

CANADIAN MARITIME SECURITY IN AN ERA OF CLIMATE CHANGE:
THE AWAY GAME

by

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DALHOUSIE UNIVERSITY
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Abstract

Beyond possible sovereignty disputes resulting from melting Arctic ice, very little is said or written about the maritime security implications of climate change. What does climate change mean for Canadian maritime security, and how can Canada adequately prepare to ensure continued safe and secure use of the world's oceans in an era of climate change?

Climate change is relevant to maritime security through two chief dimensions. First, navies will more frequently be tasked to deliver humanitarian assistance and disaster relief in the wake of more intense natural disasters. Second, increasing disorder on land will 'slop over' into the world's oceans, threatening the safety of maritime commerce.

Canada has stakes in both of these dimensions, and so there is great impetus for preparedness. The recommended model for preparedness sees Canada's navy adopting a more varied fleet structure, one better suited for constabulary and diplomatic functions as opposed to traditional military functions.

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Chapter 1.0 Introduction

As the year of the Canadian navy's centennial, 2010 is a time for celebration; in its 100 years of service, Canada's navy has grown from its roots as a small fisheries protection service to become a 'middle power' navy with a relatively modern fleet and a wide range of capabilities.¹ Today, as it has through its history, the navy continues to make strong contributions to the security and safety of Canada, its allies, and the world's ocean commons. The navy's achievements across its lifetime are to be applauded.

However, the navy's centennial also offers an opportunity for introspection and looking forward. The security environment in which the navy will spend its second century will likely bear limited resemblance to the past. As one recent Department of Nation Defence document argues:

The future security environment will offer both opportunities and challenges for military forces. The difficulty not only of maintaining readiness to respond to conventional threats but also of coping effectively with capable non-state actors operating in austere, urban, and littoral battle-spaces will continue to strain conventional forces and call for new capabilities and new approaches.²

Emerging, complex, and previously unforeseen issues render the future security environment as one of uncertainty and challenge. Many of these emerging issues may hold direct relevance to the objectives and operations of the navy and the rest of the Canadian Forces.

¹ Marc Milner, "It Began With Fish And Ships," *Legion Magazine*, <http://www.legionmagazine.com/en/index.php/2004/01/it-began-with-fish-and-ships/> (accessed July 06, 2010).

² *The Future Security Environment, 2008-2030*. (Ottawa: Chief of Force Development, National Defence Headquarters, 2010), 9.

One such issue is climate change. A CDFAI poll conducted in January 2010 found that approximately half of Canadians identify climate change as “a critical threat to the vital interests of Canada in the next ten years.”³ Similar results were found in a 2004 poll, and this year’s results place climate change significantly above other issues considered ‘critical threats,’ like international terrorism (28%), immigrants and refugees (27%) and epidemics (16%).

The public’s apprehension towards climate change seems well-founded, as many of the world’s governments have begun perceiving climate change as a security issue. “Assessments conducted by the intelligence community indicate that climate change could have significant geopolitical impacts around the world, contributing to poverty, environmental degradation, and the further weakening of fragile governments,” states the 2010 US *Quadrennial Defense Review*. “Climate change will contribute to food and water scarcity, will increase the spread of disease, and may spur or exacerbate mass migration.”⁴ Similarly, the 2010 British green paper *Adaptability and Partnership: Issues for the Strategic Defence Review* lists climate change as one of five “major trends impacting the international context for defence in the coming decades.”⁵ The 2009 Australian defence white paper notes that, should the strains of climate change exacerbate existing precursors for conflict, the Australian Defence Force may be used as “an

³ "Threat perceptions in Canada," Canadian Defence and Foreign Affairs Institute, <http://www.cdfai.org/PDF/Poll%20on%20Threat%20Perceptions%20in%20Canada.pdf> (accessed July 6, 2010).

⁴ *Quadrennial Defense Review*, report (US Department of Defence, 2010), 85.

⁵ *Adaptability and Partnership: Issues for the Strategic Defence Review* (London: Ministry of Defence, 2010), 13.

instrument to deal with any threats inimical to our interests.”⁶ Many other countries continue to discuss climate change in the context of their strategic defence planning, making it an issue with prominent security implications.

In Canada, much has been said on the subject of climate change as it relates to Canada’s regulation and control over its Arctic regions, and increased international activity there as a result of melting ice. “The melting ice in the Northwest Passage is going to result in more international shipping in the Arctic,” argues Dr. Rob Huebert, “Canada needs to be prepared for when it comes, or else the world will simply ignore Canada.”⁷ The regulation and control of Canada’s Arctic waters in an era of climate change has received considerable attention from Canada’s government and military. As the 2008 Canada First Defence Strategy states:

In Canada’s Arctic region, changing weather patterns are altering the environment, making it more accessible to sea traffic and economic activity. Retreating ice cover has opened the way for increased shipping, tourism and resource exploration, and new transportation routes are being considered, including through the Northwest Passage.... These changes in the Arctic could also spark an increase in illegal activity, with important implications for Canadian sovereignty and security and a potential requirement for additional military support.⁸

Beyond these conversations on Canadian Arctic sovereignty, little has been said or written about Canada’s context as the rest of the world is affected by climate change. Virtually nothing addresses Canada’s concerns regarding how these effects will be felt on and around the world’s oceans. Indeed, worldwide, there is a serious deficit of knowledge

⁶ *Defending Australia in the Asia Pacific Century: Force 2030* (Canberra: Commonwealth of Australia, 2009), 40.

⁷ Rob Huebert, "As the ice melts, control ebbs in the Arctic," *Globe and Mail*, August 16, 2008.

⁸ *Canada First Defence Strategy* (Ottawa: Department of National Defence, 2008), 6.

in how the security-related impacts of climate change will materialize on water, let alone how to adapt and prepare for those impacts. There exists an intellectual void – internationally, but particularly in Canada – between maritime security and the potential impacts of climate change.

1.1 Objectives and Scope

The objective of this project is to fill the void between perspectives on maritime security and climate change, with particular attention to Canada’s context and strategic interests. Three chief research questions can be posed to identify the research needed to fill this void:

1. What are the security-related impacts of climate change as they pertain to the world’s oceans?
2. How will climate change pertain to Canada’s maritime security interests, beyond issues relating to Arctic sovereignty?
3. How should Canada, and in particular the Canadian navy, best prepare to mitigate or respond to these impacts?

Stated briefly, this project answers the above questions through a set of arguments as follows:

1. a. *First, as climate change exacerbates existing state fragility and conflict – a ‘threat multiplier’ – states will be challenged to continue maintaining internal order and stability. Lawlessness and disorder will result in those states most affected and least resilient. In the case of coastal states, this disorder will*

materialize on the oceans in the form of increased maritime piracy, terrorism, drug-trafficking, and mass migration.

b. *Second, natural disasters will likely increase in both intensity and frequency.*

Given the increasing tendency to use navies for conducting humanitarian assistance and disaster relief operations, navies will increasingly be tasked with responding to natural disasters.

2. a. *Though Canada is geographically far-removed from those states most susceptible to the impacts of climate change, much of Canada's international commerce depends on transportation by sea.* Lawlessness at sea resulting from climate change jeopardizes the safe and secure movement of commercial vessels. This necessitates greater attention by the navy towards fulfilling constabulary functions, to ensure Canada's economic interests are protected.

b. *Utilizing the Canadian navy towards disaster relief and humanitarian assistance offers an opportunity to improve the navy's relevance vis-à-vis the Canadian public, overcoming the oft-lamented 'maritime blindness.'* Public appreciation for the navy has been bolstered significantly in the aftermath of disaster relief operations such as the 2010 response to an earthquake in Haiti. Further, Canada is internationally engaged, with a significant immigrant population at home and many Canadians living abroad. Future pressures from citizens at home and abroad will spur the Canadian government to act; the navy must be well-suited to support such action by fulfilling diplomatic functions like humanitarian assistance.

3. *Preparedness demands a fleet structure for the Canadian navy that can adequately respond to the above impacts, while at the same time avoiding placing new budgetary and personnel demands on the already-strained navy.* The chief force structure recommendation is a departure from a uniform fleet concept based on the single surface combatant – now or in future replacement plans – to include an expeditionary squadron mating the volumetric capacity of a landing ship with the inshore leverage provided by smaller patrol craft and riverine detachments. The squadron can be procured for approximately half the cost of a replacement surface combatant, such as a modern frigate, and requires fewer personnel to operate.

In short, the maritime dimensions of climate change are found to be significant; lawlessness at sea from the coasts of failing or fragile states jeopardizes the safety of maritime commerce, while increased natural disasters will demand greater naval involvement in humanitarian assistance. These consequences of climate change provide an impetus for the Canadian navy to pursue models of planning and procurement that leave it suitably prepared.

This project is concerned with the expeditionary aspects of maritime security and climate change. Climate change is a multifaceted issue, with implications for Canadian security abroad but also at home, and the Arctic presents but one example of the domestic security issues attached to climate change. However, out of concerns for space and the desire to investigate an aspect as of yet unaddressed, the scope of this project is limited to the ‘away game:’ the expeditionary and overseas maritime security implications of climate change.

As it generates policy recommendations for preparedness, this project's attention to reactive measures over preventative measures is not inconsequential. The reasons for neglecting preventative measures are threefold. First, there has already been significant discussion about how to halt or lessen the severity of climate change through 'green' technologies, reduced carbon emissions, and similar proposals. Militaries – including navies – have not been absent from these efforts; between 2012 and 2016, for instance, the US Navy intends to sail "Green Strike Groups" and a "Great Green Fleet," comprised of ships propelled by nuclear energy and biofuels.⁹ This project avoids rehashing the political and technological research already underway into preventing or lessening the impacts of climate change.

Second, as part of the void noted above, no public discourse has addressed the force structures and capabilities necessary to respond to the maritime dimensions of climate change. This project's focus on reactive measures aims to generate discussion in this area of climate change preparedness. Reactive preparedness measures are important elements of planning for climate change which demand greater consideration.

Lastly, and with a degree of pessimism, the years following high-profile preventative efforts like the Kyoto Protocol have seen accelerating increases in carbon emissions rather than reductions.¹⁰ Further, 2009's UN Climate Change Conference in

⁹ "USDA, Navy Sign Agreement to Encourage the Development, Use of Renewable Energy," US Navy, http://www.navy.mil/search/display.asp?story_id=50710 (accessed July 08, 2010).

¹⁰ *World Development Report 2010: Development and Climate Change*, report (Washington: World Bank, 2010), 4.

Copenhagen resulted only in disagreement¹¹ and non-binding objectives to limit increases in global temperatures.¹² Distinctions between natural changes in climate and accelerations through human activities are irrelevant in the context of this project; regardless of the cause, the consequences will likely be the same. However, the lack of international consensus or concerted efforts to reduce potential human contributions to climate change necessitates attention to reactive measures to prepare for the consequences.

1.2 Definitions of Terms

The International Panel on Climate Change's definition of *climate change* is adopted here, as a "change in the state of the climate that can be identified ... by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer."¹³ As noted above, this project does not draw distinctions between natural changes in climate and human contributions or 'anthropogenic climate change.' Concerned primarily with the resulting security implications of climate change, the causes of climate change itself are not immediately relevant.

The *maritime security dimensions of climate change* refer to the overall potential nexus between maritime security and climate change. Defined in greater detail in the third chapter, the proposed nexus identifies connections between the direct geophysical

¹¹ Lenore Taylor, "Climate talks set for failure as China dampens hopes," *The Australian*, December 18, 2009, <http://www.theaustralian.com.au/news/nation/climate-talks-set-for-failure-as-china-dampens-hopes/story-e6frg6nf-1225811570408> (accessed July 08, 2010).

¹² *BBC News*, "Copenhagen deal: Key points," December 19, 2009, <http://news.bbc.co.uk/2/hi/science/nature/8422307.stm> (accessed July 08, 2010).

¹³ "Annex I," Glossary of Terms used in the IPCC Fourth Assessment Report, <http://www.ipcc.ch/pdf/glossary/ar4-wg1.pdf> (accessed July 6, 2010), 943.

qualities of climate change – such as scarcity of resources and increased frequency and intensity of natural disasters – with security-related factors such as state fragility, lawlessness at sea, mass migration, and humanitarian assistance and disaster relief.

The maritime security *consequences* of climate change refer to precisely how, where, and when the tangible security impacts of climate change materialize. Whereas the above maritime security dimensions refer to a theoretical nexus between maritime security and climate change, the consequences point to the actual resulting security issues. The need for differentiation is due to the uncertainty in the consequences. While the proposed nexus is a clear, linear relationship, yet, as the product of speculation and trend analysis, actual policy planning for the maritime security dimensions of climate change is frustrated by unpredictability and uncertainty. Thus, in subsequent chapters that develop models for preparedness, the maritime security consequences of climate change refers to the security issues of lawlessness at sea and natural disasters as they may materialize, uncertainties included.

Preparing for these consequences necessitates greater naval involvement in constabulary and diplomatic functions. These functions – in addition to military functions – comprise the trinity of naval roles as developed by Ken Booth. Discussed in greater detail in the third, fourth, and fifth chapters, constabulary functions see navies acting in policing roles, conducting operations such as counter-piracy. In diplomatic functions, navies conduct non-combat operations aimed to influence foreign governments and populations, the most benign example being through humanitarian assistance and disaster

relief.¹⁴ Diplomatic and constabulary functions are both critical roles for the navy to fulfill in an era of climate change.

Planning for these consequences is centred on the generation of *strategic effects* in the constabulary and diplomatic roles. This may seem paradoxical, as strategic effects are traditionally thought of in a war-fighting context; one definition points to strategic effects as “impacts that the outcomes from wartime operational and tactical events have on the highest level decision-makers.”¹⁵ However, in the context of constabulary functions, strategic effects might be to influence larger populations within a foreign country or distant region, and deter them from pursuing unlawful activities at sea. Similarly, in the case of diplomatic functions, navies contributing to humanitarian assistance and disaster relief may produce strategic effects through bolstering domestic support for the navy, winning support abroad, and ensuring continued stability of foreign states in the aftermath of major natural disasters.

1.3 Methodology and Overview

Developing answers to the questions of how climate change will affect life on the world’s oceans and how to prepare for it is not without challenges. As many national defence documents also state, climate change is a *risk*, one underpinned by uncertainties and variability. It is impossible to say with precision what the impacts of climate change will be, how severe they will be, or where they will be found. Climate change lends this

¹⁴ *Australian Maritime Doctrine: RAN Doctrine 1 - 2010*, 2nd ed. (Sea Power Centre - Australia, 2010), 109.

¹⁵ Maj. David M. Whittemore, "Modeling Strategic Effects in Wargames" (thesis, Air Command and Staff College, 1999), <http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA391221&Location=U2&doc=GetTRDoc.pdf> (accessed July 22, 2010), 1.

uncertainty to any discussion of its maritime dimensions. Further, many of the maritime dimensions that are expected to materialize in the future bear limited semblance to the challenges of the past. Issues like maritime piracy and the use of navies for disaster relief have only gained prominence in the years following the Cold War. In other words, there is no reliable statistical dataset from which to construct a quantitative understanding of the maritime dimensions of climate change.

As a result of the uncertainty attached to climate change and limited experience with emerging issues, this project does not attempt to mount a quantitative argument predicting the maritime dimensions of climate change. Instead, this project generates speculation about future scenarios by analyzing a number of contemporary security trends and case studies that, while not necessarily symptomatic of climate change, are representative of the sorts of scenarios likely to be encountered in the future. Such trends analyzed include ongoing counter-piracy efforts in the Gulf of Aden, continuing drug interdiction in the Caribbean, the evacuation of non-combatants from Lebanon in 2006, and the natural disaster relief efforts in response to the 2010 Haitian earthquake, 2005's Hurricane Katrina, and 2004's Indian Ocean tsunami. Coupled with expert opinion on the security implications of climate change – and an emerging consensus that climate change will act as a 'threat multiplier' to exacerbate existing instability and conflict – these trends help to produce a probable approximation of what relevance climate change will hold for maritime security. Further analyzing these trends for the sorts of attributes needed to effectively respond to them helps to develop a preparedness model and illustrate the demands placed on a future fleet structure.

These predictions and the corresponding policy recommendations are generated over the next five chapters. The first chapter provides a survey of climate change's context in security and defence discussions by way of a literature review. Building from the broad security concerns attached to climate change that are established in the literature review, the second chapter identifies the implications climate change will likely have for maritime security in general, suggesting an emerging nexus between maritime security and climate change. The third chapter frames these implications from a purely Canadian perspective, discussing how Canada, though far-removed geographically from the expected maritime consequences of climate change, nevertheless has a stake in preparing for these consequences. Where the third chapter establishes the impetus for action, the fourth chapter offers policy recommendations – chiefly a revised naval fleet structure – to best prepare Canada to contend with the maritime dimensions of climate change. A concluding chapter offers a summary, recommendations, and suggestions for future research.

Chapter 2.0 Literature Review: Climate Change as a Security Issue?

In recent years, contemporary academic, political, and military circles have been host to a great proliferation of conversations on the security implications of climate change. However, negligible attention has been directed towards the maritime security dimensions of climate change. How climate change will affect life on land is well-discussed, yet how will it affect the use of the seas? Though the broad effects of climate change – for instance, desertification or reduced crop yields – may not directly relate to the maritime domain, those issues may still hold indirect implications for maritime security. It is, therefore, worth considering the overall security implications of climate change *in toto* by way of a literature review.

Though drawing linkages between climate change and security has come increasingly in to vogue in the twenty-first century, the discussion's roots originated around the late 1980s and early 1990s.¹⁶ Many of the early discussions are critical of any possible connections between climate change and security. Among the earliest and most critical commentators is Daniel Deudney. He discounts analytical or causal linkages between conflict and environmental degradation:

Because state and interstate conflict are such central features of both world politics and geopolitical theory, there is a strong tendency for people to think about environmental problems in terms of national security and to assume that environmental conflicts will fit into the established patterns of interstate conflict.¹⁷

¹⁶ Marc A. Levy, "Is the Environment a National Security Issue?" *International Security* 20, no. 2 (Autumn 1995): 35.

¹⁷ Daniel Deudney, "The Case Against Linking Environmental Degradation and National Security," *Millennium Journal of International Studies* 19 (1990): 461.

From this perspective, linkages between security and the environment are out of convenience, not through a true causal relationship.

One of Deudney's chief criticisms of attempts to make environmental degradation a national security issue is the politicization of the discourse. He suggests that "liberals, progressives, and environmentalists" often frame the environment as a national security concern to motivate action.¹⁸ Deudney admits that organized violence or war do have their own implications for environmental degradation (such as greater consumption of resources or direct impacts of violence on nature), but argues that the reverse is untrue: security from violence and security from environmental threats have little in common, rendering linkages between the two as "largely useless for analytical and conceptual purposes."¹⁹

Deudney's position on the conceptual mismatches between national security and environmental degradation is one firmly planted in state-centric realism. National security for Deudney is a concept pertaining to organized violence primarily involving states,²⁰ thus, environmental degradation is incompatible with any serious implications for national security:

...[T]he scope and source of threats to environmental well-being and national-security-from-violence are very different. There is nothing about the problem of environmental degradation which is particularly 'national' in character. Since environmental threats are often oblivious of the borders of the nation-state, they rarely afflict just one nation-state. Nevertheless, this said, it would be misleading to call most environmental problems 'international'. Most perpetrators and victims are within the borders of one

¹⁸ Ibid., 461-2.

¹⁹ Ibid., 463.

²⁰ Ibid., 462.

nation-state. Individuals, families, communities, other species and future generations are harmed. A complete collapse of the biosphere would surely destroy ‘nations’ as well as everything else, but there is nothing distinctively national about either the causes, the harms, or the solutions that warrants us giving such privileged billing to the ‘national’ grouping.²¹

Deudney’s critique might seem most applicable in the late Cold War period in which he writes, but there is an unfortunate degree of anachronism in this perspective; the significance of non-state violence or state vis-à-vis national security is left unconsidered.

Still, Deudney is not alone in offering early critical perspectives of potential linkages between environment and security. Writing in 1995, Mark Levy argues that American proponents of such linkages are classified under three perspectives: the existential, perceiving intimate connections between the global environment and national values; the physical, suggesting direct physical links between the environment and US national security; and the political, warning of longer-term indirect threats posed by environmental degradation.²² Levy suggests that the political perspective – including potential challenges posed by environmental refugees and resource wars – offers the “weakest substantive threat to US security....”²³ Yet at the same time, Levy notes that this perspective presents “the strongest intellectual challenge to the field of security studies.”²⁴

Levy is one of the first to directly address the specific issue of climate change as having consequences for national security. Under his discussion of the physical

²¹ Ibid., 464.

²² Levy, 36.

²³ Ibid., 36.

²⁴ Ibid., 36-7.

perspective, Levy provides an insight into possible consequences of increased temperatures resulting from climate change:

The consequences of such a temperature rise have been estimated for fresh water resources, sea level rise, erosion, wetlands loss, agricultural productivity, air quality, human health, and urban infrastructure. Taken all together, these effects would constitute a security risk if they threatened such a severe upheaval to the domestic economy that Americans would suffer greater hardship than we as a society consider tolerable.²⁵

Like Deudney, however, Levy cautions about hastily linking climate change and security. “Although it makes sense to consider climate change a security threat because of potential economic upheaval and potential loss of American lives,” Levy argues, “it is less clear how doing so enhances the way we think about the threat.”²⁶ To this end, he suggests that drawing such connections does not necessarily spur action. Defence budgets require judgements about the immediacy and urgency of security threats, yet the task of making sound judgements is “enormously difficult.”²⁷ Broadening security to encompass environmental threats, in Levy’s view, only serves to further muddy the waters of security and defence planning.²⁸

Levy suggests that this issue of judgement in driving action is made difficult through the resources and efforts likely required to halt or reverse climate change. “For action on problems like climate change, ... we need a policy-making style more like defense policy than environmental policy,” Levy argues. “Climate change is a problem much more like the problem of containing the Soviet Union; it requires a grand strategy

²⁵ Ibid., 51.

²⁶ Ibid., 53

²⁷ Ibid., 54.

²⁸ Ibid.

to guide actions in the face of distant, uncertain threats, and an overarching commitment from high levels of leadership to stay the course through the ebbs and flows of popular sentiment.”²⁹

As for the political and indirect challenges associated with environmental degradation, Levy remains critical. Taking aim at such authors as Thomas Homer-Dixon,³⁰ Levy perceives a problematic research agenda, suggesting that “[t]he research on environmental degradation and political conflict has failed to generate new findings largely because of the limits inherent in the cases that have been studied.”³¹ Many authors linking conflict with environmental factors, including Homer-Dixon, have limited their scope to nations experiencing both environmental damage and impending or on-going conflict. Levy concedes the importance of the environment in conflict, suggesting “developing country elites fight over renewable resources for the same reason that Willy Sutton robbed banks: that is where the money is.”³² Such approaches fall short, however, in providing palpable policy options or useful clues about causality between environmental degradation and conflict.³³ Further, those trends that are observed and presented as security threats – such as migration due to environmental degradation – see their relevance to US interests downplayed by Levy, arguing that “refugees tend to flee one poor country to seek safe haven in another poor country.”³⁴

²⁹ Ibid.

³⁰ See, e.g., Thomas F. Homer-Dixon, "On The Threshold: Environmental Changes as Causes of Acute Conflict," *International Security* 16, no. 2 (Fall 1991).

³¹ Levy, 56.

³² Ibid., 57.

³³ Ibid.

³⁴ Ibid., 59.

Since Levy's critique in 1995, research into the potential for conflict to be spurred by environmental degradation – and climate change in particular – has greatly expanded. Research has proliferated both in the physical sciences considering the direct environmental ramifications of climate change, and in the social sciences considering the potential social, political, and economic fallout. Interest in climate change as it relates to national security was ignited in 2003 with the release of the now oft-cited³⁵ report by Peter Schwartz and Doug Randall, *An Abrupt Climate Change Scenario and Its Implications for United States National Security*. Commissioned by the US Department of Defense, the report articulates a worst-case climate change scenario that “although not the most likely, is plausible, and would challenge United States national security in ways that should be considered immediately.”³⁶ The Department of Defense's reaction to the report is ultimately unknown, but the report has since received widespread attention and circulation within governments, militaries, and media.³⁷

Schwartz and Randall challenge conventional wisdom on climate change, which they perceive as expecting a slow, gradual increase in temperature to which human society will either adapt to or mitigate the effects through efforts such as the Kyoto protocol. “This view of climate change may be a dangerous act of self-deception,” they

³⁵ At the time of writing, Google returns 178 citations and 17,800 overall hits for the title of Schwartz and Randall's report.

³⁶ Peter Schwartz and Doug Randall, *An Abrupt Climate Change Scenario and Its Implications for United States National Security*, report, <http://www.gbn.com/articles/pdfs/Abrupt%20Climate%20Change%20February%202004.pdf> (accessed May 6, 2010), 1.

³⁷ David Stipp, "The Pentagon's Weather Nightmare: The climate could change radically, and fast. That would be the mother of all national security issues." *Fortune*, February 9, 2004, http://money.cnn.com/magazines/fortune/fortune_archive/2004/02/09/360120/index.htm (accessed July 20, 2010).

argue, “as increasingly we are facing weather related disasters -- more hurricanes, monsoons, floods, and dry-spells – in regions around the world.”³⁸ Schwartz and Randall devise a scenario that, while not the likeliest outcome, effectively illustrates the “impact climate change could have on society if we are unprepared for it.”³⁹ They concede that many scientists would regard their proposed scenario as extreme in both its magnitude and rapidity, but nevertheless argue their scenario as plausible.⁴⁰

Schwartz and Randall’s hypothetical scenario begins with a gradual warming until 2010, resulting in declining sea ice and more frequent and severe storm activity. By 2010, low-lying settlements are at risk of inundation, and changes in water temperature disrupt fish populations. This inundation, storm activity, and reduced access to food result in limited human migration, particularly from Pacific islands and around the Himalayas.⁴¹ Shortly after 2010, large-scale thermohaline ocean currents experience collapse, disrupting precipitation patterns chiefly in eastern North America and Europe, while “mega-droughts” begin in Southern China and Northern Europe.⁴² By 2020, Schwartz and Randall hypothesize a decline in ‘carrying capacity,’ that is, the “ability for the Earth and its natural ecosystems including social, economic, and cultural systems to support the finite number of people on the planet.”⁴³ Declining carrying capacity is a culmination of food shortages from decreased agricultural production, limited availability of fresh water, and decreased access to strategic minerals due to ice or storm activity.⁴⁴

³⁸ Ibid., 4.

³⁹ Ibid., 7.

⁴⁰ Ibid., 7-8.

⁴¹ Ibid., 9.

⁴² Ibid., 11.

⁴³ Ibid., 14.

⁴⁴ Ibid.

Citing Harvard archeologist Steven LeBlanc, Schwartz and Randall suggest causal connections between decreased carrying capacity and conflict:

Drawing on abundant archaeological and ethnological data, LeBlanc argues that historically humans conducted organized warfare for a variety of reasons, including warfare over resources and the environment. Humans fight when they outstrip the carrying capacity of their natural environment. *Every time there is a choice between starving and raiding, humans raid.*⁴⁵

A broad array of hypothetical conflicts materializes in their scenario following a steep decline in carrying capacity after 2020. These include internal or non-state matters like civil strife in China and mass migration from Caribbean islands to the US, as well as more organized formal violence, ultimately culminating in a direct naval confrontation between the US and China in the Persian Gulf following instability in Saudi Arabia.⁴⁶

Schwartz and Randall's suggestion of possible linkages between climate change and conflict has led to a flourishing of research efforts into the potential security implications of climate change. Over the last three years, governments, militaries, and academics alike have seemingly been making up for lost time.⁴⁷ Between March and April 2007 alone, the UN Security Council held its first-ever debates on climate change,⁴⁸ the US Senate commissioned a National Intelligence Estimate on the security implications of climate change,⁴⁹ and a panel of eleven retired US flag officers published

⁴⁵ Ibid., 16. Emphasis added.

⁴⁶ Ibid., 17-18.

⁴⁷ Cleo Paskal, *How climate change is pushing the boundaries of security and foreign policy*, report (Chatham House, 2007), 2.

⁴⁸ *BBC News*, "First climate debate divides UN," April 18, 2007, http://news.bbc.co.uk/2/hi/uk_news/6562251.stm (accessed May 07, 2010).

⁴⁹ "Durbin, Hagel: Global Warming Poses Serious Threat to National Security," US Senator Dick Urban, <http://durbin.senate.gov/record.cfm?id=271514> (accessed May 07, 2010).

a study arguing that climate change poses a serious threat to American national security.⁵⁰ All three of these initiatives arrived at similar conclusions: climate-driven reductions in carrying capacity will increase the likelihood of future conflicts in those regions worst afflicted.

2.1 Reduction in Carrying Capacity

Simultaneously, attention within the scientific community has been directed towards probing possible linkages between climate change and reductions in carrying capacity. In 2008, a paper by David Lobell et al. projected the potential impacts of 20 different climate change models onto international crop yields. The authors suggest that their analysis “points to many cases where food security is clearly threatened by climate change in the relatively near-term.”⁵¹ South Asia and Southern Africa appear most vulnerable, with yields of critical crops expected to decline. Maize production in Southern Africa is predicted to be among the hardest hit, with a median decline predicted to be 30% and worst-case predictions of 40% or more.⁵²

A 2009 paper by David Battisti and Rosamond Naylor considers the potential impacts of higher growing season temperatures on food security. Their concluding remarks add weight and perspective to the predictions of Lobell et al.:

It will be extremely difficult to balance food deficits in one part of the world with food surpluses in another, unless major adaptation

⁵⁰ Gen. Gordon R. Sullivan et al., *National Security and the Threat of Climate Change*, report, <http://securityandclimate.cna.org/report/National%20Security%20and%20the%20Threat%20of%20Climate%20Change.pdf> (accessed May 7, 2010).

⁵¹ David B. Lobell et al., "Prioritizing Climate Change Adaptation Needs for Food Security in 2030," *Science* 319 (February 2008), 610.

⁵² *Ibid.*, 609.

investments are made soon to develop crop varieties that are tolerant to heat and heat-induced water stress and irrigation systems suitable for diverse agroecosystems.⁵³

While Lobell et al. suggest that adaptation is feasible in the face of declining yields by switching to crops better suited for rising temperatures, Battisti and Naylor are less optimistic:

The genetics, genomics, breeding, management, and engineering capacity for such adaptation can be developed globally but will be costly and will require political prioritization. National and international agricultural investments have been waning in recent decades and remain insufficient to meet near-term food needs in the world's poorest countries, to say nothing of longer-term needs in the face of climate change.⁵⁴

Climate change therefore seems poised to impact the capacities of nations to adequately feed their populations, posing the possibility of food scarcity or famine.

Yet, as noted by Schwartz and Randall, declining crop yield is not the only dilemma posed by climate change. Issues surrounding water are also poised to reduce carrying capacity. The Intergovernmental Panel on Climate Change published a substantial report on climate change and water in 2008. The potential effects outlined in the report are widespread, both in geography and in nature. Effects will potentially manifest themselves in such phenomena as increased frequency and severity of floods,⁵⁵ the level and quality of groundwater,⁵⁶ expanding coverage and frequency of droughts,⁵⁷

⁵³ David S. Battisti and Rosamond L. Naylor, "Historical Warnings of Future Food Insecurity with Unprecedented Seasonal Heat," *Science* 323 (January 2009): 244.

⁵⁴ Ibid.

⁵⁵ Bryson Bates et al., *Climate Change and Water*, technical paper no. 6 (Geneva: Intergovernmental Panel on Climate Change, 2008), 37.

⁵⁶ Ibid., 38.

⁵⁷ Ibid., 42.

reduced water quality in lakes and streams,⁵⁸ erosive heavy rainfall,⁵⁹ increased intensity and frequency of tropical cyclones,⁶⁰ and many others. The resulting implications for human health are troubling:

...[I]ncrease in morbidity and mortality rates from water-borne diseases for both more humid and drier scenarios is expected, owing to an insufficient supply of potable water ... and the greater presence of pathogens conveyed by high water flows during extreme precipitation.⁶¹

The problems associated with water in a climate change scenario, then, are complex and far-reaching. The IPCC has compiled these potential problems and their extended effects, adapted and presented here as figure 1.

⁵⁸ Ibid., 43.

⁵⁹ Ibid.

⁶⁰ Ibid., 41.

⁶¹ Ibid., 70.

Phenomenon	Examples of major projected impacts by sector			
	Agriculture, forestry and ecosystems	Water resources	Human health	Industry, settlements and society
Heavy precipitation events: frequency increases over most areas	Damage to crops; soil erosion; inability to cultivate land due to waterlogging of soils	Adverse effects on quality of surface and groundwater; contamination of water supply; water scarcity may be relieved	Increased risk of deaths, injuries and infectious, respiratory and skin diseases	Disruption of settlements, commerce, transport and societies due to flooding; loss of property
Area affected by drought increases	Land degradation, lower yields/crop damage and failure; increased livestock deaths; increased risk of wildfire	More widespread water stress	Increased risk of food and water shortage; increased risk of malnutrition; increased risk of water- and foodborne diseases	Water shortages for settlements, industry and societies; reduced hydropower generation potentials; potential for population migration
Intense tropical cyclone activity increases	Damage to crops; windthrow (uprooting) of trees; damage to coral reefs	Power outages causing disruption of public water supply	Increased risk of deaths, injuries, water- and foodborne diseases; post-traumatic stress disorders	Disruption by flood and high winds; potential for population migrations; loss of property

Figure 1: Potential consequences of water-related climate change phenomena⁶²

2.2 Security Implications

The discussions by Schwartz and Randall, Lobell et al., Battisti and Naylor, and the IPCC indicate that climate change has the potential to produce a number of effects, ranging from reduced carrying capacity in water and food to increased and more intensive storm activity. As Schwartz and Randall suggest, it is not the direct and immediate impacts of climate change – e.g. higher temperatures or rising sea levels – that prove problematic from a security perspective. Rather, it is these extended effects such as the reduction of carrying capacity that will come with security implications attached.

⁶² Adapted from Bates et al., 41.

Increasing attention has been paid to understanding the impacts of climate change and how they relate to security. Oli Brown et al. suggest that “in just the past few years, the language of climate change has shifted once again. Climate change is now being recast as a threat to international peace and security.”⁶³ This was made evident in a 2007 report by the United Nations Environment Programme environmentally assessing the conflict in Sudan. The report suggests that the pastoralist societies in Darfur and Kordofan have been subject to significant stress by declining precipitation.⁶⁴ Climate change is found to be one driving variable in regional conflict:

Environmental degradation, as well as regional climate instability and change, are major underlying causes of food insecurity and conflict in Darfur – and potential catalysts for future conflict throughout central and eastern Sudan and other countries in the Sahel belt.

Setting aside all of the social and political aspects of the war in Darfur, the region is beset with a problematic combination of population growth, over-exploitation of resources and an apparent major long-term reduction in rainfall. As a result, much of northern and central Darfur is degraded to the extent that it cannot sustainably support its rural population.⁶⁵

The case of Darfur illustrates a potential causal link between conflict and environmental degradation or climate change. If climate change is indeed at work in Darfur, reductions in carrying capacity may be producing instability and conflict, as predicted by Schwartz and Randall.

⁶³ Oli Brown, Anne Hammill, and Robert McLeman, "Climate change as the 'new' security threat: implications for Africa," *International Affairs* 83, no. 6 (2007): 1141.

⁶⁴ *Sudan: Post-Conflict Environmental Assessment*, report (Nairobi: United Nations Environment Programme, 2007), 9.

⁶⁵ *Ibid.*, 329.

However, Brown et al. caution about drawing direct and impromptu connections between climate change fallout and conflicts. “[W]hile drought in Darfur has undoubtedly brought rival groups into competition for resources,” they argue, “that dynamic alone cannot explain the violence there.”⁶⁶ They particularly note that scarcity of resources and resource competition in other regions, such as northern Nigeria, have produced only localized, low-level violence.⁶⁷ Though climate change is useful as an explanatory mechanism for a conflict *after the fact*, its utility in predicting conflict is challenged by a range of intervening variables, such as absorptive and adaptive capacities, existing environmental degradation (e.g., deforestation), government stability, and existing or on-going intrastate conflicts. To these ends, they caution that “we should be extremely cautious before assuming a straight-line progression from scarcity to conflict *will* ensue across Africa.”⁶⁸

This warning has been heeded by other researchers, who now seek vulnerabilities and predispositions for conflict in states which may in turn be exacerbated by the impacts of climate change. Among the most recent and comprehensive attempts to consider states and their potential vulnerabilities to climate change is Jeffrey Mazo’s *Climate Conflict*. In particular, Mazo offers three variables affecting a particular state’s risk of failure due to climate change: “the degree of exposure to specific physical impacts, the sensitivity of the economy or society to those impacts, and the ability (capability and willingness) to adapt.”⁶⁹

⁶⁶ Brown et al., 1148.

⁶⁷ Ibid.

⁶⁸ Ibid.

⁶⁹ Jeffrey Mazo, *Climate Conflict: How global warming threatens security and what to do about it* (Abingdon: Routledge, 2010), 104.

Mazo identifies over a dozen ‘states of concern,’ which are simultaneously most vulnerable to climate change and weak, fragile, or failing. Weak, fragile, and failing states are those with various arrangements of deteriorated living standards, shortages of foreign exchange, corruption, subversion of democratic norms, break-downs in civil society and most state institutions, and ethnic tensions.⁷⁰ Mazo characterizes resulting state failure as a decline in state legitimacy with civil war or total collapse of a state.⁷¹ He finds the highest correlation between state fragility and vulnerability to climate change is in sub-Saharan Africa, where over two thirds of the states of concern are found. Those outside of sub-Saharan Africa include Afghanistan, Pakistan, Iraq, and Haiti.⁷² The result for these ‘states of concern’ is clear: in regards to sub-Saharan Africa, Mazo suggests that “climate change over the next few decades will contribute to continued volatility, instability and conflict in the region, and perhaps to a quantitative change in violence....”⁷³

Authors like Deudney inadequately evaluate environmental degradation as a causal factor in generating conflict, instead opting to ultimately examine environmental degradation as a direct danger to national security. Deudney’s rivals – namely Schwartz, Randall, and Mazo – hypothesize a ‘trickle-down’ of the effects of climate change down to security implications. Their discussion of carrying capacity is a useful articulation of the complex and intervening causal mechanisms potentially linking climate change with conflict. Contrary to Deudney, in this perspective it is not climate change or environmental degradation itself that is the threat to national security. Rather, the threat is

⁷⁰ Ibid., 88.

⁷¹ Ibid., 89.

⁷² Ibid., 106-108.

⁷³ Ibid., 110.

indirect and occurs across three interconnected tiers, as illustrated in figure 2. Climate change sits in the first tier, leading to a reduction of carrying capacity in the second tier. Scarcity of food, water, and energy in the second tier, in turn, produces national security implications in the third tier.

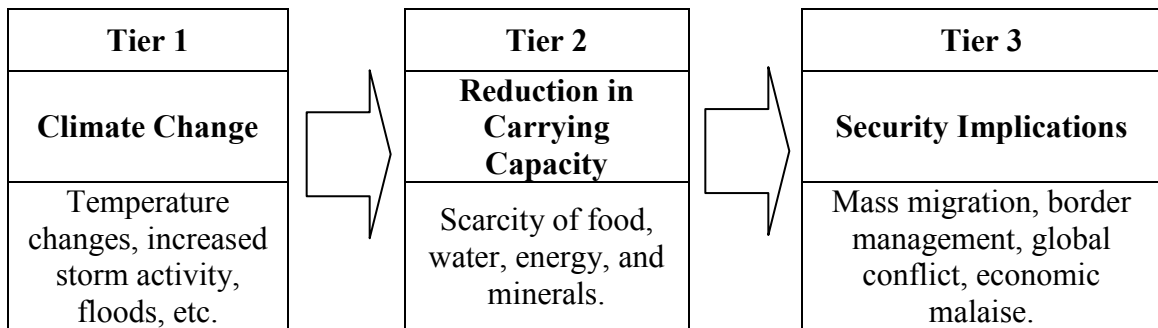


Figure 2: Suggested causal links between climate change and conflict⁷⁴

Why should the West be concerned with the impacts of climate change, particularly if they might only lead to conflict and instability on other continents? Canada, for instance, is listed neither as fragile nor particularly vulnerable to climate change in Mazo’s discussion. In fact, some models forecasting changes in crop yields suggest longer and more bountiful growing seasons in Canada, particularly in the higher latitudes.⁷⁵ Yet the security dilemmas associated with climate change are increasingly becoming framed as both relevant and important for Western states. The US Department of Defense recognized in the 2010 *Quadrennial Defense Review* that climate change “will shape the operating environment, roles, and missions that we undertake.”⁷⁶ Mazo argues that the impacts of climate change have implications far beyond the borders of those states worst hit; “when it comes to state instability and the aggregate threat it poses to

⁷⁴ Adapted from Schwartz and Randall, 3.

⁷⁵ Martin Parry et al., "Climate change and world food security: a new assessment," *Global Environmental Change* 9 (1999): 63.

⁷⁶ *Quadrennial Defense Review*, 84.

international order,” he states, “climate change is indeed a threat multiplier.”⁷⁷ In addition to these enhanced risks of state failure and instability, security concerns attached to climate change have also been framed under issues of mass migration and disaster relief, each discussed here in turn.

Climate-induced mass migration is the focus of a 2007 article by Paul J. Smith. He notes that storm activity, droughts, and sea-level change are directly associated with human migration and population displacement.⁷⁸ Smith argues that these associations are illustrated by a significant storm event like 1998’s Hurricane Mitch, though it may be unrelated to climate change: Mitch left 9,000 people in Central America dead and 4.2 million Hondurans without water. Approximately 80,000 Hondurans left their country in search of refuge elsewhere, namely the US.⁷⁹ Similarly, Smith notes, in 1994 the US was faced with a “sudden upsurge of thousands of migrants on boats and rafts”⁸⁰ originating from Haiti and Cuba. As a result, the US was prompted to “implement a number of military operations to deter and manage the influx.”⁸¹ In an era of climate change, then, Western nations are likely to find themselves the destination of frequent and sudden surges of displaced migrants. Smith argues that these surges will demand the use of military forces for interdiction operations and migrant processing, reflecting the US response to the Haitian and Cuban exodus of 1994.⁸² The flexibility and wide range of

⁷⁷ Mazo, 126.

⁷⁸ Paul J. Smith, "Climate Change, Mass Migration and the Military Response," *Orbis* 51, no. 4 (Fall 2007): 625.

⁷⁹ *Ibid.*, 624.

⁸⁰ *Ibid.*, 627.

⁸¹ *Ibid.*

⁸² *Ibid.*, 630.

capabilities inherent in militaries make them well-suited to responding to the security and humanitarian dilemmas presented in a migrant crisis.⁸³

Governments are increasingly committing militaries to recovery and relief after major weather events, both domestically and abroad. Mazo notes that the US military deployed troops internationally to Honduras following Hurricane Mitch and to Haiti after Hurricane Jeanne in 2004. Internally, US troops were deployed to the Gulf States following Hurricane Katrina in 2005. Militaries around the world were also involved in the responses to the 2004 Indian Ocean tsunami, the 2005 Kashmir earthquake, Cyclone Nargis in 2008, and the Haitian earthquake in 2010.⁸⁴ The use of militaries in disaster relief has relevance to climate change, given the increase in the last few decades of climatological disasters such as floods and cyclones. The frequency of these disasters is increasing independently of non-climatological disasters such as earthquakes, as indicated below in figure 3.

⁸³ "Migrant Interdiction," US Coast Guard, <http://www.uscg.mil/hq/cg5/cg531/amio.asp> (accessed July 21, 2010).

⁸⁴ Mazo, 128.

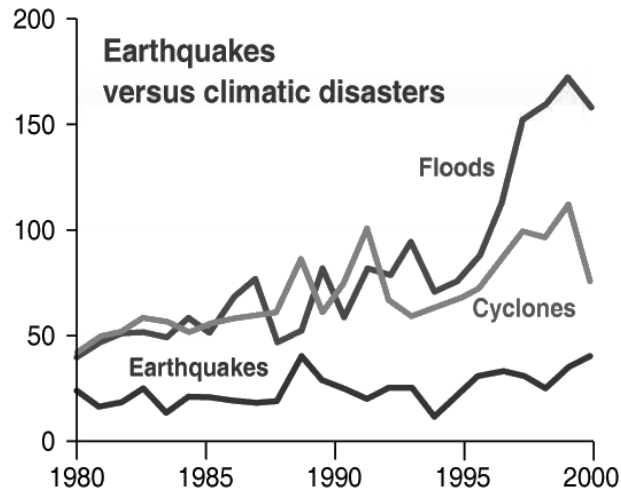


Figure 3: Climatological natural disasters vs. earthquakes⁸⁵

Militaries will continue to fulfill pivotal roles in disaster relief: as Mazo notes, “militaries are often the only institution with the capacity to deploy rapidly in response to humanitarian crises caused by natural disasters....”⁸⁶

2.3 Literature Review Conclusions

Research on potential security dilemmas associated with climate change has had a brief but varied history. Efforts span from Deudney’s denial that small-scale internal conflicts prompted by environmental degradation threaten national security, to Schwartz and Randall’s scenario illustrating the risks associated with reductions in carrying capacity, to Mazo’s survey of ‘states of concern’ being those states both at risk of failing and most vulnerable to climate change. Three brief but important conclusions result from the research presented here:

⁸⁵ "Trends in natural disasters," UNEP/GRID-Arendal Maps and Graphics Library, <http://maps.grida.no/go/graphic/trends-in-natural-disasters> (accessed July 22, 2010).

⁸⁶ Ibid, 127.

1. As Schwartz and Randall argue, it is not the direct and quantifiable effects of climate change such as changing temperatures that challenge security. Rather, it is the extended effects, such as drought and storm activity, and their impact on human society that are relevant to security concerns.
2. According to Mazo, these extended effects of climate change have considerable potential to serve as ‘threat multipliers.’ Climate change is likely to exacerbate or accelerate instability, conflict, and volatility in those ‘states of concern’ which are simultaneously most vulnerable to the impacts of climate change and are already fragile or failing.
3. Militaries can be expected to be increasingly involved in mitigating the security issues attached to climate change. As both Smith and Mazo suggest, militaries are frequently deployed – both domestically and internationally – to respond to natural disasters, and militaries find themselves summoned to respond to surges of migrants, both for interdiction and processing. The capabilities and flexibility inherent in militaries make them well-poised to mitigate the wide range of security-related impacts of climate change.

To these ends, and with recent developments like the inclusion of climate change in the 2010 *Quadrennial Defense Review* as one trend which may “spark or exacerbate future conflicts”⁸⁷ and the creation of the US Navy’s Task Force Climate Change,⁸⁸ climate change is cemented as an issue with prominent implications for security. Still, few if any

⁸⁷ *Quadrennial Defence Review*, 7.

⁸⁸ Bob Freeman, "Navy Task Force Assesses Changing Climate," *American Forces Press Service*, July 31, 2009, <http://www.defense.gov/news/newsarticle.aspx?id=55327> (accessed May 18, 2010).

discussions have addressed what these security implications mean for the future use of the seas. Carrying the above conclusions forward to consider the maritime security dimensions of climate change, what are the security implications for the specificities and peculiarities of the maritime domain? What utility will navies have in an era of climate change? What is Canada's stake in the maritime security dimensions of climate change, and how can it best prepare for the consequences?

Chapter 3.0 Maritime Dimensions of Climate Change

Climate change comes with significant security implications attached, through its potential to exacerbate or accelerate mass migration, conflict, and state failure. Discussion about these implications centres almost entirely on these effects as they are felt and pertain to life *on land*. The world's oceans are neglected so far in conversations about the security issues of climate change, except as they relate to potential sovereignty disputes resulting from receding Arctic ice coverage. However, the oceans will also be host to their own unique impacts of climate change. Chiefly, the security-related impacts of climate change will materialize on the seas in two ways. First, as climate change exacerbates existing volatility and conflict within states, lawlessness and insecurity in coastal states most impacted will spill over into the maritime domain, posing challenges for neighbouring states and international maritime commerce. Second, as natural disasters increase in intensity and frequency, nations will increasingly be tasked to deliver humanitarian assistance and disaster relief via the seas.

Proximity to oceans is a significant factor in why the seas must be an important component of discussions on security and climate change. Of Mazo's eighteen 'states of concern' – those states both most vulnerable to the impacts of climate change and failing or fragile – eleven of them have ocean coastlines.⁸⁹ Of those eleven, six – Liberia, Somalia, the Democratic Republic of Congo, Pakistan, Iraq, and Haiti – have been host to military intervention, peacekeeping, or disaster relief from Western nations within the last two decades. One nation – Somalia – remains an ongoing maritime security dilemma

⁸⁹ Mazo, 106-8.

due to the prominence of piracy off its shores. Lastly, one coastal state of concern – Pakistan – possesses nuclear weapons. That the above nations border oceans poses significant implications in how they can and do interact with other nations.

The world's oceans are relevant to discussions about climate change and security for their function as a medium between states and people. As 2007's *A Cooperative Strategy for 21st Century Seapower* argues, oceans connect people, supporting over 90% of the world's trade, and carrying the lifeblood of a "global economic system that links every country on earth."⁹⁰ "Covering three-quarters of the planet," it continues, "the oceans make neighbors of people around the world."⁹¹ In the context of climate change, the function of oceans as a medium is observable in two ways. First is the tendency for crime and conflict on land to be translated onto the oceans. An ocean then becomes a medium or 'enabler' for illicit activities, whether such activities may be focused against nearby sea lines of communication (e.g. maritime trade and commerce) or directly against regional neighbours. Second is the frequency in which nations deploy military assets, particularly in response to natural disasters, by sea. National military and paramilitary sea services – including navies, coast guards, and marines – are often involved in providing humanitarian assistance and disaster relief. Indeed, relief efforts in response to nearly every major natural disaster within the last two decades have included at least some naval component, whether it be for transport of goods and people, for basing command and control facilities, or simply the provision of small boats and aircraft.

⁹⁰ United States of America, United States Marine Corps, United States Dept. of the Navy, United States Coast Guard, *A Cooperative Strategy for 21st Century Seapower*. (Washington, 2007), 4.

⁹¹ Ibid.

The connectedness provided by the world's oceans makes climate change a maritime security dilemma. The capacity for lawlessness and disaster relief to move across the world's oceans means that coastal states vulnerable to climate change may evolve into significant security concerns of other states. This resulting dynamic – the maritime dimensions of climate change – is the focus of the rest of the discussion in this chapter.

3.1 The Sea as a Medium for Crime and Violence

For nearly as long as humans have taken to the world's oceans, so too have crime and conflict been found there.⁹² Historically, lawlessness in coastal states contributes to crime and conflict on the world's oceans: ancient coastal communities and maritime commerce in the Mediterranean and Caribbean were harassed by pirates and raiders. Similarly, over the last decade sea lanes in the Gulf of Aden, the Strait of Malacca, and elsewhere have been host to significant amounts of maritime crime and piracy. Should climate change exacerbate volatility and instigate conflict in fragile states with commensurate increases in the risks of state failure,⁹³ the corollary is that coastal regions of those afflicted states will in turn become host to increased crime and conflict.

When Sir Julian Corbett suggested that “men live upon the land and not upon the sea,”⁹⁴ it was to demonstrate that naval fleets were intended to influence events on land. The reverse is nevertheless true: events, circumstances, and outcomes on land influence activities at sea. This is underpinned in Smith's discussion of mass migration resulting

⁹² Henry A. Ormerod, *Piracy in the Ancient World: an Essay in Mediterranean History* (Baltimore: Johns Hopkins University Press, 1997), 13.

⁹³ Mazo, 126.

⁹⁴ Julian Corbett, *Some Principles of Maritime Strategy* (Mineola: Dover Publications, 2004), 14.

from climate change, where mass migration to the US from Haiti in 1994 was spurred by political instability. Today, when governments lack capabilities and capacities to enforce peace and order outward from their own shores, citizens are then free to move into the maritime domain and carry out illicit activities there. Off the coast of a failed state, crime, piracy, and terrorism are free to thrive; principles of maritime sovereignty generally forbid one nation from taking action against criminals within the territorial waters of another nation.⁹⁵ The result is a ‘slop-over’ effect, where lawlessness within a failed state permeates into coastal regions of a state and beyond to the oceans, posing challenges for neighbouring states and legitimate users of waterways.

This correlation between the collapse of peace, order, and good governance on land and the rise of lawlessness on the sea is best and most recently illustrated by the case of Somalia. With a government that has been effectively powerless since a 1991 coup and stricken with civil war and anarchy,⁹⁶ today Somalia and its surrounding waters are host to more than half of the world’s pirate activity.⁹⁷ The capacity and capability of the Somali government to enforce order has degraded so dramatically that pirates are able to establish coastal enclaves and anchor hijacked vessels near the Somali coast without fear of punishment. Permission for outside states to take punitive measures against pirates

⁹⁵ See, e.g., "UN Convention on the Law of the Sea," United Nations, Section 3, http://www.un.org/Depts/los/convention_agreements/texts/unclos/part2.htm (accessed May 19, 2010). This was made evident off Somalia, where, until 2008, foreign navies and security forces were not legally permitted to pursue pirates within Somalia’s territorial waters.

⁹⁶ See, e.g., Peter T. Leeson, "Better off stateless: Somalia before and after government collapse," *Journal of Comparative Economics* 35, no. 4 (December 2007): 695.

⁹⁷ *Piracy and Armed Robbery Against Ships*, report no. 2009 (London: ICC International Maritime Bureau, 2010), 5-6.

within Somalia's territorial waters was eventually granted in 2008,⁹⁸ yet the problem of piracy in the region has actually escalated since then. As dozens of ships continue to be hijacked and ransomed for millions of dollars, piracy remains a substantial source of frustration for Western governments.

A state need not be in an absolute condition of disorder and lawlessness for its citizens to make use of the sea for illicit activities. An example is Pakistan, which, while ranking among the ten worst countries on the Fund for Peace's Failed State Index,⁹⁹ possesses a relatively functional navy with a broad range of capabilities. Yet Pakistan's difficulty in ensuring security in and around its coast culminated on 23 November 2008, when ten Islamic extremists departed from Karachi by boat and hijacked an Indian trawler within India's territorial waters. Using the hijacked trawler to penetrate Indian security screens, the extremists arrived in Mumbai on 26 November and proceeded to kill 166 people and wound over 300 more across two days.¹⁰⁰ This case demonstrates not only the dilemmas that state fragility on land can pose even for effectively functioning security forces at sea, but also the capacity for lawlessness in one country to transmit across the seas and have deadly consequences for another.

Even in an effectively functioning state system, oceans and waterways are used for the transportation of illicit goods, particularly illegal drugs. Over the last several

⁹⁸ Colum Lynch, "United Nations Authorizes Military Raids on Somali Pirates," *Washington Post*, December 17, 2008, <http://www.washingtonpost.com/wp-dyn/content/article/2008/12/16/AR2008121602848.html> (accessed May 19, 2010).

⁹⁹ "Failed State Index Scores 2009," Fund for Peace, http://www.fundforpeace.org/web/index.php?option=com_content&task=view&id=391&Itemid=549 (accessed May 25, 2010).

¹⁰⁰ *IBNLive*, "Blunder at sea made Mumbai attack possible," December 7, 2008, <http://ibnlive.in.com/news/blunder-at-sea-made-mumbai-attack-possible/79910-3.html> (accessed May 19, 2010).

decades, illegal drugs entering the United States have most frequently moved by sea; in 2009, the US Coast Guard interdicted 58 vessels involved in trafficking drugs and seized 71,000 pounds of marijuana and 352,000 pounds of cocaine. The fact that these seizures account for half of all US-bound drugs intercepted illustrates how the illicit drug trade is largely a maritime problem.¹⁰¹

As capacities and capabilities to enforce law and order are challenged in an era of climate change, greater amounts of maritime crime and conflict can be expected. Those states of concern identified by Mazo will likely find themselves host to heightened levels of crime and violence, and those with coastlines will see their lawlessness spread unchecked into the maritime domain. Increased frequency and geographic distribution of piracy, drug trafficking, terror attacks, smuggling, and similar illicit activities become the likely maritime consequences of climate change.

Even where weak or failing states have little to no direct bearing on the interests and activities of other nations, the function of oceans as a medium enabling global connectedness means that a failed state's access to the sea poses potential international problems. Consider, for instance, maritime piracy and terrorism as jeopardizing the safe and sustained movement of international maritime trade. Below, in figure 4, an equatorial segment of the Atlantic and Indian Oceans is shown, illustrating concentrations of shipping; the lightest clusters of lines indicate the highest concentrations of shipping. Superimposed are shaded discs, each centred on the coast of Mazo's states of concern. The radius of each disc is approximately 500 nautical miles, representing both the typical

¹⁰¹ "Migrant Interdiction (CG-5313)," United States Coast Guard, <http://www.uscg.mil/hq/cg5/cg531/Drugs/stats.asp> (accessed May 19, 2010).

outer limit of pirate attacks off the coast of Somalia¹⁰² as well as the approximate distance Islamic extremists in Karachi travelled to reach Mumbai in November 2008. These discs serve to illustrate the geographical reach – and potential jeopardy for international maritime commerce – of lawlessness at sea in the event of state fragility or failure. Discs overlap significant concentrations of shipping in the Caribbean Sea, the Guinea Coast, the Indian Ocean, and the Arabian Gulf, indicating the possibility of elevated insecurity for shipping in those regions.

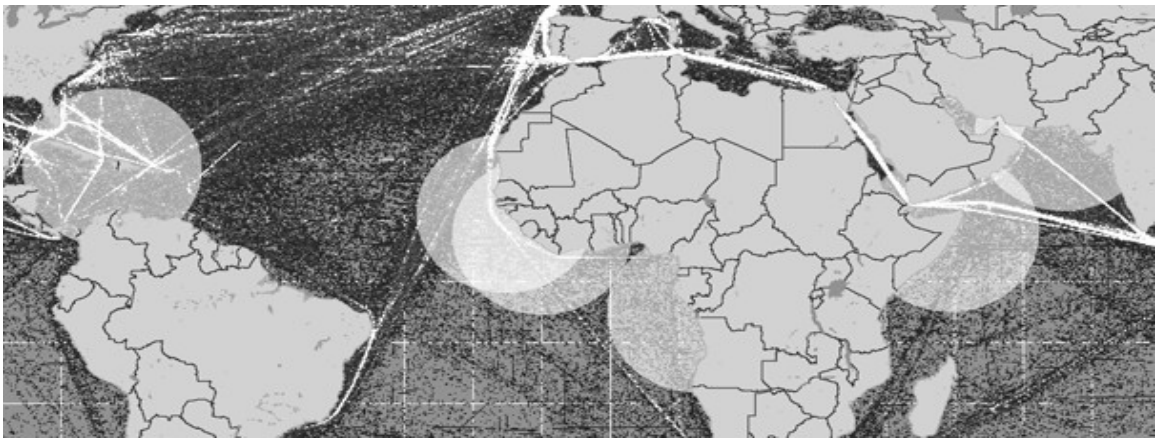


Figure 4: The potential reach of lawlessness from Mazo’s ‘states of concern’¹⁰³

There is already high demand for the involvement of the sea services in what Ken Booth identifies as ‘policing’ functions, or constabulary functions as they are known in contemporary discourse. Constabulary functions, comprising Booth’s ‘trinity’ of naval functions along with military and diplomatic functions, are characterized as “the maritime version of the work of the police, border guards, and the idea of ‘military aid to the civil

¹⁰² "Pirates Map: Hot Spots Off Somalia," New York Times, <http://www.nytimes.com/interactive/2009/04/17/weekinreview/0419-pirates.html?scp=3&sq=unosat&st=cse> (accessed June 03, 2010).

¹⁰³ Map and shipping data via "Travel time to major cities: A global map of Accessibility," European Commission, <http://bioval.jrc.ec.europa.eu/products/gam/sources.htm> (accessed June 2, 2010).

authority.”¹⁰⁴ Today, operations falling under constabulary functions include peace operations, enforcing sanctions and embargoes, counter-piracy, and maritime barrier operations.¹⁰⁵ Many modern sea services are actively involved in constabulary functions to counter lawlessness at sea; counter-piracy efforts in the Gulf of Aden, for instance, currently constitute three international maritime task forces and as many as a dozen warships at a given time.

Several attributes of vessels employed by the sea services makes them well-suited for these roles. Vessels possess mobility, sustained reach, and ability to poise, meaning they can travel great distances to reach conflict-prone regions and can remain on station for prolonged periods. Many naval forces have well-practiced joint and combined attributes, permitting a vessel to operate in conjunction and cooperation with land and air forces of its own nation or of other nations.¹⁰⁶ Further, naval presence can be conducted with high visibility, bringing with it elements of coercion and deterrence to dissuade further illicit activities.¹⁰⁷ Perhaps most importantly, a naval presence is able to project leverage: navies have “disproportionately greater effect on events occurring on land,”¹⁰⁸ and so they may influence, coerce, and deter populations to prevent the use of the sea for lawlessness. Due to their suitability and experience in these constabulary functions, navies and coast guards worldwide will likely find themselves more frequently tasked to contend with lawlessness at sea.

¹⁰⁴ Ken Booth, *Navies and Foreign Policy* (New York: Holmes & Meier Publishers, 1979), 17.

¹⁰⁵ *Australian Maritime Doctrine: RAN Doctrine 1 - 2010*, 100.

¹⁰⁶ *MCP 1 Naval Doctrine Manual*. Canadian Forces College, 2006, 4/17-4/18.

¹⁰⁷ *Australian Maritime Doctrine: RAN Doctrine 1 – 2010*, 111-2.

¹⁰⁸ *MCP 1 Naval Doctrine Manual*, 4/17.

However, the era of climate change demands a division of labour by the world's sea services between constabulary functions and the other functions comprising Booth's trinity. In other words, although maritime security forces will have greater levels of maritime crime and conflict with which to contend, they may be required to divide their time and allot fewer resources towards these challenges. Diplomatic functions – namely humanitarian assistance and disaster relief – will likely also contend for resources in an era of climate change. As Mazo notes, typically only militaries have the capabilities and capacities to quickly respond to a crisis like a major natural disaster.¹⁰⁹ If natural disasters increase in frequency and intensity as a result of climate change, militaries will likely find increased demand for resources to be allocated towards responding to such disasters. This is especially true given the current trend of using military power – particularly the sea services – towards humanitarian assistance and disaster relief.

3.2 The Sea as a Medium for Humanitarian Assistance and Disaster Relief

Globally, maritime security forces are playing an increasing role in delivering humanitarian assistance and disaster relief. In the wake of highly destructive natural disasters around the world, navies and coast guards are either among the first to arrive on scene, or make the most substantial contributions to relief efforts. The possibility, then, for natural disasters to increase in an era of climate change has significant implications for the world's sea services; as noted above, navies and coast guards will be in greater demand to respond to the more intense and more frequent natural disasters expected to result from climate change.

¹⁰⁹ Mazo, 127.

Providing humanitarian assistance and disaster relief constitutes part of the ‘diplomatic’ side of Booth’s trinity of naval functions. Booth suggests that “the range of functions within [the diplomatic role] encompasses actions with a degree of implicit or explicit coercion ... to actions promising reward ... to actions seeking to oil the wheels of relationships by improving an image.”¹¹⁰ Booth himself offers little on the subject of natural disasters and humanitarian aid, suggesting only that ‘naval aid’ – including the gifting of warships, port-clearing, and similar activities – is a prestige-building activity which “should not be mistaken for the achievement of influence” over other states.¹¹¹ However, the current reality is that, in the 30 years since Booth wrote, humanitarian assistance and disaster relief have been firmly embedded in the diplomatic functions of navies; in its discussion of diplomatic functions, for instance, the *Australian Maritime Doctrine* suggests that “[d]isaster relief is one of the many activities to which naval forces can be expected to make an immediate and effective contribution with little or no warning.”¹¹²

This reality is increasingly being codified in the strategic guidance of some of the world’s most progressive navies. In 2007’s *A Cooperative Strategy for 21st Century Seapower*, the leadership of the American sea services – the US Navy, Coast Guard, and Marine Corps – signalled a commitment to humanitarian assistance and disaster relief by establishing them as part of their six core capabilities:

Building on relationships forged in times of calm, we will continue to mitigate human suffering as the vanguard of interagency and multinational efforts, both in a deliberate, proactive fashion and in response to crises. Human suffering

¹¹⁰ Booth, 19.

¹¹¹ *Ibid.*, 260.

¹¹² *Australian Maritime Doctrine: RAN Doctrine 1 - 2010*, 110.

moves us to act, and the expeditionary character of maritime forces uniquely positions them to provide assistance. Our ability to conduct rapid and sustained non-combatant evacuation operations is critical to relieving the plight of our citizens and others when their safety is in jeopardy.¹¹³

Several attributes of vessels employed by navies and coast guards make them well-suited to providing relief in the aftermath of humanitarian crises and natural disasters. Firstly, they possess great mobility, able to move freely to wherever a coastline is found. This attribute is significant, given that ocean covers nearly three quarters of the Earth's surface and only about one quarter of nations are landlocked. Secondly, as in the case with constabulary functions, sustained reach grants the logistical capacity to deploy to disaster-stricken areas quickly and for long periods of time. As Doug Thomas notes, navy ships are "self-contained, self-supporting platforms that house a broad spectrum of talented and well-trained people," and possess "superb communication and coordination capabilities."¹¹⁴ Vessels deploying to respond to disasters typically come self-contained with the personnel, equipment, and supplies necessary for sustained deployments. Lastly, substantial volumetric capacity makes vessels an ideal way to move large quantities of relief aid and machineries; many modern logistical vessels, for instance, can hold several times the cargo of even the largest military aircraft.¹¹⁵ The value of these attributes is made clear in examples below of the sea services responding to natural disasters.

¹¹³ *A Cooperative Strategy for 21st Century Seapower*. 14.

¹¹⁴ Doug Thomas, "Responding to Disaster," *Canadian Naval Review* 1, no. 3 (Fall 2005): 31.

¹¹⁵ *MCP 1 Naval Doctrine Manual*, 4/17-4/18.

On the morning of 12 January 2010, Haiti was struck by a 7.0 magnitude earthquake centred 15 miles from the capital Port-au-Prince.¹¹⁶ The earthquake is estimated to have killed over 220,000, injured 300,000, destroyed 97,000 houses, and displaced 1.3 million Haitians.¹¹⁷ The first respondents were two US Coast Guard cutters – *Forward* and *Mohawk* – which arrived in Haitian waters early the day following the earthquake. Although the earthquake had inflicted critical damage to Port-au-Prince's harbour infrastructure, destroying port cranes and piers,¹¹⁸ Coast Guard crews began conducting medical evacuations, search and rescue operations, and delivery of relief supplies into the Port-au-Prince area via small boats and helicopters.¹¹⁹ The overall response to the Haitian earthquake by American sea services would soon include two more cutters, and a variety of naval warships including a frigate, a destroyer, a cruiser, and an aircraft carrier, and six amphibious assault ships embarking more than 2,200 marines.¹²⁰ In total, the US Navy deployed 17 ships, 48 helicopters, and 10,000 sailors and marines for relief operations in and around Haiti.¹²¹ Several other nations – including

¹¹⁶ "Magnitude 7.0 - HAITI REGION," U.S. Geological Survey Earthquake Hazards Program, Details, <http://earthquake.usgs.gov/earthquakes/eqinthenews/2010/us2010rja6/> (accessed May 21, 2010).

¹¹⁷ *Ibid.*, Summary.

¹¹⁸ Martha Brannigan, "Haiti seaport damage complicates relief efforts," *Miami Herald*, January 14, 2010, <http://www.miamiherald.com/2010/01/14/1426067/haiti-seaport-damage-complicates.html> (accessed May 21, 2010).

¹¹⁹ "Coast Guard continues support in wake of Haiti earthquake," US Coast Guard, <https://www.piersystem.com/go/doc/786/452059/> (accessed May 21, 2010).

¹²⁰ Trenton Daniel, Lesley Clark, and Carol Rosenberg, "More troops, humanitarian aid coming to Haiti; mass migration to U.S. not materializing," *Miami Herald*, January 23, 2010, <http://www.miamiherald.com/2010/01/18/1431558/window-closing-for-survivors-relief.html> (accessed May 21, 2010).

¹²¹ *U.S. Fleet Forces Public Affairs*, "U.S. Fleet Forces Commander Provides Update on Navy Contributions to Haiti Relief Efforts," January 19, 2010, http://www.navy.mil/search/display.asp?story_id=50631 (accessed May 21, 2010).

Canada, the United Kingdom, France, Italy, Spain, the Netherlands, Mexico Brazil, and Venezuela – also deployed naval vessels to the region to aid in disaster relief. The contribution made by international navies in this case had a significantly beneficial impact on the volume of aid delivered to Haiti. These contributions also illustrate the capacity of the world’s oceans to serve as a medium for the transmission of humanitarian assistance and disaster relief.

The use of navies to deliver assistance Haiti is only part of a broader trend of substantial naval involvement in disaster relief; among recent high-profile examples are the responses to 2005’s Hurricane Katrina and the 2004 Indian Ocean tsunami. Responses to these disasters included significant naval components not only from the US but also from foreign nations and regional powers. India, for instance, conducted three naval efforts, Operations CASTOR, RAINBOW, and GAMBHIR, providing relief to the Maldives, Sri Lanka, and Indonesia respectively. In all three regions, the Indian Navy played a significant role, deploying specialized hospital ships and vessels with integrated aircraft and medical teams.¹²² Despite widespread harbour destruction inflicted by the tsunami, the Indian Navy was able to promptly deliver relief supplies to shore using landing craft as well as temporary jetties constructed from pontoons.¹²³ India’s overall naval and coast guard efforts involved 7,500 sailors and 40 ships and contributed to the rescue of nearly 29,000 people and the evacuation of many others.¹²⁴ These cases

¹²² Manmohan Singh, *Tsunami - A Report to the Nation*, report, http://data.undp.org.in/dmweb/tsunami/pr/Tsunami_report%20to%20the%20nation.pdf (accessed May 25, 2010), 3.

¹²³ *Ibid.*, 4.

¹²⁴ *Ibid.*, 8-9.

illustrate that the use of navies towards humanitarian assistance disaster relief is by no means isolated to the US or other Western nations, and is indeed a global phenomenon.

The volume of naval activity in humanitarian assistance disaster relief is significant, not only in the number of vessels sent but also the relief cargo they were able to deliver. By 17 January 2010, Haiti's main airport was operable but could handle only 90 flights a day, unable to meet demand and forcing some aircraft attempting to deliver aid to divert.¹²⁵ A modest naval logistics vessel such as the Royal Fleet Auxiliary's Bay-class can embark up to 2,000 tonnes of cargo,¹²⁶ contrasted with a single C-130 Hercules aircraft which can carry a maximum payload of 20 tonnes. Unlike the aircraft, the logistics vessel can deliver its cargo independent of local infrastructure. If both were loaded to capacity, the Bay-class would be able to deliver as many supplies as 100 C-130 flights, more than an entire day's worth of flights into the Port-au-Prince airport. Such vessels also offer substantially greater economy of transport; the cost of moving one ton of cargo by sea is approximately \$0.04 per mile, while moving the same ton of cargo with a C-130 costs \$3.08 per mile.¹²⁷ Such vessels acting in a disaster relief function, then, prove highly beneficial both for their cost-effectiveness as well as their capability to operate even when local infrastructure is damaged or overloaded.

¹²⁵ Mike Melia and Alfred De Montesquiou, "Feuds grow over reaching victims in Haiti," *Navy Times*, January 17, 2010, http://www.navytimes.com/news/2010/01/ap_haiti_aid_update_011610/ (accessed May 21, 2010).

¹²⁶ Based on the weight of 33 Challenger main battle tanks; see, e.g., "News: RFA Largs Bay," Royal Navy, http://www.royalnavy.mod.uk/operations-and-support/royal-fleet-auxiliary/rfa-flotilla/bay-class-landing-ships/rfa-largs-bay/news/rfa-largs-bay/269192/*/changeNav/00h00100500800b004001/outputFormat/print (accessed May 25, 2010).

¹²⁷ *Leadmark: the Navy's Strategy for 2020*, Canadian Forces, http://www.navy.dnd.ca/leadmark/pdf/ENG_LEADMARK_FULL_72DPI.PDF (accessed June 1, 2010), 158. Based on 2001 figures.

Given the probability of more frequent and more intense natural disasters as a result of climate change and both the excellent suitability and frequent employment of navies in response to natural disasters, humanitarian assistance and disaster relief comprise the other half of climate change's maritime dimensions. Though natural disasters resulting from climate change have no direct implication for the seas, the fact that the sea services will likely be called upon to respond to them clearly make this aspect of climate change a maritime issue.

3.3 The Nexus between Climate Change and Maritime Security

The involvement of the sea services in countering lawlessness at sea and delivering humanitarian assistance and disaster relief offers two important conclusions. First, the sea services are in high demand for both sorts of functions. Around the world, navies and coast guards alike are frequently used not only in constabulary functions to contend with criminal activities at sea like terrorism, piracy, and drug trafficking, but also in diplomatic functions to respond to natural disasters. Second, this demand exists because vessels of navies and coast guards possess many attributes which make them well-suited to these sorts of operations. As noted above, these attributes include mobility, ability to poise, sustained reach, leverage, volumetric capacity, and ability to operate both jointly with other armed forces branches or combined with other nations. Today, then, the world's maritime security forces are at the vanguard of contending with both lawlessness at sea and natural disasters

Because failed and fragile states are significantly challenged to enforce laws both on land and from their shores, resulting lawlessness displays a tendency to spill onto neighbouring ocean areas and waterways, where it may materialize as piracy, drug

trafficking, terrorism, and similar illicit activities. These issues become a larger concern when they directly threaten the security and safety of either a neighbouring nation's citizens (as in the case of the Mumbai attacks in November 2008) or maritime commerce and sea lines of communication (as in the case of Somali piracy in the Gulf of Aden). Therefore, a rise of illicit activities on the seas in the fallout of climate change demands even greater involvement by the world's maritime security forces in constabulary activities. Simultaneously, climate change is expected to lead to more frequent and more intense natural disasters. The world's sea services, for their proven utility in delivering humanitarian assistance and disaster relief, will find their services in responding to the increasing levels of natural disasters world-wide in greater demand.

A nexus of pressures and demands emerges, between the potential pressures of climate change and the activities and corresponding demands of maritime security forces. This nexus is illustrated below, in figure 5.

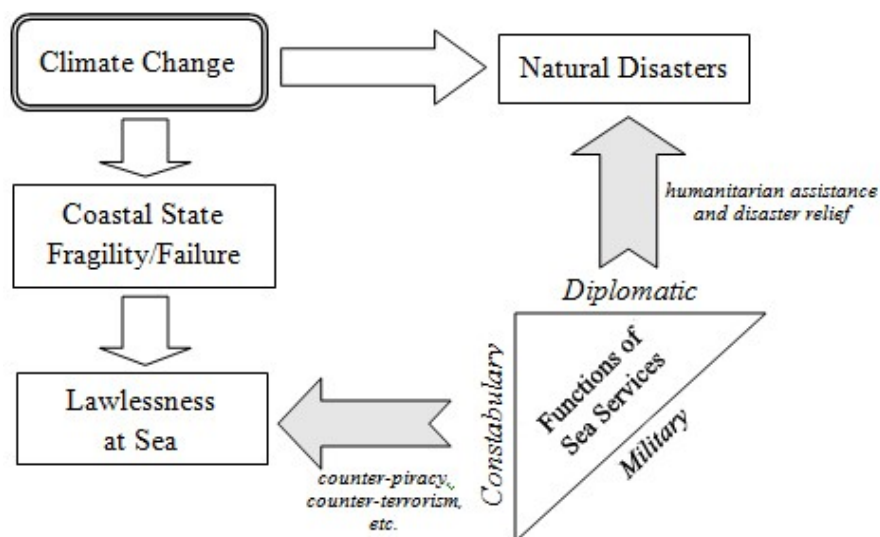


Figure 5: The nexus between climate change and maritime security

The nexus between climate change and maritime security poses new and interesting dilemmas for maritime security forces. These sorts of roles are categorized as ‘unconventional,’ far outside the realm of Booth’s military functions, the traditional state-to-state war-fighting towards which navies found themselves traditionally oriented. In being directed towards combating illicit activities at sea and responding to natural disasters, enemies are no longer necessarily other warships, submarines, or aircraft, but are instead lawlessness, disorder, and human distress. New equipment and modes of operating towards diplomatic and constabulary functions may prove necessary in order for the sea services to best remain relevant in an era of climate change.

The direct implication is a need to capitalize upon the suitability of the sea services and prioritize their constabulary and diplomatic functions, through acquiring more vessels suitable for law enforcement and with greater logistical capacities. However, a substantial amount of contention is found in attempting to balance these functions with the broader characteristics of climate change. Within the sea services, discord is found not only in balancing finite resources between the constabulary and diplomatic functions, but also in balancing those functions with the dominant military function which forms the base of Booth’s trinity. Contention is also found between a national government, its people, and its military, as governments balance resources between lawlessness at sea, disaster relief, all other dimensions of climate change, and generally meeting the needs of its people. Lastly, rivalry exists between nations, as climate change potentially limits access to resources and prompts inter-state conflict.¹²⁸ A discussion on how Canada can best prepare for the maritime dimensions of climate

¹²⁸ Schwartz and Randall, 14-16.

change must therefore not only strike a fair compromise between the military, diplomatic, and constabulary functions of the sea services, but must also be informed about Canada's national interests and context in the nexus between climate change and maritime security.

Chapter 4.0 Canada's Stake in the Maritime Dimensions of Climate Change

Canadians appears to have little to fear from the direct impacts of climate change; Canadian access to fresh water is largely secure for the foreseeable future,¹²⁹ and Canadian crop growing seasons may in fact become longer and more productive as a result of climate change. The Canadian government and military are both stable, and Canada is geographically far-removed from any of Mazo's 'states of concern.'¹³⁰ Additionally, other powers like the United States seem to have so far proven themselves both capable and willing to respond to the maritime dimensions of climate change, by already acting against illicit activities at sea and providing humanitarian assistance and disaster relief. In the context of climate change, it seems Canada has again attained the status of a "fireproof house, far from the sources of conflagration,"¹³¹ as the direct consequences of climate change in the maritime domain are geographically distant.

However, this perspective is short-sighted. It neglects the fact that, as the head of Canada's navy Vice-Admiral Dean McFadden states, "[Canada's] prosperity and security are thoroughly enmeshed in a global system that transcends all boundaries."¹³² Canada has numerous interests vested in mitigating the effects of climate change in the maritime domain, both for the direct self-interest and preservation of Canada and the safety and

¹²⁹ *The Future Security Environment, 2008-2030*. (Ottawa: Chief of Force Development, National Defence Headquarters, 2010), 40.

¹³⁰ Mazo, 106-8.

¹³¹ Sen. Raoul Dandurand, cited in Desmond Morton, *A Military History of Canada* (Toronto: McClelland & Stewart, 1999), 176.

¹³² VAdm. Dean McFadden, "A Speech by Vice-Admiral Dean McFadden, Chief of the Maritime Staff, to the Historical Conference, Ottawa, Ontario, 06 May 10," Centre for Foreign Policy Studies, http://naval.review.cfps.dal.ca/pdf/McFadden_Future_of_the_Navy_18May10.pdf (accessed May 26, 2010), 3.

security of its citizens, as well as for the sustained and regulated use of the world's oceans as a global commons. This generates a significant impetus for Canadian action against the two chief maritime dimensions of climate change – increased lawlessness at sea and increased need for humanitarian assistance and disaster relief. Examining this impetus in greater detail addresses the matter of *why* Canada should be involved in responding to and mitigating the impacts of climate change in the maritime domain.

4.1 The Value of Maritime Commerce for Canada

Canada is a maritime nation, with the longest coastline in the world – longer than the coastlines of the next five countries combined – and encompasses nearly 900,000 square kilometres of water within its borders.¹³³ Canada is simultaneously a trading nation: exports to foreign nations, mainly of energy, natural resources, and manufactured goods, constitute nearly a third of the value of Canada's gross domestic product.¹³⁴

The prospect of increased illicit activities at sea in the era of climate change has direct implications for Canada. The higher levels of maritime piracy, crime, and terrorism that are expected to eventually result from climate change pose risks to the maritime commerce upon which Canada is dependent. Canada's status as both a maritime nation and a trading nation intersect with its involvement in maritime commerce: by value, 60% of Canada's international trade is conducted by sea,¹³⁵ and Canadian maritime commerce is valued at \$190 billion annually.¹³⁶ By volume, however, maritime commerce accounts

¹³³ "Canada," CIA World Factbook, <https://www.cia.gov/library/publications/the-world-factbook/geos/ca.html> (accessed May 26, 2010).

¹³⁴ Ibid.

¹³⁵ *Canada: Committed to Marine Safety, Security, Trade and the Environment*, report (Ottawa: Transport Canada, 2010), 5.

¹³⁶ Ibid., 2.

for 95% of Canada's trade with nations other than the US.¹³⁷ Commercial vessels visit Canadian ports over 100,000 times a year, with over 18,000 international arrivals.¹³⁸ The value attached to maritime commerce leads Transport Canada to conclude that "the safe and rapid movement of Canada's domestic and international maritime trade ... is vital to our economy..."¹³⁹ To this end, maritime commerce for Canada is, as Peter Haydon suggests, the "life-blood of the economy."¹⁴⁰

One of the fundamental roles attached to navies throughout history is the preservation of safe and free use of the world's oceans. Writing in the 1970s but no less true today, Ken Booth articulates this as a fundamental purpose of navies:

The theme of navies and foreign policy is *the use of the sea*. Broadly, states are interested in the use of the sea for three purposes: (1) for the passage of goods and people; (2) for the passage of military force for diplomatic purposes, or for use against targets on land or at sea; and (3) for the exploitation of resources in or under the sea. Navies exist as a *means* to further such ends. As it has been understood from earliest times, they exist as a part of a state's general maritime policy, whose objective is to attempt to use the sea for one's own purposes, while being in a position to attempt to prevent others from using it in ways which are to one's disadvantage.¹⁴¹

This point has not been lost in Canada. The value attached to international maritime commerce and trade has led the Canadian government and military to maintain a long-

¹³⁷ "The Future: Canada's Economic Prosperity," Canadian Forces, http://www.navy.forces.gc.ca/cms/10/10-a_eng.asp?id=295 (accessed June 01, 2010).

¹³⁸ *Canada: Committed to Marine Safety, Security, Trade and the Environment*, 2.

¹³⁹ *Ibid.*

¹⁴⁰ Peter T. Haydon, "Why Does Canada Still Need a Navy?" Centre for Foreign Policy Studies, http://centreforforeignpolicystudies.dal.ca/pdf/marsec_working/WhyCanadaNeedsaNavy.pdf (accessed June 2, 2010), 4.

¹⁴¹ Booth, 15-6. His emphasis.

standing dedication towards preserving the free and safe use of the seas. Indeed, much time and resources have been devoted to this end throughout history, and the protection of the sea lines of communication sustaining both Canada and its allies has become an enduring focus and a timeless function of the Canadian navy. Many historical and contemporary examples exist to signal this commitment. Between 1939 and 1945, for example, the Canadian navy substantially expanded to fight the longest campaign of the Second World War – the Battle of the Atlantic. During this campaign, the Canadian navy was a key participant in protecting sea lines of communication linking Europe and North America from enemy aircraft, submarines, and warships.¹⁴² Likewise, during the Cold War, the desire to counter potential Soviet threats to Atlantic shipping in the event of hostilities occupied the attention of Western navies, Canada's included.¹⁴³ Following the attacks of 11 September 2001, the Canadian navy acted under Operation APOLLO to, among other things, interdict contraband and suspected terrorists in the Persian Gulf, conducting over a dozen deployments to the region across a span of three years.¹⁴⁴ Now, the commitment of Canada's navy to the freedom of the seas is observed in its counter-piracy efforts conducted off the Horn of Africa, with three deployments to protect international shipping from the threat of pirate attack since 2008.¹⁴⁵ These examples

¹⁴² "The Royal Canadian Navy and the Battle of the Atlantic, 1939-1945," Canadian War Museum, <http://www.warmuseum.ca/cwm/explore/military-history/dispatches/the-royal-canadian-navy-and-the-battle-of-the-atlantic-1939-1945> (accessed June 01, 2010).

¹⁴³ *Leadmark: the Navy's Strategy for 2020*, 88.

¹⁴⁴ "The Canadian Forces' Contribution to the International Campaign Against Terrorism," Canadian Forces, Operation APOLLO, <http://www.comfec-cefcom.forces.gc.ca/pa-ap/nr-sp/doc-eng.asp?id=490> (accessed June 01, 2010).

¹⁴⁵ "Operation SAIPH," Canadian Forces, The Mission, <http://www.comfec-cefcom.forces.gc.ca/pa-ap/ops/saiph/index-eng.asp> (accessed June 01, 2010).

prove that ensuring the safe and free use of the seas is a function firmly embedded in the navy's history.

Beyond these examples, significant attention remains focused on preserving the free and sustained use of the seas for international trade and commerce. Acting in this capacity is entrenched in many of the guiding documents of the Canadian navy. *Leadmark: the Navy's Strategy for 2020* states that "free passage upon the seas is fundamental to the system of trade that drives the global economy, and to those states that have a communal interest in continuing to provide, in the words of the Naval Prayer, 'a security for such as pass on the seas upon their lawful occasions.'"¹⁴⁶ *Leadmark* identifies contributing to the general freedom of the seas as one of the eight fundamental strategic principles underpinning a medium power navy such as Canada's.¹⁴⁷ Today, ensuring the safe and free use of the seas is no less relevant a function for the Canadian navy.

The maritime dimensions of climate change are relevant to the Canadian navy because increased illicit activity at sea stands to jeopardize the free and safe use of the seas. However, the challenges posed to Canada by the maritime dimensions of climate change should not be overestimated. Given Canada's geographical distance from those states of concern, it is unlikely that the maritime dimensions of climate change will substantially increase direct challenges to Canadian domestic security. The possibility of criminals and terrorists crossing the oceans to come to Canada's shores in substantial numbers is slim. It is also highly unlikely that illicit activities at sea directed against maritime commerce, such as piracy or terrorism, will jeopardize sea lines of

¹⁴⁶ *Leadmark: the Navy's Strategy for 2020*, 47.

¹⁴⁷ *Ibid.*, 103.

communication to the extent that it challenges the ability of a nation to feed its people or sustain war effort, as was the case for Britain during the Second World War.

Nevertheless, Canada's reliance on the seas for economic prosperity in addition to its commitment to preserving the freedom of the seas means that Canada does not escape the implications of the nexus between climate change maritime security. Given reduced inventory and stockpiling capacities in Western industrial and commercial sectors in efforts to reduce carrying costs, economies now rely on 'just in time' shipping where ships participating in maritime commerce effectively serve as floating warehouses. The result is that industries and retailers are vulnerable to supply shocks, and shipments delayed or lost as a result of piracy or terror are immediately felt by businesses and consumers. As Paul H. Nitze and Leonard Sullivan argue:

Generally, continuity in shipping flow will ... be required to avoid economic fluctuations. Even though the majority of this commerce is 'nonessential' in the sense of national survival, there would be traumas associated with short-term interruptions of shipping flow.¹⁴⁸

Canada, then, has good cause to continue working to ensure the free, safe flow of maritime commerce for itself and its trading partners.

The prospect of increased lawlessness at sea – through the proliferation of illicit activities such as piracy, terrorism, and drug-trafficking – means that the Canadian navy, already deeply involved in combating all of these activities, will likely need to contend with more challenges to the freedom of the seas and the security and safety of maritime commerce. Thus, with respect to the prospect of greater lawlessness at sea that

¹⁴⁸ Paul H. Nitze and Leonard Sullivan, *Securing the Seas: the Soviet Naval Challenge and Western Alliance Options* (Boulder: Westview Press, 1979), 17-8.

accompanies the era of climate change, Canadian policy makers cannot ignore the maritime dimensions of climate change. Greater lawlessness at sea has direct implications both for Canada's reliance on maritime commerce and for its timeless commitment to preserving the free and safe usage of the seas. As heightened incidences of piracy, terrorism, drug trafficking, and other illicit activities materialize in the maritime domain, the sea services of Western nations – Canada included – will find their constabulary functions in greater demand. It would be remiss not to plan and prepare accordingly.

4.2 The Opportunity in Humanitarian Assistance and Disaster Relief

Relevance to and recognition by the Canadian public is a great and enduring dilemma for the Canadian navy. With the majority of the Canadian population living near the centre of the country, far from the east and west coasts where the navy is based, Canadians are stricken with 'maritime blindness,' often failing to appreciate or promote the sustainment of an effective maritime security force. As Peter Haydon argues:

Because the majority of Canadians do not understand or even recognize the maritime dimensions of their country, naval programs seldom enjoy public or political support. As a result, a long succession of naval staffs have had to wage public education campaigns to explain the navy's place in the national fabric and to justify naval procurement programs.¹⁴⁹

The blinders were temporarily lifted in January 2010 when a contingent of the Canadian Forces was deployed to Haiti to provide humanitarian assistance and disaster relief in response to the earthquake that struck earlier that month. Styled Operation HESTIA, this contingent included two Canadian warships, HMCSs *Athabaskan* and *Halifax*.

¹⁴⁹ Peter T. Haydon, "'Adjusting Course.' A Strategic Orphan?" Naval Officers' Association of Canada, http://www.noac-national.ca/article/haydon/strategy_by_peterhaydon.html (accessed June 02, 2010).

Media coverage of the warships' departure, work in Haiti, and subsequent return to the port of Halifax was both widespread and positive: in a column for CBC News, Brian Stewart suggests that "the fast deployment of the frigate HMCS *Halifax* and the destroyer HMCS *Athabaskan*, carrying 500 sailors and soldiers, along with medical and relief supplies, construction materials and helicopter support, won wide domestic and international praise."¹⁵⁰ The high magnitude of praise and appreciation for the Canadian Forces' involvement in Operation HESTIA is visible in the reader comments posted on coverage at the Globe and Mail's website:

"It is wonderful to read about the fantastic things our military is doing in Haiti."

"Though I 100% oppose the Canadian Forces making war in Afghanistan, I support all Canadian military personnel in this humanitarian role."

"I am immensely proud of our servicemen and women who are doing more than their collective best to help this devastated country and its people."¹⁵¹

Thus, for a navy seeking to make itself relevant to the Canadian public and overcome the problem of 'maritime blindness,' humanitarian assistance and disaster relief as was conducted in Haiti seems an ideal opportunity. Further, the Canadian navy's involvement in humanitarian assistance and disaster relief is not isolated to the case of the Haitian earthquake. While the Canadian navy has not been as active in this capacity as other

¹⁵⁰ Brian Stewart, "Just how shipshape are we?" *CBC News*, February 10, 2010, <http://www.cbc.ca/canada/story/2010/02/10/f-vp-stewart.html> (accessed June 02, 2010).

¹⁵¹ Jessica Leeder, "Canadian sailors get to work on Haiti's ruined shores - The Globe and Mail," *The Globe and Mail*, February 8, 2010, Comments section, <http://www.theglobeandmail.com/news/world/haiti/canadian-sailors-get-to-work-on-haitis-ruined-shores/article1460752/> (accessed June 02, 2010).

navies, such as the US Navy, other examples within the last decade include Operation UNISON, off the US Gulf Coast in response to 2004's Hurricane Katrina, and Operation TOUCAN, delivery of humanitarian aid to East Timor in 2001. As Brian Stewart notes, "[w]henver Canada faces a world crisis involving international security or humanitarian aid, it is almost always the navy that gets the first call."¹⁵²

Greater involvement in humanitarian assistance and disaster relief is also driven by the impetus to ensure the safety and security of Canadian citizens and their kin. Canada is a multicultural country: foreign-born individuals account for nearly 20% of Canada's population, with many immigrants originating from South Asia, Africa, and South America.¹⁵³ Likewise, many Canadians have taken to living abroad; approximately 2.5 million Canadians currently reside in other countries.¹⁵⁴ Multiculturalism and geographical diffusion of Canada's citizens as an impetus for disaster relief is best illustrated by the Canadian response to the Haitian earthquake. At the time of the earthquake, over 100,000 individuals of Haitian ethnic origin resided in Canada,¹⁵⁵ and approximately 6,000 Canadian expatriates were living in Haiti.¹⁵⁶ Over three quarters of

¹⁵² Stewart.

¹⁵³ Canada, Citizenship and Immigration Canada, *Immigration Overview: Permanent and Temporary Residents 2008*, <http://www.cic.gc.ca/english/pdf/research-stats/facts2008.pdf> (accessed June 15, 2010), 23.

¹⁵⁴ Consular Information and Public Outreach Division, "RE: Seeking Figures re: Canadians Abroad," e-mail message to author, May 27, 2010.

¹⁵⁵ "Ethnic origins, 2006 counts, for Canada, provinces and territories - 20% sample data," Statistics Canada, <http://www12.statcan.ca/census-recensement/2006/dp-pd/hlt/97-562/pages/page.cfm?Lang=E&Geo=PR&Code=01&Data=Count&Table=2&StartRec=1&Sort=3&Display=All&CSDFilter=5000> (accessed June 15, 2010).

¹⁵⁶ Sandro Contenta, "Update: Canadians evacuated from Haiti on their way home," *Toronto Star*, January 14, 2010, <http://www.thestar.com/news/world/haiti/article/750607--haiti-quake-carnage-incredible-as-rescuers-scramble> (accessed June 15, 2010).

Canadian expatriates were eventually evacuated from Haiti,¹⁵⁷ and Canada's own Haitian community – including Governor General Michaëlle Jean¹⁵⁸ – was vocal in calling for Canadian involvement in the disaster relief effort.¹⁵⁹ In the wake of future natural disasters, therefore, the Canadian government and military can expect pressure from two fronts: by the need to evacuate Canadian citizens from disaster areas, and by Canada's ethnic communities' calls for humanitarian assistance abroad.

Given the navy's impetus for providing disaster relief as well as the enormously positive public recognition it has received when doing so, the diplomatic functions of humanitarian assistance and disaster relief are conspicuously absent from many of the navy's core strategic principles and long-term visions. In *Leadmark*, for instance, disaster relief is listed as a function for Canada's navy under the heading of "Securing Canada's Sovereignty," insinuating that the employment of such a capability should be limited to domestic circumstances.¹⁶⁰ In the more recent *Securing Canada's Ocean Frontiers*, of the five principles comprising the "Naval Strategy for 2025," the closest initiatives resembling heightened attention to and involvement in humanitarian assistance and disaster relief are to "generate multi-purpose combat capable forces to meet the assigned domestic and international missions" and to "modernize the present fleet capabilities for

¹⁵⁷ *CTV News*. "Canadian death toll in Haiti set to jump: Cannon." February 22, 2010. http://www.ctv.ca/CTVNews/MSNHome/20100222/haiti_cannon_100222/?s_name=&no_ads= (accessed June 15, 2010).

¹⁵⁸ "Statement from the Governor General following the earthquake in Haiti," The Governor General of Canada, <http://www.gg.ca/document.aspx?id=13483> (accessed June 15, 2010).

¹⁵⁹ *CBC News*, "Montreal Haitians urge Canada to do more," January 19, 2010, <http://www.cbc.ca/canada/montreal/story/2010/01/19/qe-haitian-aid-more.html> (accessed June 15, 2010).

¹⁶⁰ *Leadmark: the Navy's Strategy for 2020*, 98.

operations other than war and anti-submarine warfare.”¹⁶¹ Conversely, in a December 2009 article for *Proceedings*, Vice Admiral Dean McFadden portrays combat capability as central to the navy: “forward-deployed, [the Canadian navy] works with like-minded allies and defense partners to prevent conflict. *Ours is a navy that is benchmarked for combat in capabilities and ethos*, ‘ready, aye ready’ to prevail in combat when necessary.”¹⁶² Of Booth’s three functions defining the use of navies, the ‘military’ role seems front and center for the Canadian navy; maintaining combat capability ranks highest and most prominently on the navy’s agenda.

For the Canadian navy to rank military functions highly is not done in error. As Ken Booth correctly argues:

...the essence of navies is their military character. Actual or latent violence is their currency. It is a navy’s ability to threaten and use force which gives meaning to its other modes of action. It derives its diplomatic impact from perceptions of its military character. Obviously it derives its utility in conflicts from its ability to exert brute force successfully.¹⁶³

The military characteristics of a navy retain significant relevance. However, just as Corbett argued in 1911 that concentrated engagements between opposing fleets had become “a kind of shibboleth” demanding reassessment,¹⁶⁴ so too now is the Canadian navy’s apparent tunnel-vision on military functions. A CDFAI report contemplating NATO’s forthcoming New Strategic Concept articulates the impetus for change in the

¹⁶¹ *Securing Canada’s Ocean Frontiers: Charting the Course from Leadmark*, Canadian Forces, http://www.navy.forces.gc.ca/cms_images/strat/story_images/Securing%20Canada%20Ocean%20Frontiers%202.pdf (accessed June 2, 2010), 50.

¹⁶² VAdm. Dean McFadden, “Ready Aye Ready,” *USNI Proceedings* 135, no. 12 (December 2009): 35. Emphasis added.

¹⁶³ Booth, 16.

¹⁶⁴ Corbett, 134.

post-Cold War context: “the ‘long twilight struggle’ with Soviet communism is over,” the report argues, “many ‘captive nations’ are now free, no small number have joined the Alliance and others have expressed a desire to follow in their footsteps.”¹⁶⁵ In the new strategic concept, diplomatic functions of navies demand greater attention: “[a]s a priority, NATO needs to improve its capacity to deploy a rapid reaction force to intervene in an humanitarian crisis.”¹⁶⁶ Thus, in the post-Cold War context, military functions see their relevance eroding vis-à-vis diplomatic functions such as humanitarian assistance and disaster relief.

For a Canadian navy seeking to expand its relevance, not only to the Canadian public but also to broader strategic imperatives, improving capacities and capabilities for humanitarian assistance and disaster relief demands attention. This is not to suggest that diplomatic functions be pursued at the utter exclusion of military functions. However, if the Canadian navy’s new underpinning principles are to truly be ‘flexibility’ and ‘utility,’ as has been made evident in recent strategic planning meetings,¹⁶⁷ these principles can be satisfied by pursuing diplomatic functions, such as through greater logistical capacities and involvement in disaster relief.

4.3 Canada’s Allies and Their Interests

Despite incentives to build capacities and capabilities to combat lawlessness at sea and respond to natural disasters, it is obvious that Canada is not the only nation with a stake

¹⁶⁵ Paul Chapin, *Security in an Uncertain World: a Canadian Perspective on NATO's New Strategic Concept* (Ottawa: Conference of Defence Associations Institute, 2010), 53.

¹⁶⁶ *Ibid.*, 46.

¹⁶⁷ Cdr. Kenneth P. Hansen, "The Future of the Navy," *Broadsides Discussion Forum*, Attracting and keeping people with a new vision, <http://naval.review.cfps.dal.ca/forum/view.php?topic=57> (accessed June 03, 2010).

in the maritime dimensions of climate change. Many other nations depend on maritime commerce and deploy their navies to preserve the free and safe use of the sea, as are many navies involved in humanitarian assistance and disaster relief. It would not be remiss to ask, then, why Canada should devote resources to these ends when other nations are willing to do so.

Suggesting a reliance on other countries, namely the US, to preserve the freedom of the seas and to respond to natural disasters in an era of climate change is problematic for a simple reason: the identical suggestion is also being posed in those countries. For instance, NATO Head of Planning for Operations Diego Ruiz Palmer suggests that, in response to heightened lawlessness in the littoral regions of the world's oceans, "it is unlikely to be advantageous for the international community in general, and for NATO in particular, to see the US Navy exchange its ocean-going fleet for a more littoral-oriented maritime capability."¹⁶⁸ Palmer argues that the US Navy has much time and resources invested into the maintenance of high-end capabilities such as carrier aviation, and shedding such capabilities towards the end of a naval fleet structure designed towards combating issues like lawlessness at sea would be a mistake. Instead, Palmer leaves these functions open for America's allies:

[I]t would be paradoxical and misguided to see the US Navy attempt to fill requirements and build capabilities for littoral operations that the navies of many allied and friendly nations could address more easily, quickly, and often with greater skill, because of their particular experience and expertise in, as well as tailored capabilities for, such operations.

¹⁶⁸ Diego Ruiz Palmer, "The end of the naval era? Maritime power and engagement in the early 21st century," *Maritime security: sink or swim*, http://www.nato.int/docu/review/2010/Maritime_Security/end_of_naval_era/EN/index.htm (accessed June 03, 2010).

Instead, the rise of global maritime partnerships is an opportunity to explore a more concerted international approach among like-minded nations....¹⁶⁹

With no clear guarantee that other larger powers like the US will adequately prepare their navies for the maritime dimensions of climate change, shirking responsibility and preparedness for increasing lawlessness at sea and natural disasters is inadvisable.

Therefore, Canadians have good cause to be concerned about the maritime dimensions of climate change. Canada has substantial interests in maritime commerce, with a significant volume in trade being conducted by sea; the potential increases in lawlessness at sea as a result of climate change directly jeopardize the free and safe use of the sea towards Canada's prosperity. At the same time, with a navy struggling to retain relevance and appreciation in the eye of the Canadian public, increasing natural disasters resulting from climate change presents an opportunity for the navy to fulfill a role that is winning it much admiration and support. Lastly, as Palmer notes, larger, more powerful allies such as the US cannot be reliably expected to shoulder the entire burden of maritime lawlessness and natural disasters; critics such as Palmer are instead pointing to nations like Canada as likely candidates to help act against lawlessness at sea.

There is a clear need for Canada to be ready to respond to and help mitigate the maritime dimensions of climate change. From Palmer's discussion of structuring navies towards combating lawlessness at sea, it is evident that some naval fleet structures and capabilities centred around military functions – such as high-end combat-capable aircraft carriers – are ill-suited for constabulary functions such as combating maritime terrorism and piracy; indeed, a large, expensive aircraft carrier is a poor candidate for the coastal

¹⁶⁹ Ibid.

areas of nations, where such lawlessness originates, and is limited in its constabulary functions. At the same time, those same aircraft carriers have proven themselves invaluable in diplomatic functions like disaster relief, as in the case of 2004's Indian Ocean tsunami, 2005's Hurricane Katrina, and 2010's earthquake in Haiti. This paradox illustrates some dilemmas involved in balancing the constabulary, diplomatic, and military functions of navies and best preparing for the maritime dimensions of climate change.

While the American navy's fleet structure incorporates other platforms to cover the scope of needed capabilities and capacities, the Canadian navy's current fleet structure – dominated by destroyers and frigates – leaves it ill-prepared for the future. Frigates and destroyers lack the capabilities and capacities needed to adequately respond to lawlessness at sea or to provide humanitarian assistance in the wake of a natural disaster. An optimal fleet structure endows Canada's navy with the attributes necessary to respond to the maritime security dimensions of climate change.

As the maritime dimensions of climate change are broad – both in their geographical distribution and the range of challenges posed – so too should be the response. Canada is a nation with much interest in responding to both increased lawlessness at sea and increased natural disasters around the world, yet has limited resources and many other obligations. How, then, should Canada construct a preparedness model for the maritime dimensions of climate change?

Chapter 5.0 Constructing a Climate Change Preparedness Model

The maritime security dimensions of climate change are clear: as climate change exacerbates existing state volatility and conflict, lawlessness in the form of piracy, terrorism, drug-trafficking and other illicit activities are likely to materialize off the shores of those states most affected. Further, natural disasters will likely increase in frequency and intensity, posing heightened demands for the world's sea services to act in humanitarian assistance and disaster relief functions. The impetus for Canada to prepare is clear as well, both in preserving the freedom of the seas upon which a significant portion of Canadian commerce is dependent, and in responding to natural disasters around the world. The proper preparedness model for the maritime security dimensions of climate change therefore requires greater attention to the constabulary and diplomatic functions of the Canadian navy.

However, constructing a preparedness model is a complicated affair. The maritime security dimensions of climate change comprise but one of several issues Canada faces in the future security environment. Constabulary and diplomatic functions – responding to lawlessness at sea and to natural disasters, respectively – must be balanced between themselves and against conventional military functions. Further, the maritime security dimensions of climate change and climate change itself are *risks*; they entail a significant amount of uncertainty, from when and where the impacts will materialize, to how severe the impacts will be. Canada's limited resources and many commitments at home and abroad also impose restrictions on the design of a preparedness model. These uncertainties and limitations necessitate a careful measure of risk management to strike a

balance between overpreparedness and underpreparedness for the maritime security dimensions of climate change.

How should the Canadian navy prepare for climate change? Recent experiences of navies acting in constabulary and diplomatic roles near Haiti, Somalia, and Lebanon suggest that a revised Canadian fleet structure is necessary. The capabilities and capacities that are needed in a future fleet structure can be identified by examining these experiences in detail, with attention to the navy's successes and failures. In turn, a plausible model for the navy can be offered by identifying the limitations and uncertainties attached to climate change preparedness and juxtaposing them with needed capabilities and capacities.

5.1 Uncertainties and Limitations in Planning for Climate Change

Much about climate change and its related consequences for the maritime domain is uncertain. This uncertainty is most visible in the ways scientists categorize the possible impacts of climate change, using terms like "very likely" (a probability of >90%) or "likely" (a probability of >66%).¹⁷⁰ Further, scientific findings relating to climate change are subject to vigorous debate and revision. Controversy attached to climate change research peaked with the so-called 'Climategate' case in November 2009, when computer hackers released information from the University of East Anglia's Climate Research Unit suggesting collusion and manipulation of climate change data.¹⁷¹ The possibility also exists that 'green' initiatives and attempts to reduce carbon emissions may reach an

¹⁷⁰ Bates et al., 11.

¹⁷¹ Leo Hickman and James Randerson, "Climate sceptics claim leaked emails are evidence of collusion among scientists," *The Guardian*, November 20, 2009, <http://www.guardian.co.uk/environment/2009/nov/20/climate-sceptics-hackers-leaked-emails> (accessed June 15, 2010).

extent to reduce the severity of climate change, further frustrating predictability. A full critique of the science substantiating climate change is beyond the scope of consideration here; nevertheless, it remains difficult to predict or quantify the impacts of climate change with precision.

As a part of the causal chain of climate change, the maritime consequences – lawlessness at sea and natural disasters – are also subject to unpredictability. The prevalence of increased illicit activities as a result of climate change is further dependent upon intervening variables beyond the severity of climate change. These variables are subject to change as well, and include a state’s resiliency to respond and mitigate the environmental impacts of climate change, the capabilities and capacities of its own security forces, the capabilities and willingness of regional neighbours to provide assistance, and other prevailing political and economic factors. The complexity produces a significant challenge in predicting when, where, and how the consequences of climate change’s maritime dimensions will materialize.

This uncertainty quashes neither the need for a preparedness model for the maritime security dimension of climate change nor the potential to develop one. Below, figure 6 illustrates possible outcomes for succeeding or failing to institute a preparedness model versus how the maritime consequences of climate change materialize. For sake of simplicity, the table is presented in binary form; the model is instituted or not, either the consequences materialize or they do not. The outcomes illustrate ‘net preparedness,’ ranging from -1 for being underprepared, to 0 for being adequately prepared, to +1 for being overprepared.

		Consequences of climate change materialize?	
		Consequences materialize	Consequences do not materialize
Preparedness model instituted?	Model not instituted	-1 (Underprepared)	0 (Prepared)
	Model instituted	0 (Prepared)	+1 (Overprepared)

Figure 6: Net preparedness in instituting a model vs. materializing consequences

The top-left outcome – failing to prepare amidst materializing effects – results in underpreparedness and is therefore undesirable. At first glance, the possibility of instituting a model is ideal in only one of three remaining cases: where the maritime consequences of climate change materialize. Should the effects not materialize, Canada will either be adequately prepared if it fails to institute a preparedness model, or overprepared if it succeeds. Further, the possibility of overpreparedness in the absence of the maritime consequences of climate change may seem as undesirable an outcome as underpreparedness, as this would potentially mean resources and time wasted by preparing for scenarios and effects that never materialize.

However, the potential for waste and the dilemma of overpreparedness are easily surmountable through flexibility, given two additional attributes of warships: *versatility* and *adaptability*. In other words, a warship well-suited to responding to the maritime consequences of climate change is not limited to conducting missions related to lawlessness at sea or humanitarian assistance. Booth acknowledges the flexibility inherent in many navies around the world:

Most ships are multi-purpose. Above all, the aircraft carrier is the pinnacle of operational flexibility. Its primary mission can change between air defence, strike against surface ships, hunting submarines, to protecting power ashore. It is unique among

warships in the versatility of its wartime roles, while also being capable of performing all the short-of-war activities, from the most social to the most harassing aspects of coercive diplomacy.... Improvisation is a norm of naval employment: rare has been the warship which has been kept in the matter to which its original designer thought it would be accustomed. Because of their life-span of twenty to thirty years, this is hardly surprising.¹⁷²

Flexibility can be taken too far; the Joint Support Ship project serves as an example of capability “creep.” Though intended to replace the Protecteur-class of replenishment oilers, the costs and capabilities of the project ballooned with the introduction of sealift and command and control facilities.¹⁷³ Such creep can prove highly problematic to a procurement project: as Dave Mugridge suggests, “like any procurement project, the JSS project was likely to see an escalating financial bottom line, run late and fail to deliver against an over-egged Statement of Requirement (SOR).”¹⁷⁴ Nevertheless, a careful provision of flexibility means that warships procured chiefly for combating lawlessness at sea and providing disaster relief are not necessarily limited to fulfilling these functions.

The fact that the maritime security dimensions of climate change are but one of many other future security challenges is also significant. *The Future Security Environment 2008-2030* identifies many other potential concerns for the next few decades, ranging from the use of nanotechnology in defence applications, to ongoing inter-state rivalries, to the proliferation of a wide variety of weapons.¹⁷⁵ The implication is that a preparedness model for the maritime consequences of climate change must

¹⁷² Booth, 182.

¹⁷³ Matt Gurney, "The AOR - JSS 'gap'" BroadSides Discussion Forum, <http://naval.review.cfps.dal.ca/forum/view.php?topic=21> (accessed June 23, 2010).

¹⁷⁴ Dave Mugridge, "An Affordable JSS for Canada," *Canadian Naval Review* 4, no. 3 (Fall 2008): 31.

¹⁷⁵ *The Future Security Environment, 2008-2030*, 83 and 96-7.

recognize its place within the larger context of Canadian security and defence; resources must not only be balanced between the military, constabulary, and diplomatic functions of the Canadian navy, but also between the navy and the rest of the Canadian Forces, and between the Canadian Forces and the rest of the Government of Canada. In recent years, global economic crises and large government deficits make sustained defence budgets anything but a guarantee. Further, resources for the navy are limited not only in budgets but also in personnel; the Canadian navy is currently approximately 20% short of personnel, particularly in technical trades.¹⁷⁶ After several years of personnel deficits, the year of the navy's centennial has seen recruitment goals finally being met.¹⁷⁷ The future of personnel and resource availability for the Canadian navy remains uncertain.

In these respects, a preparedness model for the maritime consequences of climate change is limited in two ways. First, both climate change and its related maritime consequences are difficult to predict with assurance. Instead, the best that can be offered is to identify those areas of highest risk (Mazo's 'states of concern') and provide possible scenarios as has been done in previous chapters. The second limitation is that a preparedness model cannot stand by itself. It is limited by other security requirements posed both by climate change, by a broad range of other issues in the future security environment, and by the challenges of balancing resources and budgets between competing institutions within the Canadian Forces and the government of Canada. The model is therefore constrained with the need to respond to the maritime consequences of climate change with great flexibility, and restrained by the need to do so with austerity.

¹⁷⁶ Cdr. Kenneth P. Hansen, "The Future of the Navy."

¹⁷⁷ VAdm. Dean McFadden, "Opening Address" (speech, The Canadian Navy: Yesterday, Today and Tomorrow, Pier 21, Halifax, June 16, 2010).

5.2 Experiences and Cases - Necessary Attributes for a Fleet Structure

The reality of these constraints and restraints serve to define only part of the preparedness model: specifically, the *structure* into which preparedness must fit. To fill this structure, recent experiences help to define the *substance* of the preparedness model, through illustrating the capabilities and capacities necessary to adequately prepare for the maritime security dimensions of climate change. Recent case studies and the situations are not necessarily symptomatic of climate change; however, they are educative for demonstrating likely scenarios for the navy in the era of climate change and highlighting the successes and failures of the navy when operating in constabulary and diplomatic functions.

In regards to humanitarian assistance and disaster relief, the Canadian response to the 2010 Haitian earthquake is an informative experience. Although the praise for the Canadian sailors' actions was widespread and positive – says *Athabaskan's* commanding officer Peter Crain, “[t]he pride that I feel for their accomplishments is immeasurable and moves me greatly” – actual strategic effect on the situation on land was greatly limited. Disaster relief demanded attributes the navy did not have, namely volumetric capacity. As Brian Stewart notes:

The big problem is size. Both the *Halifax* (4,700 tonnes) and the slightly larger *Athabaskan* (5,100 tonnes) are fast, multi-purpose ships adept at many sea operations around the globe.

But they're positively puny in terms of the supplies they can carry.

They were never designed to provide the kind of strategic sealift needed to respond to global emergencies like Haiti or the tsunami that ravaged Southeast Asia five years ago.

These vessels can carry a few hundred tonnes of supply, where many thousands are needed.

In fact, if you combine the size of the two ships together they amount to only about one-third the size of the modern joint support ships (JSS) that the navy has long been promised, but which still languish on the drawing board.¹⁷⁸

Similarly, Doug Thomas argues:

If the Canadian navy had possessed a large ship available to deploy in the case of such incidents as the Haitian Earthquake ... it could have taken huge quantities of building supplies, mechanized vehicles such as bull dozers, back-hoes, ... SUVs, and landing craft, all of which would have greatly increased the capability of sea-borne and sea-based assistance to the Haitian people.¹⁷⁹

Vessels like the *Preserver* and *Protecteur* replenishment oilers are better suited for humanitarian assistance and disaster relief, given their greater volumetric capacity than *Halifax* and *Athabaskan*. Indeed, *Preserver* has a storied history of involvement in humanitarian assistance, including non-combatant evacuations in Haiti in 1988, disaster relief to Florida after Hurricane Andrew in 1992, and the provision of aid to Somalia in 1993.¹⁸⁰ Unfortunately, in January 2010, as *Preserver* approached 40 years since her commissioning, she was undergoing a major refit and was not available to provide disaster relief to Haiti. Though these ships are equipped with lifting cranes and small landing craft, the replenishment oilers have limited capabilities to provide support to forces ashore even if they were available. With no well deck to load and support landing craft, and the movement of stores to the flight deck for delivery by helicopter a “painful

¹⁷⁸ Stewart.

¹⁷⁹ Doug Thomas, "Canada and the Disaster in Haiti," Broadsides Discussion Forum, <http://naval.review.cfps.dal.ca/forum/view.php?topic=59> (accessed June 23, 2010).

¹⁸⁰ "Canadian Navy: HMCS PRESERVER - About the Ship," Canadian Navy, http://www.navy.forces.gc.ca/preserver/1/1-s_eng.asp?category=18&title=4368 (accessed June 24, 2010).

process,”¹⁸¹ delivering supplies becomes an arduous affair with limited effect relative to other contributing platforms. Given the inconsistent availability of these ships as well as their limited capability to provide support to forces ashore, the navy is currently unable to provide the degree of volumetric capacity demanded by the maritime security dimensions of climate change.

Another case educating the navy’s role in humanitarian assistance and disaster relief is the evacuation of non-combatants from Lebanon in July 2006. On 12 July, a raid by Hezbollah militants operating from Lebanon killed several Israeli soldiers. Israel responded with air and ground attacks into Lebanese territory, generating a crisis for the 40-50,000 Canadians living or residing in Lebanon at the time. By the end of the crisis in early August, over 14,000 Canadians had been evacuated from Lebanon.¹⁸² The evacuation effort was praised by then Minister of Foreign Affairs Peter MacKay, arguing that “the evacuation of Canadians from Lebanon is by far the largest and most successful effort ever mounted or attempted in our country’s history.”¹⁸³ Certainly, evacuating over 14,000 people with only a few days notice is an impressive accomplish. By contrast, however, a Senate report analyzing the evacuation suggests that “in general, the evacuation of Canadians from other countries is challenging and rife with potential

¹⁸¹ "DMM" "The AOR - JSS 'gap'" BroadSides Discussion Forum, <http://naval.review.cfps.dal.ca/forum/view.php?topic=21> (accessed June 24, 2010).

¹⁸² Canada, The Standing Senate Committee on Foreign Affairs and International Trade, *The Evacuation of Canadians from Lebanon in July 2006: Implications for the Government of Canada*, by Consiglio Di Nino and Peter A. Stollery (Ottawa, 2007), 1.

¹⁸³ *Ibid.*, 9.

problems” and “the challenges associated with locating and transporting to safety a significant number of Canadians ... were extraordinary.”¹⁸⁴

There were numerous challenges in evacuating Canadians from Lebanon, but chief among them was sourcing transportation. Limitations on available government resources led to the chartering of many aircraft and ships to transport Canadian out of Lebanon and back to Canada. The report is cognizant of the value of volumetric capacity:

Out of a total of 65 flights returning Canadians to Canada, 4 aircraft belonged to the Department of National Defence. Naval transport was contracted. By comparison, the United States and United Kingdom possess aircraft carriers and helicopters that were in a position to evacuate a significant number of people at one time.... The Government of Canada should review whether its military and governmental personnel and resources are sufficient to address the need for evacuations overseas, whether these resources need to be augmented, and whether the chartering of relevant resources in times of crisis is sufficient.¹⁸⁵

Sufficient volumetric capacity in the navy may not have ameliorated the crisis in Lebanon, as those vessels that did succeed in evacuating civilians were already well-poised to act. Departing from Halifax, it would have taken a task group travelling at 20 knots over a week to reach Beirut. Nevertheless, the future implications are most pertinent to preparing for the maritime security dimensions of climate change. The report notes that the “potential need for the evacuation of Canadians in crises situations abroad, whether or not it is on the same scale as that of the effort in Lebanon, will not disappear.”¹⁸⁶ With this caution and the experiences in Lebanon and Haiti, greater volumetric capacity is demanded by the need to deliver disaster relief and to evacuate

¹⁸⁴ Ibid., 8.

¹⁸⁵ Ibid., 18.

¹⁸⁶ Ibid., 12.

individuals from crisis-stricken areas. Volumetric capacity is a clear requirement in preparing for the more frequent and more intense natural disasters likely in an era of climate change.

The Canadian navy's experience in confronting lawlessness at sea is limited, but nevertheless lessons may be drawn from recent experiences. Most prolific in recent years have been counter-piracy operations in and around the Gulf of Aden. Writing of his experiences as commanding officer of HMCS *Winnipeg* during a 2009 deployment, Commander Craig Baines illustrates some of the successes and failures of the Canadian navy in a constabulary function. One aspect of these successes and failures is conceptual. For instance, Baines applauds the flexibility and adaptability inherent in his warship's capabilities, but notes that counter-piracy operations offered unique challenges in proficient operation. Baines notes that "[c]onsiderable time was still spent in developing our concept of operations and anticipating what we might face so that we would be prepared for any contingency."¹⁸⁷ Though *Winnipeg* is a warship with overwhelming firepower, Baines states that "we were not certain how the pirates would react to our presence and we needed to get it right the first time."¹⁸⁸ This experience suggests that naval involvement in constabulary roles demands new concepts and modes of thinking that depart from the understanding of sea power in traditional military functions.

Pertinent to designing a fleet structure, successes and failures were also evident in Baines' discussion of the equipment used in counter-piracy. Among those successes includes the use of *Winnipeg*'s Sea King helicopter. Baines notes that "...in every major

¹⁸⁷ Cdr. Craig Baines, "Dangerous Waters: HMCS Winnipeg Tackles Piracy in the Gulf of Aden," *Canadian Naval Review* 6, no. 1 (Spring 2010): 16.

¹⁸⁸ *Ibid.*

interaction that *Winnipeg* had with pirates, the ship's helicopter was instrumental in resolving the situation. Often the helicopter was the first to detect the pirates or was *Winnipeg*'s first response to a developing situation."¹⁸⁹ As for *Winnipeg* herself, though the frigate held a speed advantage over pirates, the small pirate skiffs were more maneuverable. In one case on 18 April 2009, a pirate skiff was pursued by *Winnipeg* at close range for several hours. By the time the pirates capitulated and the skiff was boarded, the pirates had already jettisoned weapons and equipment that would have served as evidence for prosecution.¹⁹⁰ To effectively counter maritime piracy and ensure fast, effective responses, maneuverability emerges as a key requirement.

Winnipeg's experiences in combating piracy are applicable to the broader dilemma of effective constabulary operations, as many functions of navies – counter-piracy, counter-terrorism, and drug interdiction – demand navies to shift focus to littoral regions. Littoral regions constitute areas where ocean meets shore, and present their own unique sets of challenges through dense maritime traffic, weapons technology including shore-based missiles and naval mines, and asymmetric threats.¹⁹¹ A recent article in *Proceedings* argues that in the littorals, “sea-control challenges are often asymmetric in nature, with military objectives, such as establishing a sea base or conducting an amphibious landing, tied to the broader context of influencing events on shore.”¹⁹² This perspective resonates with Canada's naval leadership: Vice-Admiral Dean McFadden

¹⁸⁹ Ibid.

¹⁹⁰ Ibid., 17-8.

¹⁹¹ Cdr. Kenneth P. Hansen, "Starting Over: the Canadian Navy and Expeditionary Warfare," *Canadian Naval Review* 1, no. 1 (Spring 2006): 22.

¹⁹² Capt. Victor G. Addison Jr. and Cdr. David Dominy, "Got Sea Control?" *USNI Proceedings* 136, no. 3 (March 2010), http://www.usni.org/magazines/proceedings/story.asp?STORY_ID=2256 (accessed June 30, 2010).

defines the world's littoral region as "that strip of the planet where land meets sea, extending landward or seaward as far as force and influence can be projected from either environment."¹⁹³ Another recent *Proceedings* article makes clear the connection between the littorals and lawlessness at sea:

Increasingly, the contest of ideas is being waged in niche arenas, in the littorals, the near-shore green-water areas, and up and down contested riverine estuaries that provide concealment and cover for terrorists, pirates, and warlords. It is in these areas that the slow erosion of law and order is an accepted fact of life.¹⁹⁴

Clearly, littoral regions will be the destinations of navies desiring to preserve order at sea in the era of climate change.

Unfortunately, as *Winnipeg's* experience partly suggests, the Canadian navy is currently ill-suited to constabulary missions in littoral zones. Though speaking in the context of expeditionary operations, Commander Ken Hansen nevertheless identifies the navy's general shortcomings in littoral operations:

Canadian 5,000- to 6,000-tonne warships are too large, too poorly armed and too unwieldy to venture close in-shore for joint support tasks. Yet, Canadian destroyers and frigates have neither the sensors nor the weapons to function effectively from further offshore....

...The Canadian fleet now finds itself in an awkward no-man's-land, composed of warships too small to accommodate the staff, sensors and weapons needed to perform effectively in the outer littoral zone but too large to be risked in the inner littoral zone.¹⁹⁵

¹⁹³ VAdm. Dean McFadden, "The Navy And Canada's National Interests in this Maritime Century," *Canadian Naval Review* 6, no. 1 (Spring 2010): 6.

¹⁹⁴ Cdr. Henry J. Hendrix, "More Henderson, Less Bonds," *USNI Proceedings* 136, no. 4 (April 2010): 62.

¹⁹⁵ Hansen, 23-4.

An additional attribute of warships therefore emerges as necessary: *leverage*. This constitutes the ability of naval forces to leverage operational and strategic effect onto land and shape events ashore. If and when climate change contributes to the destabilization of coastal states, navies must be prepared to apply leverage – both into the littoral zone and onto shore – to ensure continued security at sea.¹⁹⁶

Leverage is traditionally thought of in terms of using amphibious forces to coerce or otherwise influence a conventional enemy force. For instance, in Operation DESERT STORM, US amphibious task groups successfully employed leverage against Iraqi forces. In the opening phases of the conflict, the presence of the task groups in the Persian Gulf kept approximately 80,000 Iraqi personnel occupied with defences on Kuwait's east coast, allowing coalition forces to envelop the defenders from the western flanks.¹⁹⁷ However, thought of in a broader context, leverage may apply to constabulary functions directed against illicit activity by non-state actors. Consider Geoffrey Till's arguments on naval coercion:

The more familiar, traditional, coercive aspects of naval diplomacy, once known as “gunboat diplomacy,” are aimed at putative adversaries rather than allies. They can deter those potential adversaries from doing things they might otherwise be tempted to do, or compel them to do things they do *not* want to do.¹⁹⁸

Meanwhile, Vice-Admiral McFadden offers a more contemporary perspective:

¹⁹⁶ *MCP 1 Naval Doctrine Manual*. 4/17.

¹⁹⁷ "Desert Storm: the War with Iraq," Naval History and Heritage Command, <http://www.history.navy.mil/wars/dstorm/ds5.htm> (accessed July 14, 2010).

¹⁹⁸ Geoffrey Till, *Naval Transformation, Ground Forces, and the Expeditionary Impulse: the Sea-Basing Debate* (Carlisle Barracks: Strategic Studies Institute, US Army War College, 2006), 4.

Operations in the littorals, especially those conducted ‘from the sea’, will centre on influencing populations and establishing the conditions to achieve strategic advantage in what some have called ‘the battle of the narrative.’¹⁹⁹

In the context described by McFadden, it is useful to define leverage not only in terms of sea control of littoral waters towards denying their use for illicit activity, but also in maintaining presence close inshore to effectively dissuade populations from pursuing such illicit activities in the first place. For a fleet operating inshore, the demands are diverse, with possible tactical actions ranging from surveillance and scouting to skirmishes and raids.²⁰⁰ A fleet structure optimized for leverage must be similarly diverse; as Milan Vego argues:

A fleet best suited to accomplish the tasks in narrow seas is not one designed to fight on the open ocean.... Failure to build a balanced navy has in the past created many difficulties in accomplishing strategic objectives in a war at sea.... In other words, a blue-water navy should avoid using large, high-capability and high-cost ships for routine tasks that can be carried out more effectively and more cheaply by smaller, less capable but less costly ships.²⁰¹

Towards the end of effectively achieving leverage in an era of climate change, the present fleet structure and capabilities of the Canadian navy demands reevaluation.

Capabilities necessary for the new maritime security demands of climate change shape the preparedness model. Recent experiences emphasize the need both for naval functions in constabulary and diplomatic roles and a naval focus towards two attributes.

¹⁹⁹ McFadden, "A Speech by VAdm. Dean McFadden, Chief of the Maritime Staff, to the Historical Conference, Ottawa, Ontario, 06 May 10,"

²⁰⁰ Milan N. Vego, *Operational Warfare* (Rhode Island: Naval War College, 2000), 373.

²⁰¹ Milan N. Vego, *Naval Strategy and Operations in Narrow Seas* (London: Cass, 2003), 297.

In the case of humanitarian assistance and disaster relief, the attribute is *volumetric capacity*, the ability to move cargo and people over long distances, quickly and cheaply. In the case of lawlessness at sea, the attribute is *leverage*, the ability for a navy to project strategic effect into coastal regions and ashore, denying criminals the ability to exploit littoral zones for unlawful activities, and maintaining sufficient inshore presence to dissuade foreign populations from pursuing unlawful activities. When mated with the limitations discussed above, these attributes form a model in preparing for the maritime security dimensions of climate change.

5.3 Developing a Fleet Structure for Preparedness

In recapitulation, a preparedness model for the maritime security dimensions of climate change must adhere to the following constraints and restraints:

1. *Flexibility*: recognizing both that climate change is surrounded by a significant degree of uncertainty and that climate change is but one of several potential challenges in the future security environment, the model must offer enhanced flexibility and allow the navy to remain adaptable for a wider variety of tasks. Capabilities and capacities should not be limited to surge use or crisis situations.
2. *Austere fiscal and personnel resources*: as US Secretary of Defense Robert Gates recently noted, the “gusher” of defence spending following the attacks of 11 September 2001 has been turned off.²⁰² The global economic crisis and deep government deficits limit the funds available for major procurement programmes

²⁰² Brad Norington, "Robert Gates takes aim at 'gushing' US military budget," *The Australian*, May 10, 2010, <http://www.theaustralian.com.au/news/world/robert-gates-takes-aim-at-gushing-us-military-budget/story-e6frg6so-1225864224006> (accessed June 30, 2010).

or naval transformations. The Canadian navy's current challenges in attracting and retaining personnel provide additional limitations. The model must restrain its budgetary and personnel footprint.

Simultaneously, the challenges of greater lawlessness at sea and greater need for humanitarian assistance abroad demand the navy to pursue the following attributes:

1. *Volumetric capacity*: in response to a natural disaster, the navy needs the capability to transport large amounts of relief supplies and machinery into a disaster-stricken region. Likewise, it should be able to contribute to the evacuation of Canadians as necessary.
2. *Leverage*: to confront lawlessness at sea, the navy needs the capability to project strategic effect into both littoral waters where lawlessness is found and ashore where it originates.

Mating these attributes with the above limitations to produce an ideal fleet structure is a tall order, but it is possible. In an April 2010 article in *USNI Proceedings*, USN Commander Henry J. Hendrix proposes a shift from the US Navy's traditional fleet structure, in which the aircraft carrier is central, to incorporate a new model emphasizing cheaper, smaller vessels. Dubbed the "influence squadron" for its intention to expand American influence into the littoral zones of other countries, Hendrix proposes a collection of ships eschewing high-end combat capabilities in favour of deploying ships in greater numbers and incorporating lower-end capabilities needed to confront emerging maritime security challenges. Hendrix describes the environment for which the influence squadron is tailored:

It is a naval force tailored to missions both new and old. Harking back to the founding of the republic, Influence Squadrons will be numerous enough to combat piracy – the only naval mission actually enshrined within the US Constitution – and strong enough to take on terrorists who smuggle weapons across the seas as well as interdict the drug lords whose products kill more Americans per month than al Qaeda has in its history. Larger numbers of platforms will also enable Influence Squadrons to both provide local medical assistance in the form of vaccinations and respond swiftly to natural disasters and thus prevent epidemics of such diseases as dysentery and cholera.²⁰³

Clearly, the environment in which the influence squadron is intended to operate makes this proposal highly relevant to the maritime security dimensions of climate change.

Hendrix’s proposed squadron is uncomplicated, aiming to provide ten lower-end ships for the cost of a single higher-end combat-capable ship like an Arleigh Burke-class guided missile destroyer. “[N]aval presence is a strategic end in itself; as long as you are present, you establish and maintain the rules in the area where you operate,” notes Hendrix. “In ten years, through an alternative shipbuilding scheme that converts one high-end platform’s worth of investment per year into ten less complex ships, the US Navy would gain 100 ships’ worth of war-preventive naval presence.”²⁰⁴ Working from a budget of about \$1.35 billion, Hendrix proposes the squadron be composed of the following vessels:

- A riverine detachment “[t]o embed a credible capability to operate in the porous inshore waterways where criminal and terrorist networks abound in the South American, African, and Pacific island areas of operation.” Valued at \$40 million, the detachment is comprised of:
 - One 49’ riverine command boat, to “mobile liaison, communications, and command-and-control capabilities.”

²⁰³ Hendrix, 62.

²⁰⁴ *Ibid.*, 65.

- Three 38’ riverine patrol boats, to “conduct inland waterway patrol and interdiction to preserve rivers for friendly use as lines of communications and to deny the enemy their use.”
- Two 33’ assault boats to “deny the use of rivers and waterways to waterborne and immediate shore-sited hostile forces by barrier and interdiction operations.”²⁰⁵
- Four 150’ coastal patrol craft, to “to extend influence into the coastal realm,” valued at \$80-160 million total.²⁰⁶
- Three 295’ multi-role vessels (such as Austal’s MRV): “a ship capable of dealing with local security issues, yet inexpensive enough to be purchased in large numbers.” Valued at \$450 million total.²⁰⁷
- One Joint High-Speed Vessel (such as HSV-2 *Swift*), to provide intra-theatre cargo lift and logistically link the littoral, riverine, and green water elements of the squadron. Valued at \$170 million each.²⁰⁸
- One ‘mother ship’ hosting command and control capability for the squadron, as well as acting as a “central dispersal point” for dry cargo and spare parts. The mother ship would also transport the riverine detachment on its deck or in its hold for long transits. Hendrix nominates the Lewis and Clark-class of T-AKE dry cargo vessels as suitable candidates, as \$400 million each.²⁰⁹
- “Numerous and relatively inexpensive unmanned platforms to provide air, surface, and undersea surveillance as well as communications relay nodes.”²¹⁰

As noted above, the influence squadron does not incorporate high-end combat capabilities. This is not by mistake: “[t]he high-end portion of the Navy does not just go away,” notes Hendrix. “Ninety percent of the shipbuilding budget would still go towards these [high-end] platforms.” According to Hendrix, “only a fool plays with a grizzly bear cub in the woods, because the mother bear may be just over the hill. Our

²⁰⁵ Ibid., 62-63.

²⁰⁶ Ibid.

²⁰⁷ Ibid.

²⁰⁸ Ibid.

²⁰⁹ Ibid., 64.

²¹⁰ Ibid.

high-end force will remain over the hill, ready to respond.”²¹¹ Whereas Hansen finds that the Canadian fleet structure is in an ‘awkward no-man’s-land,’ Hendrix’s influence squadron is able to fulfill a broad range of tasks from patrol of inshore waterways to command and control in the outer littoral zone.

How does the influence squadron rate against those requirements and limitations specific to Canada, outlined above? Smaller, more manoeuvrable, and more numerous patrol craft are better suited than a single larger frigate to contend with pirates and terrorists within and near the littoral zone. Likewise, the inclusion of the mother ship provides significant strategic cargo capacity, while the high-speed support vessel provides the capability to quickly move cargo intra-theatre. The squadron meets the demanded attributes of leverage and volumetric capacity with flying colours, making it very suitable for contending with the maritime security implications of climate change.

With respect to limitations, the influence squadron is flexible; as a ‘catch-all’ force, it could conduct a variety of missions including homeland security, disaster relief, counter-piracy, plus deliver and support military expeditionary units and special forces. Budgetary limitations are satisfied by the squadron’s relatively small price tag, and Hendrix suggests decommissioning one or two aircraft carriers to circumvent problems in allocating personnel.²¹² Yet from a Canadian perspective, the influence squadron as proposed by Hendrix is problematic. A \$1.35 billion influence squadron would consume one-tenth of the US Navy’s \$13 billion shipbuilding budget. By contrast, \$1.35 billion is

²¹¹ Ibid., 65.

²¹² Ibid., 61.

just over half the Canadian navy's \$1.97 billion overall annual budget.²¹³ Further, Hendrix's proposed squadron demands a complement of around 500 officers and crew; with no aircraft carriers of its own to decommission, this is in no way a realistic number for Canada's navy. Exceeding budgetary and personnel limitations, the influence squadron unfortunately is an unrealistic option for Canada.

However, it is possible to 'Canadianize' the influence squadron and fit it within the stated limitations. Hendrix aims to keep his influence squadron beneath the fiscal requirements of a single Arleigh Burke-class guided missile destroyer, so that one influence squadron may be constructed in place of one destroyer. A similar objective could be adopted in Canada. Given the Canadian navy's intention to replace existing surface combatants – the navy's frigates and destroyers – on a "like-for-like" basis, the future fleet could be reduced by one surface combatant in favour of constructing a smaller, slimmer version of Hendrix's influence squadron. This squadron should be devised in such a way that it could replace a single surface combatant without placing additional budgetary or personnel burdens on the navy's shoulders.

Again, this seems a tall order. Yet with a few basic modifications, a 'Canadianized' influence squadron is possible to fit within the budgetary and personnel footprint of a single future surface combatant. Consider that the approximate per-unit rate of a modern frigate such as the Indian Shivalik-class or the Norwegian Fridtjof Nansen-class is about \$700 million, and a reasonable complement to work with is within the

²¹³ *CBC News*, "Canada's navy cuts coast patrol fleet in half," May 13, 2010, <http://www.cbc.ca/canada/nova-scotia/story/2010/05/13/ns-navy-coastal-ships.html> (accessed July 03, 2010).

range of 250. The following is just one alternative fleet structure of how Hendrix's proposal could be altered to fit within these confines:

- Retain the riverine detachment as above for \$40 million.
- Replacing the T-AKE 'mother ship' with a vessel similar to the 16,000 tonne Bay-class of landing ship docks, crewed by the Royal Fleet Auxiliary. Opting for the Bay-class over the T-AKE sacrifices absolute cargo capacity in favour of lower cost, substantially lower complement, shallower draft, and added options for amphibious/sealift capability by way of a well deck.

Smaller craft incapable of traversing open ocean could be contained within the ship's stern well deck, which might also be reconfigured for amphibious landing craft as required. One unit costs approximately \$230 million,²¹⁴ although additional modifications are likely necessary for command and control and helicopter handling facilities.

- Deletion of the joint high-speed vessel. Though Hendrix argues for the HSV as the "critical logistics link" of the influence squadron, this capability might instead be filled by smaller, less-expensive landing craft.
- The most room for creativity is in deciding between 150' patrol craft and 295' MRVs. Existing or future Canadian surface combatants could possibly stand in place of the large MRV when needed. Alternatively, acquiring 150' patrol craft edges into the capabilities of the Kingston-class patrol vessels. An in-between option such as the Australian 186' Armidale-class patrol boat might be ideal, at around \$30 million per unit. Four hulls for \$120 million total would be suitable.

This produces a squadron of eleven ships – six riverine craft, one amphibious 'mother ship,' and four larger patrol craft – for a combined cost of \$390 million. This figure is nearly half the cost of a modern frigate, providing significant overhead space for costs associated with research and development, training, and shipyard development. Further, it requires a complement of only approximately 200 officers and crew, below that of a modern surface combatant. This presents a more realistic option for Canada, one that the navy can likely accommodate over the next few decades.

²¹⁴ United Kingdom, National Audit Office, *The Landing Ship Dock (Auxiliary) Project* (2007), 12.

Such a model would leave Canada very well-equipped to contend with the maritime security dimensions of climate change. Significant volumetric capacity is provided by the landing craft, while leverage is provided over and beyond the capability of existing frigates by the riverine detachment and the patrol craft. These attributes make the squadron well-tailored to responding to increased natural disasters and lawlessness at sea that characterize an era of climate change.

In addition to its low budgetary and personnel footprint, the squadron is highly flexible. A mother ship based on the Bay-class may be reconfigured for amphibious landings as future requirements dictate, and may also be used for sealift, sea basing, and general support of operations ashore. Likewise, the smaller patrol craft may augment existing and future resources for sovereignty enforcement and aid to the civil power within Canada. This ensures that no matter the intensity of the maritime security dimensions of climate change, no resources are wasted or reserved for surge usage.

Ideally, squadrons would be procured in place of one or two replacement surface combatants, keeping the navy's core frigate/destroyer-oriented structure intact. This ensures that high-end combat capabilities are retained, and that maximum flexibility and scope of capabilities are available to the navy. Though high-end combat capabilities and military functions in general will likely see their relevance decline in favour of constabulary and diplomatic functions, the possibility of conventional conflict does not disappear. As Schwartz and Randall note, reduction in the Earth's carrying capacity coupled with difficulty accessing or scarcity of resources breeds inter-state rivalry.²¹⁵ The possibility that this rivalry may involve Canada or its closest allies should not be ignored;

²¹⁵ Schwartz and Randall, 16.

indeed, Schwartz and Randall point to naval clashes between the US and China over the supply of oil from Saudi Arabia as one possibility in the era of climate change.²¹⁶ While this is an extreme scenario, the uncertainty of climate change means that the Canadian navy must maintain an array of military, diplomatic, and constabulary capabilities and capacities needed to respond to a range of future scenarios.

A preparedness model incorporating these squadrons is both realistic and effective. This structure alters the navy into a force that emphasizes flexibility and utility, attributes sought after by the navy's leadership.²¹⁷ Most importantly in the context of the maritime security dimensions of climate change, this structure enables rapid and effective responses to the increased illicit activities at sea and natural disasters, while leaving the navy still able to contend with conventional military threats and a broad range of other possible scenarios in the future.

²¹⁶ *Ibid.*, 17.

²¹⁷ Hansen, "The Future of the Navy."

Chapter 6.0 Conclusion

Climate change has significant relevance to maritime security. Though the effects of potential reductions in the Earth's carrying capacity may be felt most directly and immediately upon land, an emerging nexus exists between climate change and maritime security. For those states both most affected by climate change and lacking resiliency to adapt, climate change may exacerbate existing state fragility. As a 'threat multiplier,' climate change may intensify existing conflicts or spur new ones. States most fragile or on the verge of failure may be unable to effectively enforce law and order within their borders. Those states will likely see their disorder 'slop-over' into the maritime domain, where it materializes as mass migration, piracy, terrorism, or drug trafficking. For navies around the world, the phenomenon of lawlessness at sea resulting from climate change places new demands on navies to fulfill constabulary functions and ensure the continued safe use of the seas.

Simultaneously, natural disasters will potentially increase in both intensity and frequency. Acting in diplomatic functions, in the last few years navies have made significant contributions to humanitarian assistance and disaster relief efforts worldwide. In operations ranging from 2010's earthquake in Haiti to 2004's Indian Ocean tsunami, the volumetric capacity and mobility of navies makes them well-poised to provide relief in the wake of a significant disaster. Expecting the trend of using navies to respond to disasters to persist into the future, climate change will place increasing demands on navies to fulfill diplomatic functions and deliver humanitarian assistance.

Though Canada has little to fear from climate change directly and is geographically distant from the states at highest risk – they are mostly found in Africa and Southeast Asia – Canada does not escape the nexus between maritime security and climate change. Canada is simultaneously a trading nation and a maritime nation; much of the international commerce upon which Canada is dependent travels by ship. Lawlessness projecting from coastlines has great range, as demonstrated by contemporary experiences – namely piracy off the coast of Somalia and the 2008 terrorist attacks on Mumbai. Such lawlessness may threaten the safety and security of the sea lines of communication upon which Canada is dependent. Likewise, as both a culturally diverse state and with many of its citizens living abroad, Canada has vested interests in ensuring prompt and effective responses to natural disasters. Canada's allies are contemplating the future capabilities of their own navies; as it is uncertain whether navies like the US will sustain the capabilities necessary for missions like counter-piracy. Canada is unable to shirk the responsibility of responding to lawlessness at sea and natural disasters abroad; there is great impetus to prepare for the maritime security consequences of climate change.

Achieving preparedness is not without complications. Canada's navy faces significant restraints through austere budgetary planning and experiences difficulties attracting and retaining personnel. Further, much about the maritime consequences of climate change is uncertain. As climate change is a *risk*, planning is frustrated with uncertainty about where, when, or how its consequences will materialize. This does not make planning impossible; indeed, navies are inherently flexible so that any future fleet structure can perform a variety of tasks, not only those relating to the diplomatic and

constabulary demands of climate change. The result, therefore, is that a preparedness model must be constrained by a need for flexibility to perform a wide range of functions not limited only to surge instances, and be restrained by budgetary and personnel limitations.

In designing a preparedness model, contemporary experiences in and around Haiti, Somalia, and Lebanon indicate that the fleet structure of the current Canadian navy is inadequate to produce strategic effect in operations against lawlessness at sea or in support of disaster relief. The Canadian navy has neither the diverse array of smaller patrol craft needed to project leverage into coastal areas where pirates and terrorists lurk, nor the volumetric capacity of larger landing ships or dedicated transports to deliver significant amounts of disaster relief. A preparedness model is therefore further constrained by the need to inject attributes of leverage and volumetric capacity into the navy's fleet structure.

The above constraints and restraints make preparedness seem a tall order, but a model fleet structure like Hendrix's 'influence squadron' satisfy the requirements. Downsized and using alternate platforms where appropriate, a 'Canadianized' influence squadron based around a large landing ship and a riverine detachment can be procured for approximately half the cost of a future surface combatant. Crewing requirements for such a squadron would be lesser than or equal to one modern frigate or destroyer. The squadron would deliver maximum utility by supplying the needed attributes of leverage and volumetric capacity. Yet it would also offer great flexibility in its ability to not only contend with the consequences of climate change like piracy and natural disasters, but also added capabilities like amphibious landing, sealift, support to forces ashore, and

domestic security, among others. One to two squadrons procured in place of a future frigate or destroyer replacement is an ideal preparedness model for the maritime security dimensions of climate change.

Recommendation 1: In place of one or two future surface combatants, the Canadian navy should seek to procure a Canadianized ‘influence squadron’ centred on a landing ship and riverine detachment.

This project has considered the maritime security dimensions of climate change almost entirely from the perspective of the Canadian navy. The recommended fleet structure and its capabilities are tactical considerations aiming to contribute to overall strategic effects. Yet the navy is certainly not the only party of interest in planning and preparing for these consequences, and operations like disaster relief and counter-piracy are not conducted in vacuums. Vego underlines the value of considering such efforts in their operational context:

Future operational commands must not have a narrow, tactical perspective in the performance of their duties in peacetime and in time of war. To be fully successful, they must possess a much broader perspective on all aspects of the situation - political, diplomatic, military, economic, informational, and others - or what is arbitrarily called ‘operational perspective.’²¹⁸

The need for a comprehensive approach to meet future challenges like climate change is echoed in *The Future Security Environment 2008-2030*:

Meeting the challenges of the future security environment will require contributions from all instruments of national power; achieving the desired effects will require the participation of, and cooperation with, allied defence teams, other government departments, the private sector and, where applicable, non-

²¹⁸ Vego, *Operational Warfare*, xiv.

governmental organizations; this is commonly being referred to as the Comprehensive Approach among Canada's allies.²¹⁹

Towards the end of a comprehensive approach, other departments within the Canadian government should not be neglected from having roles in preparing for the maritime dimensions of climate change.

Other departments possess expertise, capabilities, and resources that the navy does not, enabling or improving the effectiveness of naval operations abroad. This makes cooperation between the navy and other departments – chiefly Foreign Affairs and International Trade (DFAIT) – crucial in preparing for the maritime security dimensions of climate change. For instance, DFAIT coordinates Canada's humanitarian assistance efforts abroad and mobilizes domestic support for disaster relief.²²⁰ The Canadian navy's participation in disaster relief therefore benefits from a synergistic relationship with DFAIT. DFAIT possesses the authority and experience needed to coordinate a disaster relief effort, and the Canadian Forces "has long-standing logistical and communications expertise and experience operating in complex and insecure environments, and its personnel are trained specifically for these roles."²²¹

This project has focused largely on expeditionary aspects of preparing for the maritime dimensions of climate change. However, it is important to recognize that the maritime security implications of climate change are not limited to the 'away game.' For example, sovereignty disputes in the Arctic and mass migration to Canada present two

²¹⁹ *The Future Security Environment, 2008-2030*, 91.

²²⁰ "Canada's response to natural disasters and risk reduction," Foreign Affairs and International Trade Canada, http://www.international.gc.ca/humanitarian-humanitaire/natu_disas-cata2.aspx (accessed July 13, 2010).

²²¹ *The Evacuation of Canadians from Lebanon in July 2006: Implications for the Government of Canada*, 17.

potential maritime challenges to Canada's domestic security arising from climate change. Therefore, the potential for cooperation is not limited between the navy and DFAIT. Naval cooperation with organizations such as the Royal Canadian Mounted Police or the Canadian Coast Guard will prove beneficial in domestic situations, and further research is necessary to understand what the maritime dimensions of climate change mean for the 'home game' of Canada's security.

While comprehensive intra-governmental cooperation would likely prove beneficial in planning for the maritime security dimensions, space considerations prohibit in-depth inquiry into how exactly these relationships would function and how they should be developed. Future research should therefore consider whole-of-government approaches as they pertain to the maritime security dimensions of climate change. Individual organizations and departments would also be well advised to begin contemplating possible partnerships with the navy.

Recommendation 2: Future research should consider whole-of-government cooperative approaches to contending with the maritime security dimensions of climate change. Such cooperation will likely prove useful for facilitating or enhancing the use of Canadian sea power abroad in constabulary or diplomatic functions. Future research should also consider the 'home game' implications for the maritime dimensions of climate change in greater detail.

Lastly, while the discussion has centred largely on the maritime security dimensions of climate change, it would be remiss not to address climate change itself. The consequences of climate change are typically projected decades into the future, while the procurement process for the suggested fleet structure – centred on already established platforms and low-end capabilities – may only take a few years to develop.²²² Therefore,

²²² See, e.g., Smith, 619.

planning for the maritime security dimensions of climate change would benefit from continued research and modeling of climate change itself.

Future research should continue to scrutinize emerging trends in climate change, particularly in regards to how climate change may affect those states with little resiliency and at risk of failure – in particular, Jeffrey Mazo’s ‘states of concern.’ As the future for climate change becomes clearer with additional research, how will these states be affected? How can they best prepare themselves to mitigate those affects? Will the proposed fleet structure be adequate for meeting future challenges? Future developments and findings in the science of climate change can therefore better inform the process of preparedness, leading to modifications of the proposed fleet structure as necessary.

Recommendation 3: Climate change itself should continue to be the subject of scrutiny and study towards the end of best informing the development of preparedness models.

Climate change is poised to act as a threat multiplier, potentially exacerbating existing instabilities and conflicts that may ‘slop-over’ into the world’s oceans and waterways. Canada’s stakes in the maritime security dimensions of climate change are not insignificant. With its dependency upon maritime trade and its involvement in humanitarian assistance and disaster relief, Canada cannot afford to neglect planning for the consequences of climate change as they pertain to the maritime domain.

While the consequences of climate change may be fraught with uncertainty and the Canadian navy may be hamstrung by budgetary and personnel restraints, the future is not dismal. Preparedness models like the fleet structure proposed here maintain the navy’s military functions to contend with conventional threats to Canadian defence and security,

yet they also deliver the attributes of leverage and volumetric capacity demanded by the maritime security dimensions of climate change. These attributes also have military applications; the proposed fleet structure and other above recommendations will leave Canada best prepared to contend with the implications of climate change for maritime security, ensuring the safe, free, and sustained use of the seas for the future.

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