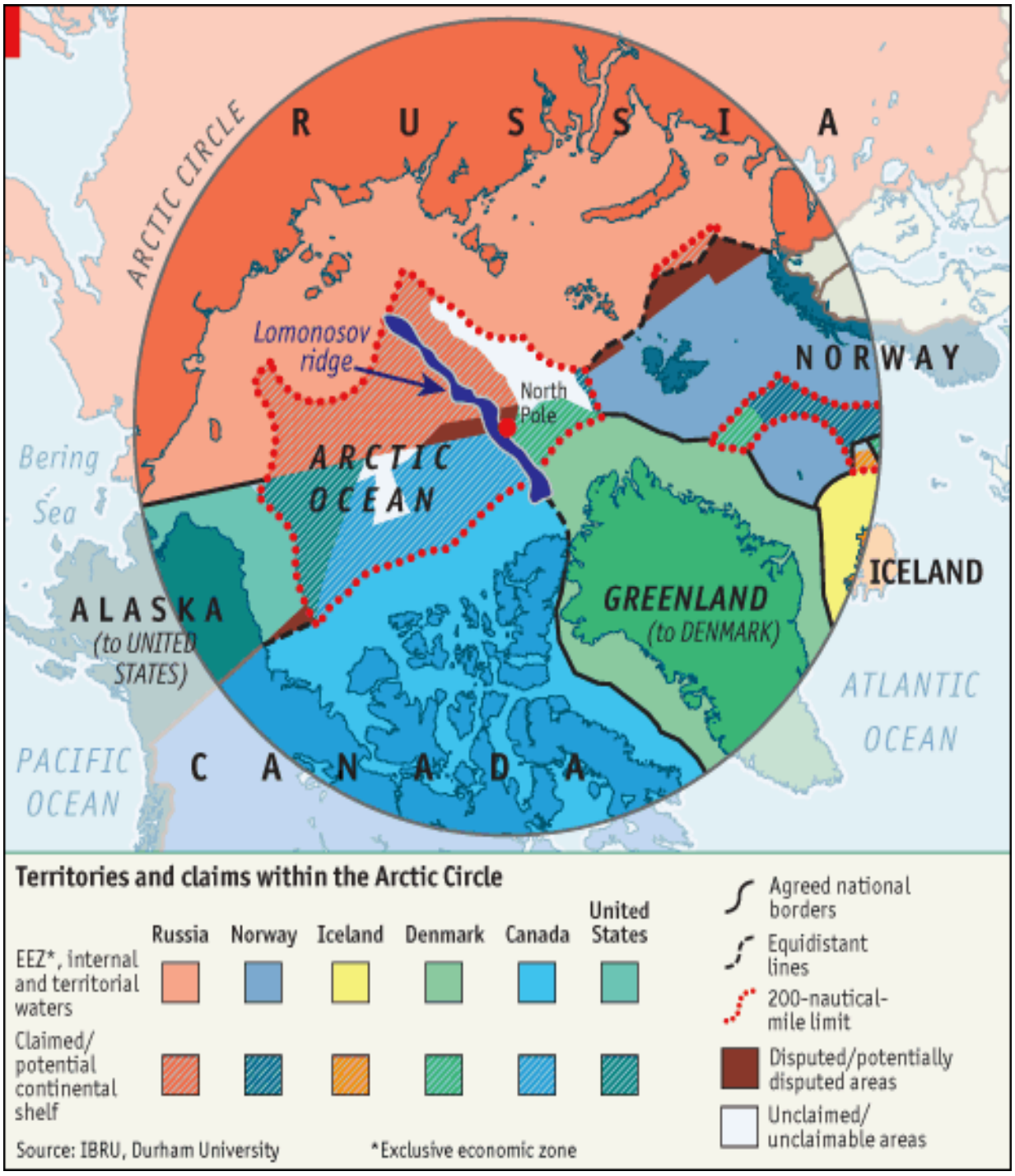

Figure 4. Arctic Circle Territories and Claims
Source: The Economist, (2009)

The US Arctic policy is based on two documents: the National Security Presidential Directive 66 and Homeland Security Presidential Directive 25, both initiated in 2009. Arctic directives include Freedom of Navigation (PDD/NSC-32); protecting the Ocean Environment (PDD/NSC-36); Maritime Security Policy (NSPD-41/HSPC-13); and the National Strategy for Maritime Security (NSMS) (US State Department, 2015).

Canada's first priority in the Arctic is to resolve national boundaries (Government of Canada, 2015). Canada's Arctic policy includes plans and provisions for regional governments. Further, Canada desires dynamic economic and social development, and environmental protection. Canada wants to extend the current Economic Exclusion Zone beyond the 200 nautical miles.

Russian Arctic policy is mainly determined by two documents: "The fundamentals of state policy of the Russian Federation in the Arctic for the period up to 2020 and beyond" (Osnovy 2008); and the "Maritime Doctrine of the Russian Federation for the period up to 2020" (Padrtova 2012). Russia's national interests are based on two elements – natural resources and maritime transport (Osnovy 2008). Russia, too, desires to extend its Economic Exclusion Zone beyond the 200 nautical miles.

The Nordic countries have many policies relating to the Arctic. Finland's Arctic policy is to enhance its involvement in the region. The objectives of Finland's Arctic policy are to strengthen multilateral Arctic cooperation; to take part in the shaping of the EU's Arctic policy; and to raise Finland's profile as an expert in Arctic issues (Ministry

of Foreign Affairs of Finland (2015). Norway's policy on the governance of the Arctic gives priority to the following five areas: international cooperation, the development of a knowledge-based business sector, knowledge development, infrastructure, and emergency preparedness and environmental protection (Regjeringen.no, 2015). However, there is no legislation for Norway's policy for law. Denmark's policy is to work for a peaceful, secure, and safe Arctic with self-sustaining growth and development with respect for the Arctic's fragile climate, environment, and nature in close cooperation with international partners (Kingdom of Denmark, 2011). However, there is no actual legislation for this policy. The Arctic policy of Sweden is seen through three priorities of the climate and the environment, economic development and the human dimension (ministry of Foreign Affairs, 2011). Iceland's policy encompasses 12 principles including promoting the Arctic Council, securing Iceland's position as a council leader, promoting understanding of the region, resolving differences under the United Nations Convention on the Law of the Sea, increasing cooperation, supporting the right of indigenous people, promoting cooperation, prevent human induced climate change, safeguard security, develop trade relations, advancing knowledge, and increasing domestic cooperation within Iceland on the Arctic (Iceland, 2011). The parliament passed this policy in 2011.

2.2 Wicked Problems and Working in the Arctic

A wicked problem is one where the planning for adverse events is difficult or impossible to solve because of incomplete, contradictory, and changing requirements that are often difficult to recognize. Wicked problems are generally seen as complex, open-ended, and intractable (Head, 2008). They can be defined in several ways, and have multiple characteristics (Camillus, 2008). Past decisions, historical trends, and current industry knowledge may not be useful in addressing wicked problems compared to other events (Rittel and Webber 1973; Koelsch 2014). Wicked problems are influenced by many economic, social, and political factors, and biophysical complexities: and the cause and effect of these factors and complexities are difficult to determine (Batie, 2008; Koelsch, 2014). For example, the wicked problem of the disaster prevention and response in the Arctic may be due to a lack of communication among stakeholders, a lack of research in the Arctic environment, a lack of organization or infrastructure, all the above, or none of the above.

The 'wicked problem' framework has not been widely adopted in management. This maybe due to the fact that wicked problems are viewed as unsolvable because of their complexity (Rittel and Webber 1973). However, wicked problems can become better mitigated with proper identification of issues, requirements, and constraints (Koelsch 2014).

Further, global industries such as the maritime industry contributes to complexity of issues and decisions when addressing operations, which may lead to disaster or other

adverse events in a harsh environment such as the Arctic. The complexity of issues may increase chances of human error. The changing environment both of the Arctic and the economic pressures on the maritime industry constrain solutions/betterment (Kampf and Haley 2011).

However, management of stakeholders and their conflicting and competing values has been recognized in the management and organizational theory literature as critical to survival and success of firms (DiMaggio and Powell, 1983) and is a critical factor in addressing wicked problem mitigation (Conklin 2006). Stakeholder participation has been considered important for firms operating in the marine environment (Mileski *et al* 2010). Further, stakeholders view potential solutions, interdependencies, and influences on the wicked problem differently (Koelsch 2014).

Therefore, as the Arctic environment is becoming more accessible to the international community with its many stakeholders with different values and priorities (Camillus, 2008) - employees and trade unions; shareholders, investors, and creditors; suppliers and joint venture partners; the governments of the different nations where they operate; nongovernmental organizations, the eight Arctic states, and customers, among others, the social complexity increases. Further changes in technology, regulations, and economic demand influence potential solutions/betterments. Governance for wicked problems must depend on the collective judgment of stakeholders in a process that is experiential, interactive, and deliberative (Jentoft and Chuenpagdee, 2009).

So, one of the steps toward mitigating a wicked problem is to involve stakeholders, document opinions, and communicate (Robert 2000). The focus should be

to create a shared understanding of the problem and foster a joint commitment to work towards resolving it. Not everyone will agree on what the problem is, but stakeholders should be able to understand one another's position well enough to discuss different interpretations of the problem and work towards mitigation (Camillus, 2008). Wicked problems require complex answers, but they can be improved in small increments. The wicked problem of prevention and response to a maritime disaster in the Arctic can be met through collaboration and cooperation of its stakeholders. The next section discusses how to facilitate the collaboration and cooperation of stakeholders attempting to better a wicked problem situation for disaster prevention and response.

2.3 Art and Strategy of Cooperation

Individually, we are one drop. Together, we are an ocean.

-Ryunosuke Satoro

Axelrod (1980), in his *Art of Cooperation*, suggests that a cooperative strategy is necessary in facing a dilemma when groups face ongoing interaction and each party receives mutual gains from cooperation. This game theory is elucidated through the prisoner's dilemma example using the United States and Canada (See Figure 5). If Canada chooses to cooperate and the United States chooses to not cooperate/defect, then we see Canada receiving the sucker's reward with zero while the U.S. gains all benefit. For example, these two nations can be cooperating when planning for disaster response

in their use of assets for clean up efforts. If both the United States and Canada choose not to cooperate/defect, then both are punished with minimum benefit. Only if both cooperate, will they each gain mutual benefit. A disaster or adverse event could also be considered a dilemma for the maritime stakeholders working in the Arctic. The ongoing interaction between nations is working in the same Arctic waters. Moreover, Axelrod notes the possibility that one party will exploit another in the dilemma and that no one will cooperate. Disaster can happen to any party due to human error. Having a plan of response to a disaster in place motivates cooperation, versus not having a response to disaster. For example, the Baltic Master plan addresses maritime security and safety. When parties only pursue their self-interests, it creates a less desirable outcome for all is described in the cooperation theory as the Prisoner's Dilemma (Axelrod, 1980).

PRISONER'S DILEMMA

		United States	
		Cooperate	**Defect**
Canada	Cooperate	R=3; R=3	S= 0, T=5
	Defect	T=5, S=0	P=1, P =1

Figure 5. Game Theory: Prisoner's Dilemma Model

(P= Punishment; T= Temptation to Defect; R= Reward; S=Sucker)

Reference: Axelrod, Robert 1984 The Evolution of Cooperation

The assumption of Axelrod's theory contends that parties pursue their own self-interest without the aid of a central authority to force them to corporate with each other. Currently, there is no central authority for enforcement of policy in the Arctic. The Arctic Council, the United Nations, and the International Maritime Organization all have some authority; however, there is no one authority over all maritime industry parties for all current and potential activities in the Arctic.

Further, an Arctic maritime disaster or adverse event may challenge or create a prisoner's dilemma for the security of various parties including nations. The situation where parties pursuing their own self-interest creates a less desirable outcome for all is described in the cooperation theory as the Prisoner's Dilemma (Axelrod, 1980). The parties may seek their own security through their own means, which challenge the

security of others. This self-pursuit of assets for disaster response may not appropriately solve the prisoner's dilemma. For example, in a maritime disaster, one party may not have the full knowledge and resources to resolve the situation such as what occurred in the Gulf of Mexico Macondo oil spill. In that spill, there were several failed efforts to contain the flow of the well that led to it being one of the largest accidental marine oil spills in history. Potentially, not sharing knowledge and resources stakeholders due to security concerns may have resulted in more damage (such as greater pollution) to all parties from the disaster.

The Prisoner's Dilemma is best illustrated as a game. In the game, there are two players with the choice to either cooperate or not cooperate the other. Neither knows what the other player will do. Not cooperating appears to have a payoff greater than cooperation, i.e., using and controlling one's own assets to respond to disaster. However, there are disaster response benefits from cooperation because of quicker, more effective response when assets and expertise are combined. If both chose not to cooperate, then both will suffer the maximum consequence. If both cooperate, then both benefit from the best outcome. So, ultimately, non-cooperation for self-interest tends to lead to the worse outcome for both.

Arctic stakeholders face a Prisoner's Dilemma in a disaster situation which, in turn, contributes to the complexity of the wicked problem. It is important to understand that the Prisoner's Dilemma is not a situation of opposing interests or a zero sum game where one side does well, and the other must do badly. Both sides can do well. For

competing entities operating in the Arctic, many can benefit from collaborative efforts in a disaster. A plan still benefits the whole rather than all separate.

2.4 Free Riders

Free riders are non-cooperative parties who benefit from the efforts of cooperation, such as in the case of a disaster prevention, mitigation, or response (Sandler 2008). Cooperation may be beneficial even if all parties do not participate equally to the cooperation agreement. Under the theory of Strategic Alliance, two or more independent parties can enter into an agreement to work together toward common objectives (Wakeam, 2013). Strategic alliances embrace a diversity of collaborative forms (Grant and Baden-Fuller, 2004). One of the most noted strategic alliances is the National Atlantic Treaty Organization (NATO), cooperating among countries for security (Olson and Zeckhauser 1966).

The criteria of a strategic alliance are critical to the success of a core goal or objective because it helps block threats, mitigates risk, and creates strategic choices (Wakeam, 2013). For example, an open Arctic Ocean creates opportunities for countries like China to join as a member of the Arctic Council and create strategic alliances to widen their connectivity to maritime business (Hong, 2012). Mutual reward in a strategic alliance comes though the norm of reciprocity. The emergence of these cooperative agreements can be explained as a consequence of parties pursing their own interests (Axelrod, 1980). However, everyone can best benefit if there is mutual trust and

transparency (Axelrod, 1980). But, countries, such as Russia, that are very powerful and self-reliant may not be as willing to cooperate with other Arctic states on plans for prevention and response to maritime disasters.

How, then, are free riders addressed in cooperation efforts? Those who do not contribute but benefit from the efforts of others can cause the collapse of cooperation. However, groups that sanction such free riders stabilize cooperative behavior (Henrich, 2006). Conditional cooperation from selfish and rational actors is sometimes feasible in repeated encounters, which is supported by the norm of reciprocity (Abell and Reyniers 2000). Even though mutual cooperation is possible, it is not always achieved. Cooperation among involved Arctic stakeholders may be the most effective mechanism for an appropriate plan for disaster prevention and response, and cooperation will play a vital role in increasing collective benefit (Sandler 2008). If there is a collective benefit, then there will be an increase in maritime effectiveness; thus, increasing the speed of maritime disaster response (Mileski and Honeycutt 2013). Further, cooperation strategies free up resources (Pfeffer 1976) which can be used to address aspects of bettering the wicked problem such as creating a plan for disaster prevention and response.

2.5 Planning for Prevention and Response for Maritime Related Disasters

As stated above, a wicked problem is one where the planning for adverse events

is difficult or impossible to solve because of incomplete, contradictory, and changing requirements that are often difficult to recognize. Wicked problems cannot be solved but can be mitigated; however, they must be made better incrementally or in stages after which the wicked problem changes. Applying cooperation in Arctic disaster prevention and response planning can be a successful way to address this wicked problem.

To address how to apply cooperation strategies to Arctic maritime disaster prevention and disaster response, we must understand the wicked problem of Arctic disaster and its potential impact. Disaster as defined by Fritz (1961) as an "event concentrated in time and space, in which a society, or relatively self-sufficient subdivision of a society, undergoes severe danger and incurs losses and physical appurtenances such that the social structure is disrupted and the fulfillment of all or some of the essential functions of the society are prevented." Response is defined by addressing necessary social functions disrupted by the immediate consequences of the disaster (Quarantelli 1987). We define "social structure" broadly to include economic, environmental, social, and political territories in the Arctic.

Disasters produce a range of impacts that can be characterized as direct, secondary, and indirect effects (Lindell, Tierney, & Perry, 2001). Direct effects include the deaths, injuries, and physical damage and destruction that are caused by the impact of the disaster agent itself. Secondary effects complicate response and recovery efforts because these occurrences may cause more impact than the disaster itself (Lindell,

Tierney, & Perry, 2001). If disaster takes places, such as flooding for example, then environmental pollution would be considered the secondary effect. The cleanup efforts for the pollution may be worse than the flooding itself. The indirect effect of a disaster includes "the ripple effects" resulting from disruptions in the flow of services, unemployment, business interruption, and declines in levels of economic activity and productivity (Lindell, Tierney, & Perry, 2001).

Effective disaster response requires proper planning (Mileski and Honeycutt 2013). The primary goal of emergency preparedness is for entities, businesses, and government agencies to develop appropriate strategies for responding when disaster occurs. Society tends to respond to the last disaster that has taken place on which to base their preparation (Popik, 2010) so comprehensive planning is needed where all phases of all types of disaster events are considered in the plan (Mileski and Honeycutt 2013). Emergency planning involves two basic components: physical preparedness and social preparedness (Gillespie *et al*. 1993). Physical preparedness entails ensuring that infrastructure can withstand disaster and uphold safety. Social preparedness means training, planning, and educating community of stakeholders (Lindell, Tierney, & Perry, 2001). Further, the plan should address pre-impact planning and post-impact response. Decision-making during both processes should have a framework that does not exclude the possible unforeseen event (Mileski and Honeycutt 2013). The wicked problem serves as that framework because of the issues of the unforeseen event that emerge are constantly changing and evolving into new challenges.

In order to organize effective disaster response decision-making through the comprehensive plan, the three dimensions of Mileski and Honeycutt's (2013) response decision-making framework is reviewed. The first dimension of the problem is the nature of the disaster. Disaster can be caused by natural events, human error, or a terrorist act. The second dimension is the nature of responder. To effectively respond to disaster, responders must accurately respond to a disaster, effectively communicate, and recommend solutions. The third dimension is the nature of the recipient, whether it is a business, local citizen, or government. Ultimately, flexibility is needed in all disaster planning, especially in the ability to respond. However, flexibility levels can vary depending on the type of disaster.

In implementing a plan of a response to a maritime disaster using maritime assets, the speed and timing is affected by three factors (Mileski and Honeycutt 2013). The first is the ability of the response to disaster, which is dependent on the control of maritime assets and the level of design specificity of the maritime assets. The second factor is the experience for the response so whoever controls the maritime assets must have the experience to deploy those assets in the specific disaster. The third factor is the staging of the response which is the strategic positioning of maritime assets or the where, when, and with what.

Since the response to a wicked problem such as an Arctic disaster is dependent upon the three factors of ability, experience and staging, flexibility in the plan and the implementation is a key factor (Mileski and Honeycutt 2013). Mileski and Honeycutt (2013) suggest cooperation strategy where there is asymmetry of information such as in

a post-disaster and a prisoner's dilemma exists as in the competition for maritime assets. Asymmetry of information may occur due to the nature of the wicked problem of an Arctic disaster. The mitigation is to encourage and implement a plan of response of cooperative effort to respond to Arctic disasters.

III. STRATEGIES AND THE MODEL FOR COOPERATION

In a complex system of environmental, social, political, and legal concerns and a marine environment including Arctic stakeholders, the framework of a wicked problem fits well. The first step towards mitigating a wicked problem is to understand its complexity. In doing so, we must recognize that wicked problems will constantly change. One change occurs with the emergence of new entrants. New entrants are, for example, non-member Arctic Council state entities that enter Arctic waters to explore resources and activities. The second change is the change a disaster has on entities involved. For example, disaster will have a very different impact on the local economy of the indigenous people that it will have on private corporate entities.

Wicked problems are mitigated if broken down into smaller, more manageable parts addressing one part of the problem at a time. Further, the mitigation of wicked problems faced in the Arctic requires a more hands on, interactive approach. An interactive, hands on approach will require those involved to make adjustments as the problems occur and change.

Social and political problems embedded in a wicked problem are never solved, but must be mitigated over and over again as they change (Rittel and Webber, 1973). Similarly, disaster planning issues are also faced over and over again in many different ways, as is the response to disasters. Effective planning prepares for any disaster (not just the last one) and is flexible if unpredictability is encountered. Further, effective

planning can limit (made better) the impact of a disaster in both public and private sectors (Ritchie, 2004).

As stated above, responsible planning and response to disaster are best addressed as a cooperative event (Mileski and Honeycutt 2013). Further, a mishap causing a disaster in the Arctic will likely take place. This means that it is highly possible Arctic stakeholders will have to interact whether or not there is an established plan for a cooperative response.

Cooperation strategy and implementation can be addressed through dynamic multilateral cooperation (Sandler, 2008). Although this research contends that cooperation is the best way to mitigate "wicked problems" in the Arctic disasters, there are some advantages to competitive rather than cooperative strategies to solve wicked problems. Competitive strategies challenge the institutionalization of power (Roberts, 2000), and it may be important to keep power circulating among the stakeholders particularly in the Arctic. However, cooperation can manifest itself through alliances, partnerships, and joint ventures and incorporates both the transfer of power and the use of collaborative strategies. The wicked problem of addressing an Arctic disaster can be used as grounds for dynamic cooperation (Sandler, 2008).

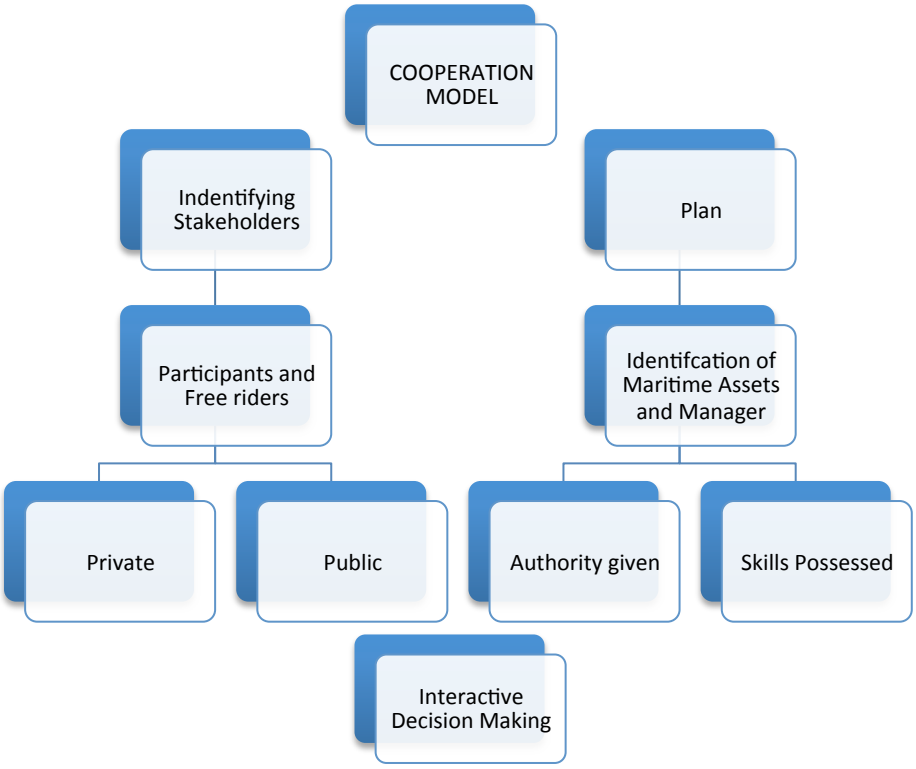

Figure 6. Model of Cooperation

This research results in the following cooperation model. A model of cooperation is presented to encourage stakeholder cooperation for a plan of prevention and response to an Arctic maritime disaster (See Figure 6). First, stakeholders are identified. The Arctic Council can be used as the starting population of stakeholders. Members of the Arctic Council can be approached to identify the Council's stakeholders. Once stakeholders are identified, a request to cooperate through a common disaster plan of response should be made. Cooperation should be on a voluntary basis. For public/government and private stakeholders who choose not to cooperate when disaster takes place, members who do participate should still support the free rider in the time of

need and disaster. However, an incentive system may be put in place to encourage cooperation.

Next, a plan must be prepared. Mileski and Honeycutt (2013) state that an accounting for maritime assets available to respond to a disaster. Further, the use and deployment of the assets must be assessed preferably by a designated manager or management team. This team would optimize the utilization of these assets during a disaster response and prevent competition among stakeholders for these assets. The manager identified in the plan must have the skills at staging and coordinating maritime assets. Further, the manager must be given authority of the asset used by the various stakeholders in the plan across all countries.

Once stakeholders are identified and the plan is in place, interactive decision-making among all stakeholders should be anticipated during any response to an Arctic disaster. This must be anticipated in wicked problems as the circumstances of the problem are constantly changing and reacting to any action taken with regard to the problem. Appointed stakeholder leaders along with the manager share information with stakeholders and respond to stakeholder suggestions during and after the disaster response.

Using the Arctic Council can contribute to this collaborative system and plan to limit the impact of disaster in the Arctic. However, once cooperation is established, a mechanism for enforcement should be created that requires some level of payment/reimbursement for the efforts of those who cooperated and provided response.

For example, a fine or added tariff for stakeholders may be assessed by the Arctic Council directly for not following proper maritime procedures under the plan.

IV.IMPLEMENTATION OF THE ARCTIC MARITIME DISASTER PLAN

The previous section describes the plan, while this section describes how the plan will be implemented. Contributing to the wicked problem of an Arctic response is the relative operational inefficiencies in parts of the maritime industry (Panayides *et al* 2011). Again this research emphasizes coordination of an Arctic disaster response will be more effective if a plan is in place prior to any events (Thomas and Fritz 2006). The plan should contain marine asset provisions for public and private stakeholders to be effective and be flexible in the provisions and the implementation (Mileski and Honeycutt 2013). All of these plan provisions, regardless of when and what type of disaster takes place, should be as a result of the interactive decision making process of cooperation among the stakeholders.

First, as indicated above the plan should designate a manager. The designation should be given to a manager based the combination of his/her experience in the industry, leadership ability, coordination skills and his/her experience handling any previous disasters rather than on mere legal or governmental authority (Mileski and Honeycutt 2013). Further, there may be several managers needed for various tasks related to the wicked problem. For example, a manager in a private company with a technical background may be able to coordinate maritime assets needed to combat the Arctic environment during the disaster but may not be the best communicator to indigenous stakeholders.

Second, the plan should clearly state stakeholder responsibilities and required actions during and after a disaster as well as agreed upon actions to be taken by the designated response manager or managers. During a disaster, implementation of the plan requires flexibility. Asymmetry of information (all parties may not receive all information at the same time) may occur due to the nature of the wicked problem of an Arctic disaster so communication from the designated manager to and from the stakeholders is first priority. Further, the designated manager should communicate with the Arctic Council.

Third, the plan must contain an inventory of maritime assets, capabilities and competencies owned by both public and private Arctic stakeholders. If needed response assets, capabilities and competencies are not owned by the stakeholders, the plan should contain contingency provisions to acquire the needed inventory for the disaster. This inventory helps address the prisoner's dilemma that occurs due to competition among various stakeholders for assets, capabilities, and competencies during a response.

Fourth, as noted above in previous section if an incentive system is in place, the manager should have authority from all stakeholders participating to enforce the system. For example, maritime assets requisitioned may be entitled to compensation paid by all appropriate stakeholders whom the owner receives compensation. Asset activation and utilization rates should be negotiated as part of the plan (Mileski and Honeycutt 2013). The incentive system can be monitored by the Arctic Council to make sure compensation is properly distributed to stakeholders, in order to lower and discourage system corruption assuming the Artic Council would agree to the manager.

The disaster response should have uniform safety procedures across multiple levels to prevent future disasters while proactively promoting proper planning for disaster. Proper safety measures must address the placement of assets, type of equipment, and properly trained personnel. Uniform safety procedures are important for consistency of response among stakeholders. Safety authority should be given to the designated manager. The manager must train response personnel including the indigenous people, to follow disaster response safety protocol.

V. CONCLUSION AND MANAGERIAL IMPLICATIONS

The interconnectivity of services and assets needed in disaster response and prevention confirms the need to address a wicked problem. The plan should allow for training potentially managers. Gathering information on maritime assets, capabilities and competencies across all Arctic stakeholders will be a challenge. However, each member of the Arctic Council can contribute to overcoming this challenge. For example, the United States, as current chair of the Council, can show how to gather such information with the help of the American Bureau of Shipping, the United States Coast Guard, the United States Transportation Security Administration and Alaska. As reported by Mileski and Honeycutt (2013), "The American Bureau of Shipping records the physical characteristics and primary capabilities of all U.S. flagged ships. The United States Coast Guard, through the National Vessel Documentation Center, documents all vessels five tons or greater that are employed in fishing activity or coastwise trade on the navigable waters of the US or in the Exclusive Economic Zone (USCG 2012). The U.S. Transportation Security Administration approves and monitors the personnel that are employed on and have unrestricted access to vessels (MTSA 2002). Haas (2010) identifies 12.7 million recreational boats registered by state offices." The Macondo incident used recreational boats to assist in cleanup efforts.

Further, the IMO can assist on overcoming the challenge as well. The IMO governs flagging. For example, the ships that meet requirements for disaster response should be allowed to show compliance by an Arctic Council flag or another symbol of

approval. The flag gives legitimacy to organization as a good and prepared world citizen protecting and mitigating against Arctic disaster damage. This will not only assist in creating a new norm of disaster awareness and preparedness among a diverse team of stakeholders, but also help provide incentive to become distinguished for meeting requirements for response and maritime assets.

Additionally, the Arctic indigenous people are asking maritime industry firms to pay large amounts for entering their environment in exchange for growing their local economies (Nuttall 2000). This adds to the complexity and interconnectivity of the Arctic disaster response wicked problem as stakeholders are highly interconnected. Some local governments are requesting investment in personnel training and infrastructure improvement in exchange for the procurement of resources. Many of the indigenous people benefit because they learn skills and obtain jobs (Agranoff and McGuire 2004). However, if Arctic stakeholders are able to properly communicate through a plan to respond with coordinated mitigation local economies will grow.

5.1 Implications for Managerial Practice

International support of contingency planning can be implemented for an Arctic maritime disaster. As stated above, the Baltic Master plan is an example of cooperation for maritime safety (Jeppson 2011). Although maritime disasters are rare, more can be done to plan for response and mitigation. Clearly, the stakeholders need to create a plan and evaluate implementation options. However, more research is needed to pinpoint

what motivates stakeholders to join in a cooperative plan without global regulation interventions. Given the increasing importance of the Arctic environment for the maritime and related industries, the results of this study can be useful to policymakers and industry decision makers.

Future research should collect data on Arctic specific maritime assets, capabilities, and competencies for the wicked problem of disaster planning and response. This information will assist with plan development and disaster response. Flexibility is required as the type of response is disaster dependent. Disaster preparedness and flexibility can often prevent it or mitigate its damage, so data on maritime assets may help to plan for the prevention and response to the rare event of disaster.

REFERENCES

Abell, P., & Reyniers, D. (2000). Generalised Reciprocity and Reputation in the Theory of Cooperation. In *Symposium on R. Axelrod's" The Evolution of Cooperation* (Vol. 22, No. 1).

Abramov, V. M., Gogoberidze, G. G., Karlin, L. N., Lednova, J. A., and Berboushi, S. V. (2014). Concept of environmental monitoring in the Russian Arctic coastal regions. 14th SGEM GeoConference on Ecology, Economics, Education And Legislation, 2(SGEM2014 Conference Proceedings, ISBN 978-619-7105-17-9/ISSN 1314-2704, June 19-25, 2014, Vol. 1, 161-168 pp.), 161-168.

Agranoff, R., & McGuire, M. (2004). *Collaborative Public Management: New Strategies for Local Governments*. Georgetown University Press. Washington, DC.

Arctic Council. (2013). Past Task Forces. Retrieved August 24, 2014, from http://www.arctic-council.org/index.php/en/about-us/working- groups/task-forces/811-past-task-forces.

Axelrod, R. (1980). More effective choice in the prisoner's dilemma. *Journal of Conflict Resolution*, *24*(3), 379-403.

Axelrod, R. (1984). “The Evolution of Cooperation.” 1st Ed. (New York: Basic Books).

Batie, S.S. (2008). Tackling wicked Problems: A Public Policy Perspective. Australian Public Service Commission: 1-38.

Bard, S. M. (1999). Global transport of anthropogenic contaminants and the consequences for the Arctic marine ecosystem. *Marine Pollution Bulletin*, *38*(5), 356-379.

Bender, J. (2014). "Russia Has a Crucial Advantage over the US in the Arctic." Business Insider. Business Insider, Inc, 22 Apr. 2014.

Bond, N., Overland, J. and Soreide, N. 2015. Why and how do scientists study climate change in the Arctic? What are the Arctic climate indices? National Oceanic and Atmospheric Administration, www.arctic.noaa.gov, accessed March 2, 2015.

Camillus, J. C. (2008). Strategy as a wicked problem. *Harvard Business Review*, *86*(5), 98.

Cohen, A. (2010). *From Russian Competition to Natural Resources Access: Recasting US Arctic Policy*. Heritage Foundation.

Council on Foreign Relations,. (2015). *The Thawing Arctic: Risks and Opportunities*. Retrieved 7 August 2014, from http://www.cfr.org/arctic/thawing-arctic-risks-

opportunities/p32082

Department Of Economics And Social Affairs (2015). World Population Ageing: 1950-2050, United Nations, www.un.org, accessed March 2, 2015.

Diener, E., & Biswas-Diener, R. (2002). Will money increase subjective well-being?. *Social indicators research*, *57*(2), 119-169.

DiMaggio, P. J., & Powell, W. W. (1983). AND COLLECTIVE RATIONALITY IN ORGANIZATIONAL FIELDS. *American Sociological Review*, *48*(2), 147-160.

Dunbar, B, 2005. "Arctic Sea Ice Continues to Decline, Arctic Temperatures Continue to Rise In 2005." NASA. Web. 23 Apr. 2014.

Economist. (2009). *Suddenly, a wider world below the waterline*. Retrieved 24 April 2014, from http://www.economist.com/node/13649265

Ehlers, S., Asbjørnslett, B., Rødseth, Ø. and Berg, T. (2014). *Maritime-port technology and development*. CRC Press. p. 1-248.

Gillespie, D. F., Colignon, R. A., Banerjee, M. M., Murty, S. A., & Rogge, M. (1992). Interorganizational Relations for Disaster Preparedness.

Government.NO (2014). Norway's Arctic Policy for 2014 and beyond – a Summary, www.regjeringen.no accessed March 9, 2015.

Government Of Canada. (2015). Canada's Arctic Foreign Policy, Foreign Affairs, Trade and Development Canada, www.international.gc.ca, accessed March 3,

2015.

Grant, B. A. M. (2009). Where Hope Lives: An Examination of the Relationship between Protagonists and Education Systems in Contemporary Native North American Young Adult Fiction. (Doctoral dissertation, University of British Columbia (Vancouver).

Hass, G. A. (2010). Snapshot of recreational boating in America. Retrieved from /http://www.uscgboating.orgS, Accessed on July 16, 2014.

Harsem, Ø., Eide, A., & Heen, K. (2011). Factors influencing future oil and gas prospects in the Arctic. *Energy policy*, *39*(12), 8037-8045.

Head, B. W. (2008). Wicked problems in public policy. *Public Policy*, *3*(2), 101.

Henrich, J. (2006). Cooperation, punishment, and the evolution of human institutions. *Science(Washington)*, *311*(5769), 60-61.

Hong, N. (2012). The melting Arctic and its impact on China's maritime transport. *Research in transportation economics*, *35*(1), 50-57.

Huebert, R. N., Exner-Pirot, H., Lajeunesse, A., & Gulledge, J. (2012). *Climate Change & International Security: The Arctic as a Bellweather*. Arlington: Center for Climate and Energy Solutions. Available at: http://www.c2es.org/publications/climate-change-international-arctic-security.

Huntington, H. P., Daniel, R., Hartsig, A., Harun, K., Heiman, M., Meehan, R., &

Stetson, G. (2015). Vessels, risks, and rules: Planning for safe shipping in Bering Strait. Marine Policy, 51, 119-127.

Iceland (2011) A Parliamentary Resolution on Iceland's Arctic Policy, Approved by Althingi at the 139th legislative session March 28.

International Maritime Organization (IMO) (2014) Shipping in polar waters: Development of an international code of safety for ships operating in polar waters (Polar Code), www.imo.org, accessed March 2, 2015.

Jentoft, S., & Chuenpagdee, R. (2009). Fisheries and coastal governance as a wicked problem. Marine Policy, 33(4), 553-560.

Jeppson P. (2011) BalticMaster II—from vision to action. In: N Bellefontaine, O Linden editor, Oil spill risk management. Proceedings from the WMU-IMO conference on oil spill risk management (pp. 109–117). Malmo, Sweden: World Maritime University and International Maritime Organization,pp. 21–116.

Kämpf, M., & Haley, S. (2014). Risk management in the Alaska Arctic offshore: wicked problems require new paradigms. *The Polar Journal*, *4*(1), 150-169.

Keil, K. (2014). Evaluation of the Arctic shipping season 2013. The Arctic Institute.[Available at: http://www. thearcticinstitute. org/2014/01/evaluation-of-arctic-shipping-season. html.], 13.

Kingdom of Denmark (2011) Denmark, Greenland and the Faroe Islands: Kingdom of

Denmark, Strategy for the Arctic 2011-2020. Copenhagen/Nuuk/Torshavn: Ministry of Foreign Affairs/Department of Foreign Affairs/Ministry of Foreign Affairs.http://ec.europa.eu/enterprise/polices/raw-materials/files/docs/mss-demark_en.pdf (20 November 2014).

Koelsch, Cari J. (2014) Potential Impact of Changes in Risk Assessment to Address.

Koivurova, T., & Molenaar, E. J. (2009). International Governance and Regulation of the Marine Arctic. WWF International Arctic Programme, 1, 1-44.

Knapp, Gunnar (2014) Arctic Fisheries: Opportunities and Policy Issues, University of Alaska Anchorage Institute of Social and Economic Research, presentation, February 26.

Lasserre, F., (2012) Climate change and commercial shipping development in the Arctic.

Lindell, M. K., Tierney, K. J., & Perry, R. W. (2001). Facing the Unexpected: Disaster Preparedness and Response in the United States. Joseph Henry Press.

Mileski J. and J. Honeycutt (2013). "Flexibility in Maritime Assets and pooling Strategies: A Viable Response to Disaster," Marine Policy, Vol. 40, 111-116.

Mileski, J. P., Mejia Jr, M. Q., & Carchidi, A. D. (2013). How to Thwart Success in Piracy: Core Strategies of Security. In *Piracy at Sea* (pp. 217-240). Springer Berlin Heidelberg.

Mileski, J. P.,Thrailkill, R., Haupt, K., Lane, J., McMullen, W., Gunn, J., Kruse, C. J., &

Bierling, D. (2010). *Recommendations and Guidelines on Shoreline Development And Hazards to Navigation* (No. Product 0-6225-P1). Texas Transportation Institute, Texas A&M University System.

Ministry of Foreign Affairs of Finland (2015) Arctic Cooperation, formin.Finland.fi, accessed March 3, 2015.

MSTA (2002) United States Coast Guard. Maritime Transportation Security Act of 2002. Retrieved from /https://homeport.uscg.mil/mycg/portal/ep-/channelView.do?channelId=24885&Channelpage=%25Fep%25Fchannel%252F default.jsp& pageTypeId=13489S; 2002. [Accessed on July 15, 2014].

NSIDC.org (2015) National Snow and Ice Data Center, Arctic Sea Ice News and Analysis, nsidc.org/arcticseaicenews, accessed April 6, 2015.

Nuttall, M. (2000). Indigenous peoples, self-determination, and the Arctic environment. The Arctic: Environment, People, Policy, 377-409.

Olson, M., &Zeckhauser, R. (1966). An economic theory of alliances. The Review of Economics and Statistics, 266-279.

Padrtova, Barbora (2012) Russian Approach Towards the Arctic Region, Centre for European and North Atlantic Affairs, cenaa.org, accessed March 3, 2015.

Panayides P, Lambertides N, Savva C. The relative efficiency of shipping companies. Transp Res Part E 2011;47:681–94.

Pfeffer, J., & Salancik, G. R. (2003). The external control of organizations: A resource

dependence perspective. Stanford University Press. Palo Alto, CA.

Regeringskansliet (2011) Sweden's strategy for the Arctic Region, Government offices of Sweden, www.regeringskansliet.no. accessed March 9, 2015.

Roberts, N. (2000). Wicked problems and network approaches to resolution. International public management review, 1(1), 1-19.

Rittel, H.W.J. and M.M. Webber (1973). "Dilemmas in a General Theory of Planning" Policy Science 4: 155-169.

Sandler, T. (2008). Public International Law And Economics: Treaties: Strategic Considerations. *University of Illinois Law Review*, *2008*, 155-1643.

Snyder, J. (2007). *Tourism in the Polar regions*. Paris, France: UNEP DTIE.

Thomas, A., & Fritz, L. (2006). Disaster relief, Inc. Harvard business review, 84(11), 114.

USCG (2012) United States Coast Guard. National Vessel Documentation Center. Retrieved from /http://www.uscg.mil/hq/cg5/nvdc/default.aspS; 2011. [Accessed on July 3, 2012].

United States Department of State (2015) Arctic, www.state.gov, accessed March 3, 2015.

United States Navy (2014) Arctic Roadmap: 2014-2030, Navy Task Force Climate Change, Chief of Naval Operations, February.

Wakeam, J. (2013). The Five Factor of a Strategic Alliance - Ivey Business Journal. [online] Iveybusinessjournal.com. Available at: http://iveybusinessjournal.com/topics/strategy/the-five-factors-of-a-strategic-alliance# VNfAS1V4oRx [Accessed 8 Feb. 2015].

Wilkinson, J. P., Boyd, T., Hagen, B., Maksym, T., Pegau, S., Roman, C., & Zabilansky, L. (2015). Detection and quantification of oil under sea ice: The view from below. Cold Regions Science and Technology, 109, 9-17.