



# MERIDIAN

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## CANADA AND CHINA IN THE ARCTIC: A WORK IN PROGRESS

*Rob Huebert*

As recently as five years ago, the suggestion that China was well on its way to becoming a major player in arctic affairs would have been treated with a combination of surprise and disbelief in Canada. Yet it has become abundantly clear in the last few years that China not only is interested in arctic issues but is also actively developing the means to play an increasingly powerful position in the region. This has caught Canada off guard. Given the growing economic wealth and power of the new China, Canada needs to take into account Chinese interests in the Arctic. The Chinese government is now spending considerable resources on ensuring a sustainable and long-term arctic capability. What then, are the Chinese interests there, and how do they impact Canada?

Only since 2009 have western academics and media begun to take serious notice of China's arctic ambitions.<sup>1</sup> Much earlier, however, there were signs that should have alerted Canadians. In 1999 the Chinese arctic research vessel *Xue Long* (Snow Dragon) arrived at Tuktoyaktuk, NWT, at the mouth of the Mackenzie River. This marked the first arctic voyage for this vessel, which had already seen extensive operations in Antarctic waters. Its arrival caught local Canadian officials off guard. While China had notified Canada of its intention to do research in the

adjacent waters of this region, the information was not passed on to officials in the North.<sup>2</sup> This was only the beginning of Chinese arctic research efforts.

### CHINA : THE NEXT ARCTIC SCIENCE POWERHOUSE ?

The Chinese have at least four major areas of interest in the Arctic: science, maritime navigation, resources, and geopolitics. They are currently focussing on developing their scientific program to further their understanding of the Arctic, especially the impacts of climate change on the region. To support these efforts they rely primarily on the work of the Polar Research Institute of China, based in Shanghai, and the China Institute for Marine Affairs, the research department within the State Oceanic Administration, in Beijing.<sup>3</sup> As well, several universities are developing increased arctic expertise. In 1993 China purchased the *Xue Long*, which at 21,000 tonnes is one of the largest non-nuclear powered research vessels operating in the Arctic. It has completed three arctic research voyages and a fourth is planned for the summer of 2012. A second research icebreaker, an 8000 tonne vessel designed by Finnish engineers and powered by British-built engines, is under construction



The Chinese arctic research station in Svalbard is unmistakable with its guardian lions (shishi) at the entrance. Its facilities support research in meteorology, space-earth measuring, glaciology, marine ecosystem, and environment. The station can accommodate 25 people. Photo: Chin Q.Z. Chang.

1. The first major article on China in the Arctic was produced by Linda Jakobson, "China Prepares for an Ice-Free Arctic", *SIPRI insights on Peace and Security*, no. 2010/2 (March 2010) [<http://books.sipri.org/files/insight/SIPRIInsight1002.pdf>]. In Canada there is an increasing number of authors who have been examining this issue. See Frédéric Lasserre "China and the Arctic: Threat or Cooperation Potential for Canada?" *China Papers*, no. 11 Canadian International Council (June 2010) [[www.opencanada.org/wp-content/uploads/2011/05/China-and-the-Arctic-Frederic-Lasserre.pdf](http://www.opencanada.org/wp-content/uploads/2011/05/China-and-the-Arctic-Frederic-Lasserre.pdf)]; Joseph Spears, "China and the Arctic: Awakening the Snow Dragon", *China Brief*, vol. 9, issue 6, the Jamestown Foundation (March 18, 2009) [[www.jamestown.org/programs/chinabrief/single/?tx\\_ttnews%5Btt\\_news%5D=34725&cHash=9638471049](http://www.jamestown.org/programs/chinabrief/single/?tx_ttnews%5Btt_news%5D=34725&cHash=9638471049)]; and David Wright, *The Panda Bear Readies to meet the Polar Bear: China and Canada's Arctic Sovereignty Challenge* (Calgary: Canadian Defence and Foreign Affairs Institute, March 2011) [[www.cdfai.org/PDF/The%20Panda%20Bear%20Readies%20to%20Meet%20the%20Polar%20Bear.pdf](http://www.cdfai.org/PDF/The%20Panda%20Bear%20Readies%20to%20Meet%20the%20Polar%20Bear.pdf)].
2. Aldo Chircop, "The Emergence of China as a Polar-Capable State", *Canadian Naval Review*, vol. 7, no. 1 (Spring 2011); 9 [<http://naval.review.cfps.dal.ca/archive/5548626-5517830/vol7num1art3.pdf>].
3. Jakobson, p. 4.

in Chinese shipyards. China established an arctic research station, "Yellow River", at Ny Ålesund, Svalbard, in 2004.

In the spring of 2010, I participated in an academic visit to both the China Institute for Marine Affairs and the Polar Research Institute of China.<sup>4</sup> We were shown the many research buildings currently under construction in Shanghai which, once completed, will greatly expand Chinese scientific capabilities. It was obvious to the Canadian participants that China is investing heavily in science.

Our Chinese hosts made it clear that, while they have several research interests,

4. The Canadian delegation was composed primarily of legal scholars from Dalhousie University and the University of Victoria as well as an historian from St. Jerome's University and a political scientist from the University of Calgary. It took place in February 2010.

they are most interested in understanding the processes of climate change in the Arctic, in order to understand its impacts on China itself. As one of the Chinese researchers stated, what happens in the Arctic has a direct bearing on China's western deserts and on the sea levels along its eastern coasts.

The Chinese are also very interested in the potential impacts of climate change on maritime navigation routes, for much of China's economic growth is based on exports to North America, Europe, and Asia through maritime trade. They are watching for the possibility of new trade routes developing in the Arctic Ocean. Our hosts showed us a map that places an ice-free Arctic at the centre of the globe, with potential new routes marked out between China and Northern Europe, and between China and Eastern United States<sup>5</sup> – illustrating how an ice-free Arctic would substantially reduce travel distances and times. Of course no one is yet suggesting that this will occur any time soon, except during very short periods in summer, but the Chinese are monitoring this closely.

The Chinese are also keenly interested in possible new resource opportunities. They have made it clear that they do not challenge the sovereign rights of the Arctic coastal states to their resources within the existing 200 nautical mile Exclusive Economic Zones or in any future extended continental shelf zones; but they have both stated and demonstrated that China wants to be an active participant in the economic development of the region. They have begun to purchase shares in various resource development companies throughout the circumpolar North including Canada, focussing on midlevel corporations and offering premiums on their stock purchases.<sup>6</sup> This is clearly a long-term strategy designed to give them an important foothold while at the same time allowing for the corporate world to get used to their increasing participation.

5. This map is included in Jakobson, p. 4.



The *Xue Long*, China's Arctic and Antarctic re-supply and research icebreaker. Photo: © International Polar Foundation /René Robert.

## KNOCKING ON THE DOOR OF THE ARCTIC COUNCIL

China's fourth area of interest is the geopolitical developments of the region, and on an official level they are very interested in participating in the governance forums now developing. In particular they are, like the European Union, attempting to become permanent observers to the Arctic Council. There has been a reluctance within the Arctic Coun-

cil to grant this status to either. After some debate the Council postponed decision on the EU's application in 2011 by deciding to create new criteria for membership.<sup>7</sup>

In part the arctic states are still adjusting to the desire of non-arctic states to participate more actively on this body. To a certain degree China has been caught in the reluctance of Canada to extend permanent observer status to the European Union because of its concerns over the European ban on seal products.<sup>8</sup> At the same time the dispute between Norway and China over the awarding of a

Nobel peace prize to Chinese dissident Liu Xiaobo has also given rise to speculation that the Norwegians are not enthusiastic about the Chinese application.<sup>9</sup> While it is difficult to know the official positions of Canada and Norway, it is clear that the Arctic Council has delayed addressing this issue. One of the biggest challenges that will face Canada when it takes over the chairmanship of the Arctic Council in 2013 will be dealing with these applications.

6. For example see: Margo McDiarmid, "China keen market for oil sands, Oliver says", *CBCNews* (November 9, 2011) [www.cbc.ca/news/politics/story/2011/11/09/pol-oliver-oil-sands-china.html]; Cecilia Jasmasmie, "China secures major second stake in Canadian oil sands with a Cd\$2.1 billion deal", *Mining.com* (November 28, 2011) [www.mining.com/2011/11/28/china-secures-major-second-stake-in-canadian-oil-sands-with-a-cd2-1-billion-deal/].

7. Andrew Willis, "EU gets cold shoulder in the Arctic", *euobserver.com* (May 13, 2010) [http://euobserver.com/24/32331].

8. CBC news, "Canada against EU entry to Arctic Council because of seal trade ban" (April 29, 2009) [www.cbc.ca/news/world/story/2009/04/29/cda-eu-arctic-seal.html].

9. Jonathon Watts, "Norway could shut China out of Arctic Council after diplomatic snubs", *the Guardian* (January 25, 2012) [www.guardian.co.uk/world/2012/jan/25/norway-china-arctic-council].

There is growing recognition that it would be better to have China in the Arctic Council rather than outside. But the Canadian position on new permanent observers will be coloured by the EU request. The European ban on seal products has hurt the interests of Canadian Inuit, and the Inuit Circumpolar Council (ICC) and the other Permanent Participants are therefore reluctant to see the EU given permanent observer status. Given Canada's close relationship with the ICC, Ottawa has objected to the EU application. But this places Canada in a difficult situation. How does Canada support the Chinese efforts to become a permanent observer while at the same time opposing the European application? There is no easy answer.

Once Canada assumes the chair of the Arctic Council it may simply attempt to postpone any decision. But what impact will this have on Canadian-Chinese Arctic relations? China could view such a postponement as a slight, which could in turn affect other aspects of the relationship. If Canada supports both the European and Chinese applications, this could damage Canada's relationship with the permanent participants. If Canada supports only the Chinese application and not that of

the EU, it runs the risk of being labelled as inconsistent and anti-European. The only good solution for Canada is if the Swedish chair surprises everyone and resolves the issue before 2013.

C H I N A I N A R C T I C  
G E O P O L I T I C S :  
P A N D A O R T I G E R ?

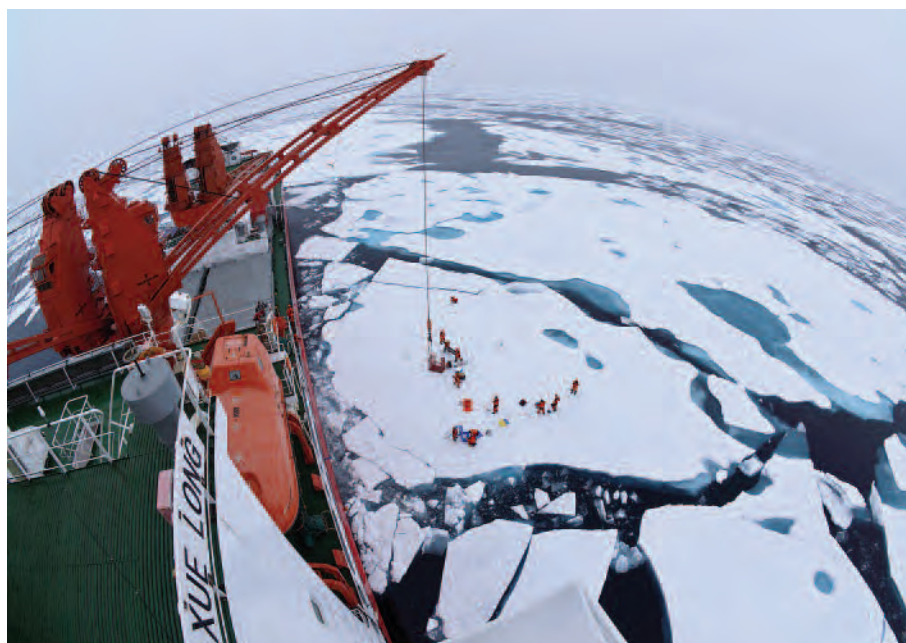
Chinese scholars have also begun to address issues pertaining to the strategic value of the Arctic Ocean, and the Polar Research Institute of China has recently created a department of strategic studies to examine these.<sup>10</sup> A debate is developing between scholars who contend that China should take a more assertive role and those who argue instead that Chinese interests are best served by focussing on cooperation with the various Arctic states, including Canada. The Chinese government has not taken sides, nor has it indicated its preference in this regard; some Canadian scholars have suggested that China is still waiting to see how this debate develops before issuing a position.<sup>11</sup>

China is investing heavily to become a significant research actor in the Arctic, and its presence is already being felt. It is only a matter of time before Chinese researchers and scholars take a position at the cutting edge of arctic studies and debates, and China's strategy of investing in resource industries that include arctic developments will pay dividends over the long term.

China has been very careful not to appear overtly assertive in its efforts to become a player in the Arctic, and has been very careful to follow the rules established by the arctic states; but it is also increasingly apparent that the Chinese will continue to press for inclusion on arctic-related governance issues, regardless of any concerns that may arise. In addition to the request for Arctic Council observer status, Canada will face a number of long-term issues pertaining to this increasing Chinese presence. Some will be more easily dealt with than others.

First, the increasing Chinese scientific efforts will provide important new avenues of cooperation for Canadian science. It has long been established that cooperation amongst scientists is one of the best ways to reduce the high costs of arctic research. China's willingness to invest heavily in research provides Canadians with opportunities to develop new relationships with Chinese scholars, who will have substantial support from their government. This will of course require Canadian scholars to seek out partnerships with their new Chinese colleagues, and welcome their involvement. Given Canada's record of scientific collaboration – reinforced during the

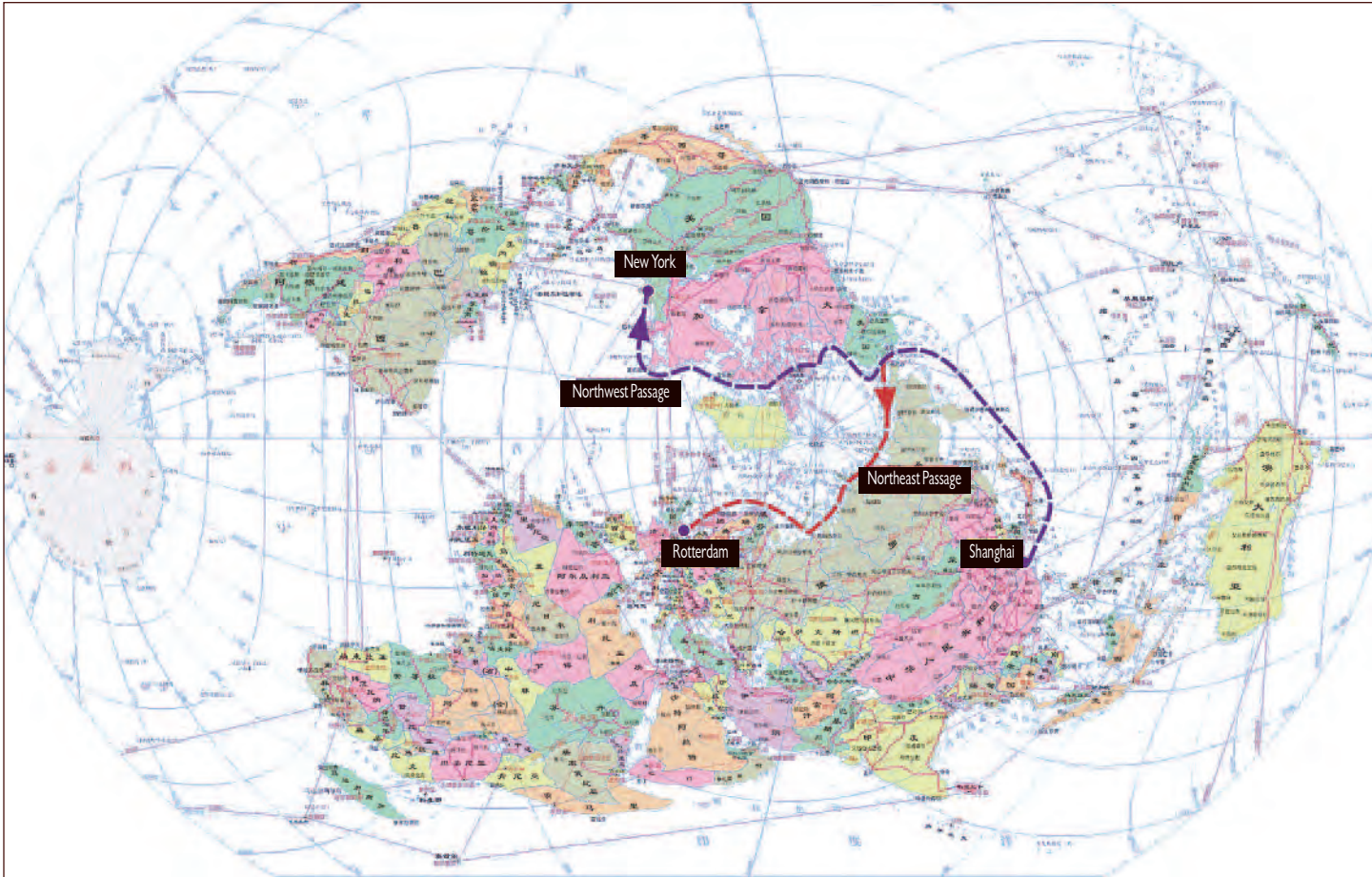
Scientists at work on the Arctic Ocean drift ice, seen from the deck of the *Xue Long*. Photo: Timo Palo.



10. Wright, pp. 2–5.

11. *Ibid.*

12. Jason Fekete and Mark Kennedy, "Multibillion dollar deals 'new level' for Canada-China relationship", *National Post* (February 9, 2012) [<http://news.nationalpost.com/2012/02/09/china-and-canada-reach-deals-on-air-travel-oil-and-uranium-and-pandas/>].



Potential arctic maritime trade routes from China to North America and Europe. Image: Chinese Arctic and Antarctic Administration (in Jakobson).

recent International Polar Year – there is little doubt that they will do so.

CANADA - CHINA  
ARCTIC  
RELATIONS :  
A COMPLEX  
CHALLENGE

The increasing Chinese presence in the Canadian resource industries is a more complicated challenge. On the one hand, Canada is committed to the prosperity provided by an open and liberal international economic system. Furthermore, the Canadian government has made it clear that they welcome Chinese investment and will consider a recent Chinese request to develop a free trade agreement.<sup>12</sup> On the other hand, there have been rising sensitivities about increasing foreign ownership of Canadian resource companies. This was recently demonstrated by the response of the Canadian government to the efforts by

Australian companies to invest in the Canadian potash industry. However, in a period of economic uncertainty following the economic crisis of 2008 and the ongoing European crisis regarding the Euro, Chinese investments offer economic opportunities for Canada that will be hard to resist. But given the fact that China remains an authoritarian government, questions will remain as to the independence of the Chinese corporations that are buying into Canadian resource companies. Does this provide undue indirect control of Canadian resources to the Chinese government in the long term? Does it matter? It may be that these companies are now completely independent of the government – but at the moment this is not certain, and thus concerns will continue to exist. Perhaps, as Canadians adjust to an increasing Chinese presence in their resource industries, these will subside.

Complicating the situation is the Canadian government's intention to diversify ex-

port markets from the current heavy reliance on the United States. The ongoing issue of the Keystone pipeline has raised questions about the export of oil and gas to the United States. Furthermore, growing American concerns about the environmental impact of the oil sands have also raised questions in Canada regarding the long-term reliability of the American market. The proposed construction of the Northern Gateway pipeline is partly premised on the hopes of increased oil exports to Asian markets, including China. Any effort to limit Chinese investment in Canadian resource companies could damage these efforts. Canada now faces an increasingly complex trading relationship with China that will impact resource development across the country, including the Arctic.

In the long term Canada, along with the other arctic states, may face the issue of Chinese fishing fleets entering the Arctic Ocean. There is still considerable debate about the possibility of commercially viable fish stocks developing in an increasingly ice-free Arctic. Many researchers think this unlikely, while others do not rule it out. But if it were to occur China and other non-arctic states would have the right to fish in any region beyond the Exclusive Economic Zone of coastal states. This means that the water column above the extended continental shelf is open to international fishing. While it is entirely possible that some form of regional fishing agreement could be developed that would protect and promote the interests of both the arctic coastal states and foreign fishing fleets, disagreements are also possible.

In the much longer term, questions will arise over the Chinese view of the legal status of the Northwest Passage. There has been no official statement by Chinese officials on this issue and, when asked whether they view it as internal waters or as an international strait, they have declined to commit. Ultimately, their position will reflect a mixture of concerns over their own coastal waters and their ambitions as a rising maritime and naval power. Canada can hope that China will

not side with the Americans, but should not assume that they will automatically support Canada.

Canada may eventually need to deal with a Chinese naval presence in the Arctic, as in time China could come to see the region as strategically important. While most western observers suggest that such a move is unthinkable, it needs to be remembered that very few observers had thought that China would become a major actor in Africa, and would begin to deploy warships off the Horn of Africa under the mandate to engage pirates; and yet in 2012, the Chinese presence is an accepted fact both in Africa itself and in its waters. Given the current efforts of China to extend its economic involvement in the Arctic, it would be naïve to believe that there could never be a Chinese naval deployment in the future. The arrival of Chinese surface or sub-surface vessels near its arctic waters would complicate the strategic picture facing Canada.

The evolving Canadian-Chinese arctic relationship is one that will grow in complexity over time. Very few people had even thought that such a relationship was likely or possible just a few years back. But China's determination to understand the changes that are now occurring in the Arctic, and to avail

itself of the opportunities that may arise as a result, will increasingly challenge Canadian decision-makers. The Chinese are willing to approach their new arctic enterprises in a cooperative fashion; but they have made it equally clear that they will proceed regardless of the response from the other arctic states, including Canada. They are clearly making the expenditures to transform themselves into a major arctic power. This will bring opportunities for mutual gain, as Canada can benefit from working with the Chinese on a wide range of issues, but China is beginning to view the Arctic in a broader geo-political context, and on this level Canadian and Chinese interests may not always meet.

Canada needs to recognize that there is a new actor in the Arctic, one that will soon become much more powerful. Canada would be wise to start thinking much more seriously about this increasingly complex and interesting relationship.

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## ARCTIC SHIPPING: A FREE RIDE FOR AQUATIC INVASIVE SPECIES?

*Farrah T. Chan, Sarah A. Bailey and Hugh J. MacIsaac*

Sea lampreys, zebra mussels, and green crab are among the invasive species familiar to many in southern Canada. Unintentionally introduced in areas outside their native habitat, they have reproduced, spread, and disrupted ecosystems where they have no natural place. So far very few invasions of non-indigenous species have been recorded in the Arctic – but with a warming climate and increasing ship traffic that could change.

### AQUATIC NONINDIGENOUS SPECIES AND COMMERCIAL SHIPPING

Nonindigenous species (also known as non-native, invasive, introduced, exotic, foreign, or alien species) include plants, animals, microbes, and fungi that have established reproducing populations outside their native

range, sometimes with negative consequences for the environment, ecology, or even economy of the invaded area.

A typical invasion is a three-stage process: introduction, establishment, and spread (Figure 1). First, a transport vector picks up and carries individuals of the nonindigenous species from its source region and introduces them to a new area. Next, the individuals establish themselves in the new environment

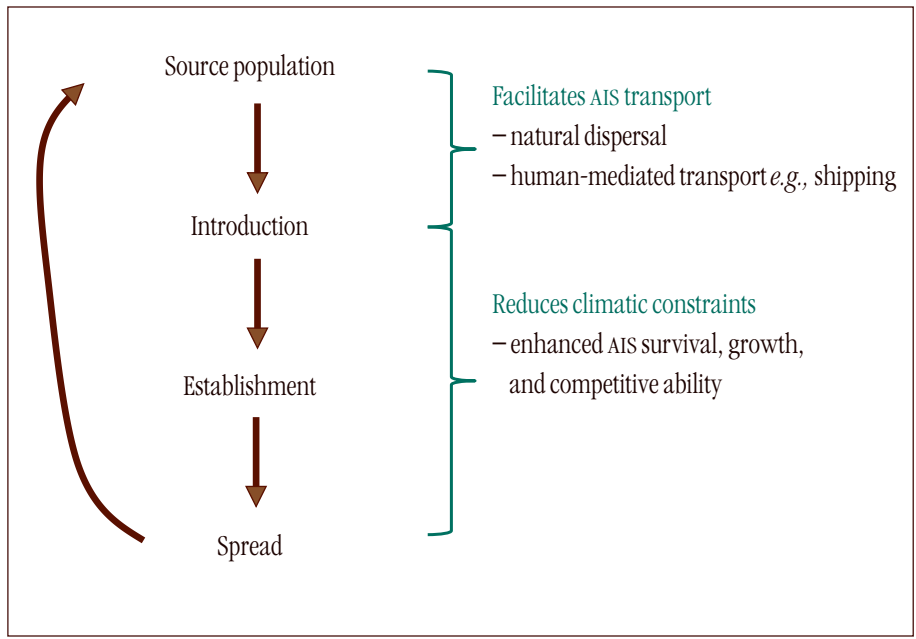


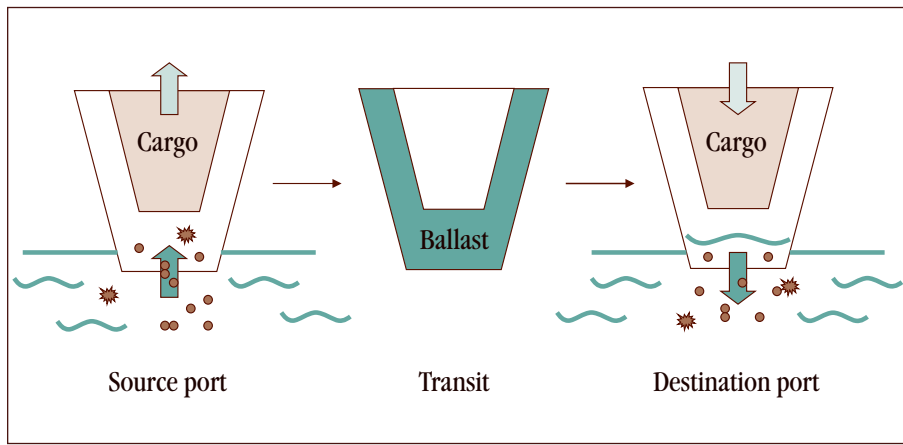
Figure 1  
 Stages of a typical invasion by a nonindigenous species (left) with possible effects of climate change indicated (right).

by surviving the environmental conditions and interactions with resident species. The established population may then spread and become the source of further invasions.

Profound negative impacts from aquatic nonindigenous species (ANS) have been recorded in aquatic systems worldwide. In Canada, the sea lamprey (*Petromyzon marinus*) has contributed to the collapse of lake trout fisheries in the Great Lakes; the zebra mussel (*Dreissena polymorpha*) causes millions of dollars in damage to human infrastructure in the Great Lakes each year; the green crab (*Carcinus maenas*) has brought about the decline of native shellfish populations on the East and West Coasts; the clubbed

Figure 2  
 Barnacle colony fouled on a ship propeller. Photo: Farrah Chan.





**Figure 3**  
A variety of species (brown symbols) can be moved between ports through the ballast water activities of ships.

tunicate (*Styela clava*) is threatening fishing and aquaculture industries on the East Coast; and spiny (*Bythotrephes longimanus*) and fishhook (*Cercopagis pengoi*) waterfleas interfere with sport and commercial fishing and compete with native fish for food in the Great Lakes (DFO, 2011).

Commercial shipping provides an effective mechanism for invasive species to bypass geographic barriers and reach areas far beyond their natural range. All the species mentioned above, except the sea lamprey, are examples of ship-mediated ANS. Ship hulls and other underwater surfaces like propellers and rudders can harbour fouling organisms such as barnacles, tunicates, and mussels in dense colonies that shelter and protect mobile crustaceans from the strong shearing forces produced when a ship is under way (Figure 2). These organisms drop off and can release larvae during transit or at destination ports, establishing populations anywhere along the ship's route.

In addition, a menagerie of species from microbes to fish can move around the globe in the ballast water used to control a ship's stability and trim. Organisms in the water column, and sometimes bottom dwelling species in harbour sediment, may be pumped into ballast water tanks during water uptake and travel to the destination port, where they are released when the water is pumped out (Figure 3). To prevent introduc-

tion of invasive species Canada has ballast water management regulations that require most transoceanic vessels entering and operating in Canadian waters to replace ballast water loaded near shore with open-ocean saltwater (*Canada Shipping Act, 2006*). Empirical studies indicate that the process, known as ballast exchange, purges 60–100% of coastal planktonic organisms pumped in at the source port, and it is over 99% effective in reducing freshwater species (Gray *et al.*, 2007; Ruiz and Reid, 2007). Open-ocean species in exchanged ballast water are unlikely to thrive in coastal and freshwater environments and thus present a low risk for invasion. Regulations also require transoceanic ships carrying little or no ballast to flush residual ballast water and sediment with open-ocean saltwater. As a result, ballast water from foreign sources is not discharged in Canadian waters, reducing the risk of ballast-mediated ocean introductions.

S H I P - M E D I A T E D  
A N S I N V A S I O N S  
A N D T H E  
C A N A D I A N A R C T I C

At first glance, the Arctic seems an unlikely region for ANS invasions. Ship traffic to northern ports is low compared to temperate locations, and cold temperatures and limited food

resources in the Arctic may hinder survival, reproduction, and growth of many organisms. There are no confirmed reports of ship-mediated ANS invasions in Canadian arctic waters; however, at least nine non-indigenous species have been recorded in arctic and subarctic waters outside Canada. It is not known how or when they arrived (Molnar *et al.*, 2008). These species include the soft-shell clam (*Mya arenaria*), zebra mussel (*Dreissena polymorpha*), Akartia copepod (*Acartia tonsa*), red king crab (*Paralithodes camtschaticus*), marine pill bug (*Sphaeroma walkeri*), naval shipworm (*Teredo navalis*), hydroid (*Ectopleura crocea*), green algae (*Cladophora sericea*), and dinoflagellate (*Alexandrium affine*). All except the red king crab can be introduced through hull fouling and ballast water discharge (Molnar *et al.*, 2008). The small number of ANS recorded in arctic and subarctic waters may reflect insufficient research efforts and limited taxonomic knowledge of the region (Ruiz and Hewitt, 2009), but nonetheless suggest that invasions to northern regions by temperate ANS are possible under current climatic conditions.

Most arctic communities are on the coast and, with no road or rail access, rely on marine transport for supplies of food, clothing, materials and equipment, fuels, and consumer goods (Figure 4). Ships also carry raw resources, such as minerals, hydrocarbons, and grains, through arctic waters to domestic and international markets. Churchill's proximity to the Prairies and its connection to the rail system has established it as a major transshipment port for grain, while resource extraction sites, including the Raglan Mine in Deception Bay, Quebec, rely on ships to transport mineral concentrates for processing. Ship traffic is far lower than on the Atlantic and Pacific coasts, but is expected to increase in the near future. Several large-scale resource developments have been proposed for the next 20 years, including iron ore at Mary



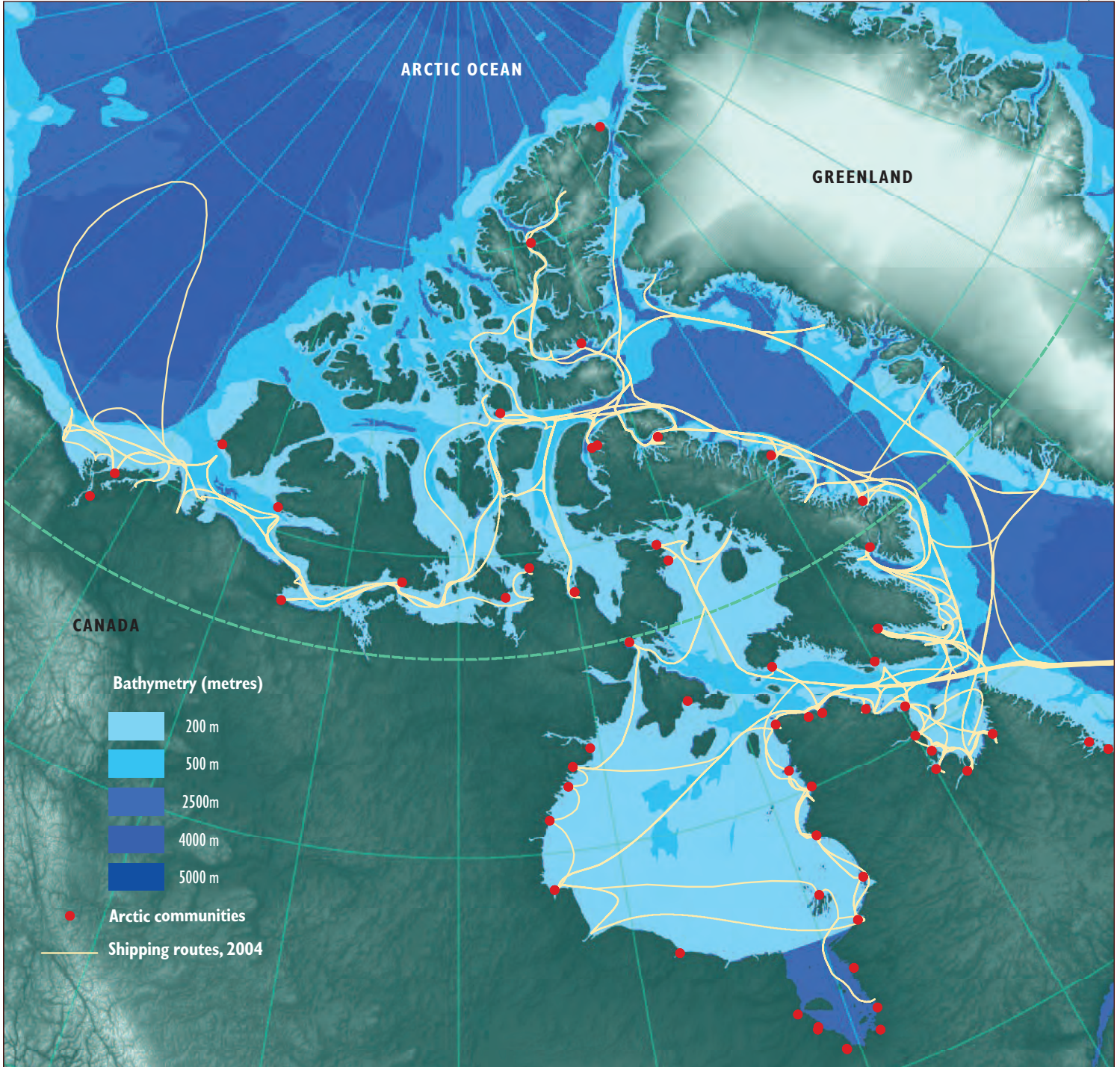
River, Baffin Island, magnetite at Roche Bay, also on Baffin Island, and High/Izok Lake near Yellowknife for lead/zinc/copper concentrates (Arctic Council, 2009). These operations will require shipping for bulk exports, as well as logistics and fuel imports. Plans to diversify international commodity shipments at Churchill and proposals to develop deep-

water ports at locations such as Iqaluit may further increase shipping traffic in the region (Stewart and Howland, 2009). The federal government has also announced plans and allocated resources to promote social and economic development through the Northern Strategy (Government of Canada, 2010). The growing popularity of arctic marine tourism and the cruise industry's plans to expand and

diversify the arctic market may bring increases in ship traffic (Arctic Council, 2009). With increased ship traffic in the Canadian Arctic comes greater risk of ship-mediated ANS invasions.

Climate change can also increase the

**Figure 4**  
 Network of shipping routes serving major Canadian Arctic communities. Courtesy Susie Harder, Transport Canada.



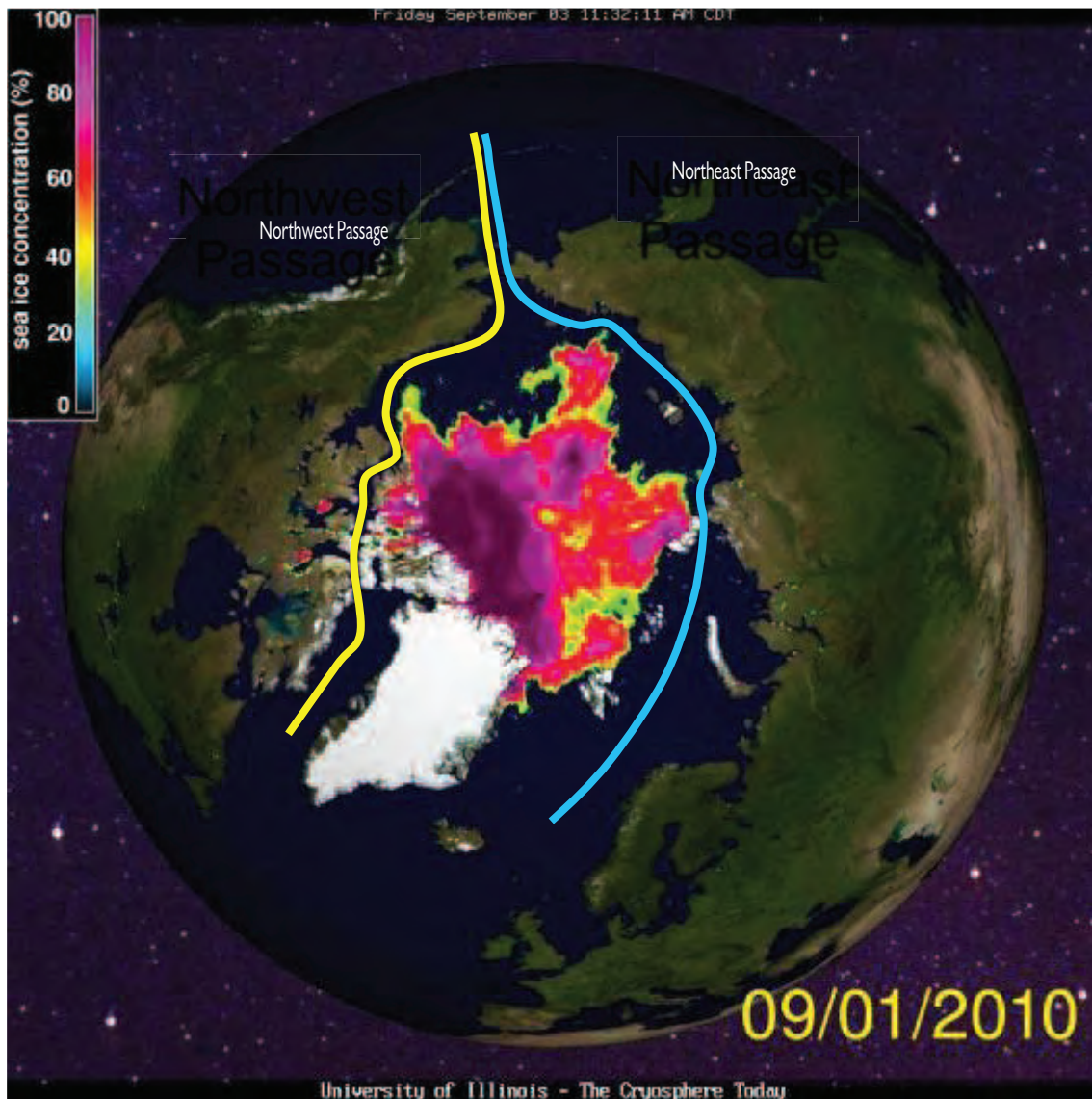


Figure 5  
The Northeast and the Northwest Passages appear navigable and free of pack ice in the 2010 shipping season. Image modified from University of Illinois Department of Atmospheric Sciences, The Cryosphere Today [available at <http://arctic.atmos.uiuc.edu/cryosphere>].

rate and extent of ANS invasions by influencing the dispersal and survival of both native and non-indigenous species (Figure 1; Wassmann *et al.*, 2010). Changes in temperature regimes, ocean currents, sea level, and other key physical processes associated with climate change can directly affect the invasion process by altering natural dispersal. For example, a Pacific diatom (*Neodenticula seminiae*) was found in the north Atlantic Ocean for the first time in 1998. It likely migrated from the north Pacific Ocean via the Arctic Archipelago when receding coastal ice sheets boosted the inflow of water (Reid *et al.*, 2007). Melting sea ice continues to open up water-

ways and shipping channels in the Arctic Ocean and extend the length of the shipping season (Figure 5; Arctic Council, 2009). In the summer of 2007, the Northwest Passage was free of pack ice and fully navigable (Cressey, 2007). In 2009 two commercial vessels, unaided by icebreakers, used the Northeast Passage and the Northern Sea Route to dramatically reduce the time and cost of shipping goods from northern Europe to northeast Asia and northwest North America (Smith, 2009).

Furthermore, warming temperatures may enhance survival of introduced ANS by allowing them to reproduce in areas where they previously could not (Hellmann *et al.*, 2008). Once established at the introduction

site, their growth and competitive ability may be enhanced by warmer climates and other effects of climate change, promoting their spread and amplifying their environmental impacts.

#### UNCERTAINTIES AND CURRENT RESEARCH

The increased potential for ship-mediated ANS invasions highlights the need for adaptive management of ANS in the Arctic. Intra-coastal shipping can disperse species within a region at much higher rates than would occur naturally and can also transport them to areas they would not reach through natural

Figure 6

Below: Collecting zooplankton from the ballast water tank of a cargo ship at the Port of Churchill with a plankton net tow. Right: surveying the hull of a harbour tug at the same port for fouling organisms. Photo: below, Krista Hanis; right, Farrah Chan.



mechanisms. Since intra-coastal voyages are often short, high survival in ballast tanks is expected, and a large number of ANS individuals could therefore be released. In addition, ships can directly transport ballast water from Canadian temperate waters to the Canadian Arctic without any form of management, although some vessels do voluntarily conduct ballast water exchange. The direct transfer of domestic ballast water may allow species native to Canadian temperate ports – or ANS that have been previously introduced to temperate Canadian ports – to gain a foothold in the Arctic. What is more, Canada has no management regulations on anti-fouling treatment of hull surfaces.

The importance of hull fouling as a transport vector for ANS in the Arctic is poorly understood. Some research has shown that sea ice can scrape hulls, removing or damaging fouling species (Lee and Chown, 2009). This may decrease the risk of ANS introduc-

tion by killing fouling organisms; or, it may increase the risk by releasing them into the water. Some hull fouling species can survive long voyages through a wide variety of marine environments with major changes in salinity and temperature (Davidson *et al.*, 2008). More research on domestic ballast water and hull fouling is needed to fully evaluate the invasion potential of shipping.

Few studies have examined the magnitude of ship-mediated ANS invasions in arctic waters, and only one qualitative study has been done for northern Canada (Niimi, 2007). We are therefore conducting a comprehensive study of the potential for ship-borne ANS invasions in Canadian arctic waters. We have conducted a transit analysis to examine shipping patterns in the Canadian Arctic and to identify high traffic ports. As a result, the ports

at Churchill, Manitoba, Deception Bay, Quebec, and Iqaluit, Nunavut have been selected for biological sampling with the assumption that ports receiving greater ship traffic and/or ballast water discharge are more vulnerable to ANS introductions. We are collecting biological samples from the hulls and ballast water of ships arriving at high traffic ports to determine the identity and abundance of any potential ANS (Figure 6). We will compare the environmental conditions of the native habitat of all identified ANS with those at the introduced port in order to determine whether the ANS can survive in, and potentially invade, the introduced environment. Finally, we can determine the potential impact of invaders based on known impacts in invaded habitats. The results of this research can be used to inform long-term monitoring and early detection strategies in the Canadian Arctic – to reduce the risk of non-indigenous species invading and disrupting our Arctic marine ecosystems.

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# FLEXIBLE DESIGN FOR PUBLIC HOUSING IN IQALUIT, NUNAVUT

Avi Friedman and Elizabeth Debicka

A housing crisis in Nunavut is causing negative consequences for communities already stressed by several decades of rapid change. Many new homes are needed quickly, but they must be designed with care so that they meet the needs of Inuit in the short and long term.

Public housing in the Canadian Arctic has a history of poor adaptation to the social and cultural realities of Inuit communities and the northern climate. In this article we look at how a user-led, flexible approach can help tailor the design of new public homes to the needs of the local housing authority and occupants. Flexibility, incorporated into the pre-occupancy, post-occupancy and refurbishment stages of the unit's life-cycle, means that the dwelling can adapt as the needs of its inhabitants change over time. Housing authorities and residents are offered a choice of interior and exterior design components. The redevelopment of Widow's Row, in Iqaluit, Nunavut, demonstrates how appropriate design can play a pivotal role in addressing the housing crisis.

## BACKGROUND

Following World War II permanent settlements began taking shape across Canada's Eastern Arctic. Attracted to the communities by services such as health care and schooling, and opportunities for wage employment, Inuit left behind their semi-nomadic existence in growing numbers. To improve the living conditions in the settlements the Government of Canada initiated mass public housing programs.

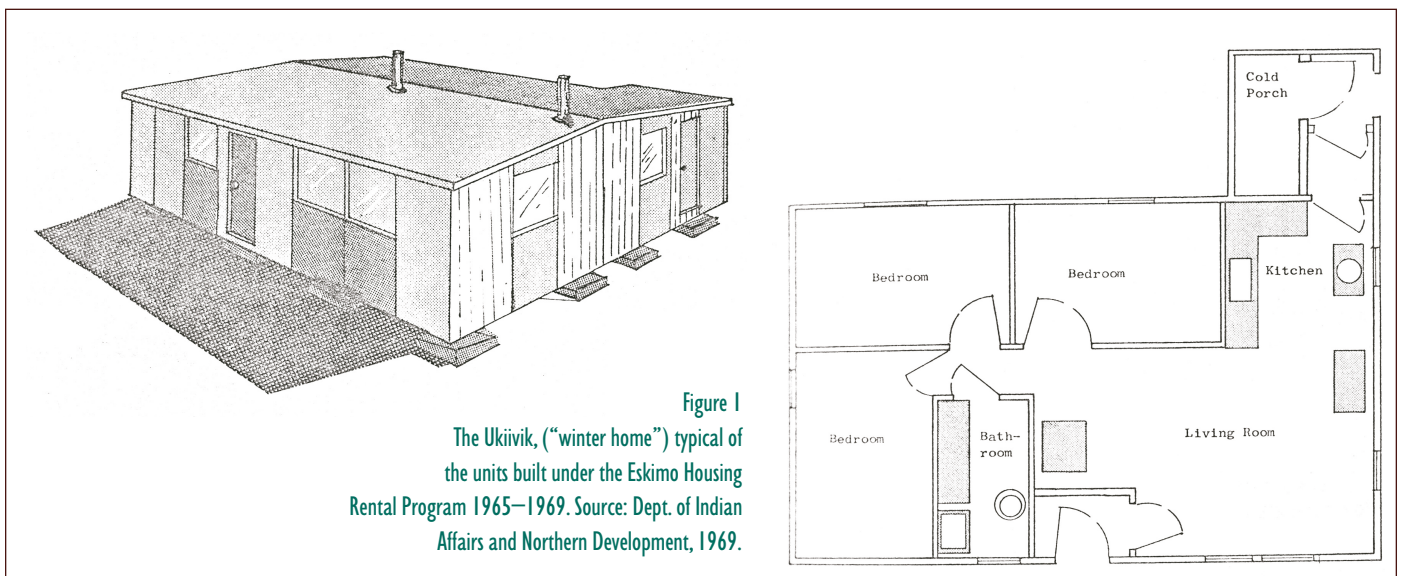
The first housing prototype, introduced in 1959, was called the "matchbox" because of its small size—3.66 by 7.32 meters (12 by 24 feet). According to Peter Collings (2005), the matchbox "was poorly designed for the arctic environment, and residents typically fell behind on their payments or ceased using them altogether because of the high costs of heating and maintaining the houses during the long winter." Throughout the ensuing decades, the designs of housing prototypes were repeatedly revamped in an attempt to address issues of affordability, accommodate large Inuit families, and improve the quality of the prefabricated homes imported from the South.

Units delivered across the Arctic embodied Euro-Canadian notions of the household and introduced partitioning between rooms, a foreign concept for Inuit, who were used to dwellings with one communal living space. The kitchens were ill-equipped for preparing country foods and the interior spaces did not accommodate land-based activities (Figure 1). As described by Robert Robson,

*The houses were inferior, expensive, small, often not provided with services and above all else, clearly not constructed with a view to meet the housing needs of the local population. In this regard, the living space was compartmentalized, there was no workspace within the unit to clean or prepare meat or fix snow machines, [and] little thought was given to storage areas [...].*

Despite efforts to improve the quality of public housing over the ensuing decades, the absence of users from the design process has meant that public housing is often ill-suited to Inuit.

To this day, public housing in Iqaluit fails to adequately meet the needs of Inuit



households: overcrowding remains a serious issue and houses remain ill-adapted to the cultural requirements of families.

Although community consultation has recently been incorporated into the approval stage of public housing in Iqaluit, community input can and should play a greater role throughout the process. Users need to participate in design if current and future housing needs are to be met with practical dwellings well suited to the Inuit way of life and the arctic environment.

### FLEXIBLE DESIGN

Flexible housing can reduce costs over the long term by extending the lifecycle of public housing. Schneider and Till (2005a) encourage the public sector to recognize the long-term economic advantages of flexible design: “[I]f technological systems, service strategies and spatial principles are employed that enable the flexible use of a building, these buildings will in turn last longer.” Flexible design projects need not be expensive and complex, requiring expertise unavailable locally, as some have been in the past. Stan-

dardization of building measurements and materials, for example, is a simple and cost-effective way to ensure that future housing can be economically retrofitted and adapted to the needs of changing households.

Furthermore, if flexible design truly responds to the social and cultural needs of its inhabitants, their satisfaction will translate into increased housing longevity. Schneider and Till (2005a) indicate that flexibility includes long-term economic savings “such as a higher appreciation of the dwelling on the part of the user, less occupant fluctuation, and the ability to react quickly to changing needs or wants of the existing or potential inhabitants and the market”. Where flexible design meets the economic requirements of a public housing strategy, it also supports environmentally responsible initiatives in public housing development.

Reducing the environmental impact of housing is integral to the concept of flexible design. Longer-lasting units mean less new construction, retrofitting, and rehabilitation – and fewer condemned houses sent to the local dump. This is significant given the

resource-intensive nature of building in the Arctic. The emphasis on planning in flexible housing presents an important opportunity to make environmentally conscious decisions during design. Where flexible design can reduce the use of materials through standardization, it can also facilitate future alterations.

### WIDOW’S ROW : A CASE STUDY FOR FLEXIBLE HOUSING IN IQALUIT

In fall, 2007 planning officials from the City of Iqaluit invited us to design public housing to replace existing dwellings on Widow’s Row, a narrow plot of land of about a hectare adjacent to Iqaluit’s downtown and near Inukshuk High School (Figure 2).

The site consisted of fourteen single family, public housing units constructed in the 1970s. Today, these units are dilapidated and require extensive repairs. Not only are the buildings themselves in poor condition – insufficient insulation, poor quality of con-

Figure 2  
An aerial view and images of the Widow’s Row site.



struction materials and lack of general maintenance are some of the problems – they were also inadequately designed for their inhabitants and did not adapt well to the shifting needs of the community. Given the site’s central location and the scarcity of buildable land in Iqaluit, such low density is unsustainable. Consequently, the City encouraged the redevelopment of the Widow’s Row site.

We were asked to create a plan and design public housing units adapted to the arctic environment, the site and, most importantly, to the social and cultural requirements of the inhabitants. A flexible design approach required that we study and incorporate the intersecting factors that affect public housing design in Nunavut. We carefully studied the local climate and developed a typology of unit-level and planning responses; we surveyed available information on Inuit dwelling culture and lifestyles; and we developed an overview of the socio-demographic profile of the community.

Site plans were conceived according to the need for a medium density development that safely accommodates pedestrians and snow machines alike. We identified communal spaces for children’s play, soapstone carving, and socializing, and included common parking, reduced setbacks, and multi-unit buildings with private entrances. The plan also suggested individual storage units for hunting and fishing equipment. Lastly, climatic considerations affected site design: buildings were oriented to take into consideration wind direction and solar exposure, and located so as to shelter each other; houses were aligned parallel to prevailing winds and raised above grade to prevent permafrost thaw and allow snow-bearing winds to pass underneath without forming drifts; the structure’s silhouette was streamlined, with shallow roof slopes; and entrances included wind locks to prevent drafts when the door is opened (Figure 3).



### UNIT DESIGN

A dwelling’s lifecycle consists of three phases: pre-occupancy, occupancy, and post-occupancy. Our approach applied flexibility to all three.

For the pre-occupancy phase we incorporated principles of flexibility into community consultation and the design process, so that public housing would meet the needs of future occupants and the community. Secondly, flexibility played an important role during occupancy: housing must be adaptable to family lifestyles and changing family composition. Lastly, flexibility is an important factor in the rehabilitation of units, ensuring that dwellings will meet the needs of new tenants or that they can easily and economically be refurbished over time.

#### Flexibility Prior to Occupancy

To meet the needs of the eventual residents we created a choice of design options to be select-

Figure 3

The proposed site (9,400 sq. m) has 50 new dwellings, a density of 54 units/hectare and 47 parking stalls.

Source: Shuang Chen.

ed by the future occupant or an agency representing them. Floor plans include a list of features that can be incorporated into the unit design according to budget and household requirements. A “menu” made available by a builder could include a range of components to assist occupants with limited mobility and adapt the house for elders and small children.

Depending on household composition and lifestyle, a choice of floor plans is available. The size and layout of the kitchen, bathroom, and multipurpose room can be adapted according to need, and there are different options for interior and exterior components (Figures 4 and 5). Although residents of public housing change over time, in Iqaluit people often remain in a dwelling for long periods.

Ensuring that they are satisfied with their homes is an important step towards improving the sustainability of public housing.

The local housing authority consults the future occupants on their choice of floor plan and interior menu components. Future occupants also have a say in where to locate these items during conception of each dwelling's layout, according to their need. When these are decided the housing authority passes the information on to the unit developer (Figure 6).

Given the growing number of skilled tradespeople in Nunavut, prefabrication of materials can and should take place in Iqaluit. Rather than imposing one standard design and expecting families to conform, this flexible system of design supports the needs of occupants in a cost-effective manner.

#### Post-Occupancy Flexibility

Public housing that can adapt to the evolving needs of its occupants will last longer and have less impact on the environment. Northern housing needs to adapt to families that differ in composition and change over time. Inuit families tend to be large, and there is insufficient housing for growing families. In addition, multiple generations of one family – a grandmother, a young mother and her child, for example – may live under a single

roof, and it is common for extended family members to join a household for various reasons.

Designing for flexibility while the dwelling is occupied is an important strategy

to accommodate changing household realities. If, for example, the multipurpose room designed as a laundry and workroom has a

Figure 4  
Menu of Interior Components. Source: Shuang Chen.

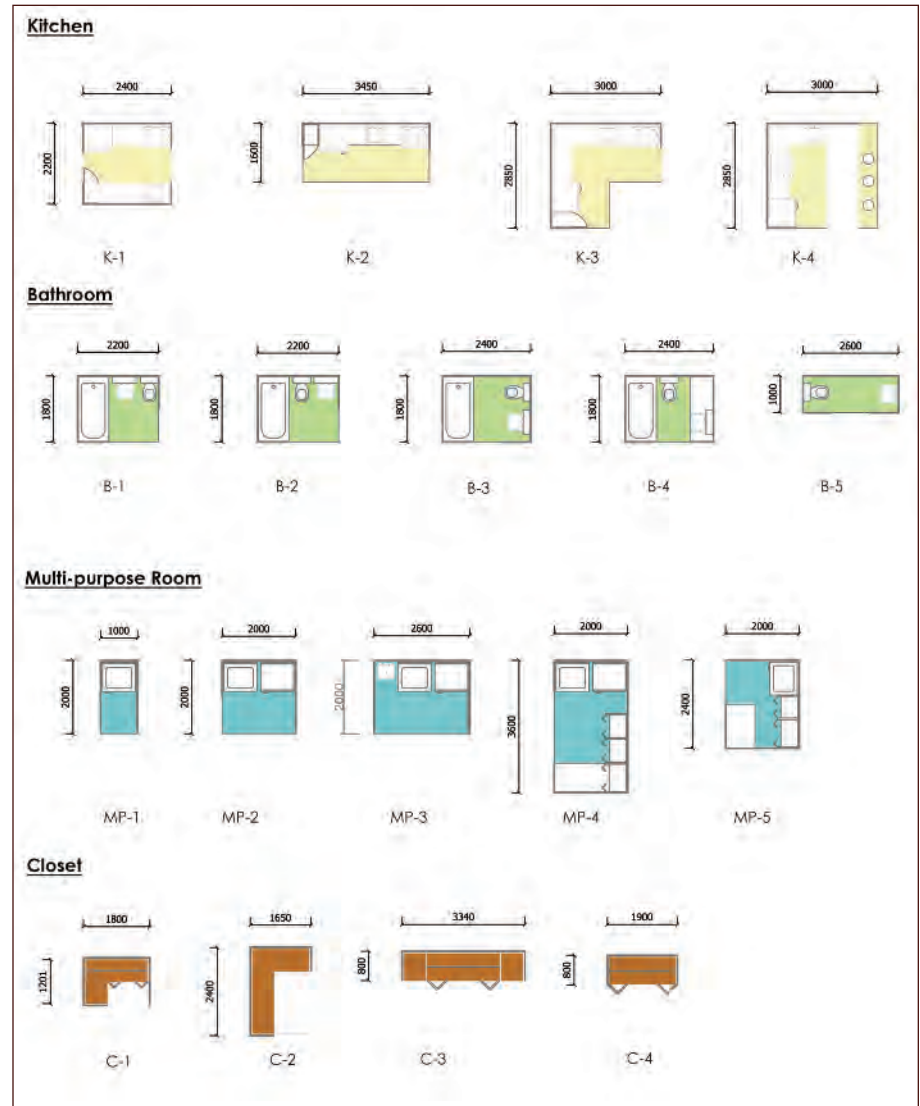
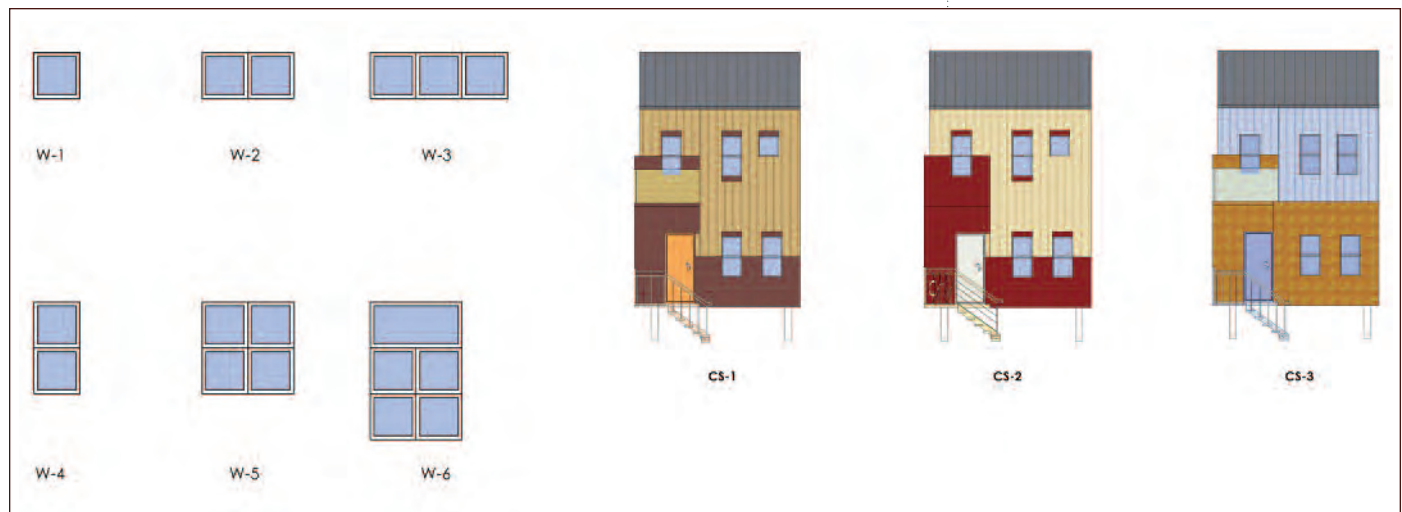


Figure 5  
Menu of Exterior Components. Source: Shuang Chen.





window, it can be converted into a bedroom if necessary. Likewise, a home office can also function as a sewing room and, if designed

with a window, can be converted into a small bedroom should the need arise. Including additional windows, and not labelling rooms, are simple and affordable ways to design a dwelling that adapts to changing families.

Unit designs also included a range of options to create a highly adaptable floor

plan. Appropriate housing design for Inuit communities supports the lifestyle of residents, providing the storage and workspace needed by families who hunt and fish. Cold porches are incorporated into the design of all units. These are unheated vestibules for storing outdoor clothing and equipment (cari-

Figure 6  
 Examples of floor plan scenarios selected according to the needs of housing occupants. Source: Shuang Chen.





**Figure 7**  
A block of dwellings made up of units and exteriors selected by occupants in a simulation exercise. Source: Shuang Chen.]

bou-skin winter clothing must be kept cool) that provide a transition zone between the interior and exterior where people can acclimatize to major changes in temperature.

According to Peter Dawson (2003), “the [highly compartmentalized] spatial configuration of Euro-Canadian houses often makes Inuit household activities difficult to organize, execute and complete.” In our design an open floor plan for the kitchen and living area creates communal space that is highly integrated. Open-concept kitchens, a common practice in modern housing design, are well-suited to the needs of Inuit households. They transform the kitchen from its traditional service purpose into a practical, adaptable, and efficient utility space that not only accommodates food preparation, but also enables clear supervision of children playing and allows large families to gather together for meals. An expanded living room becomes a more flexible all-purpose space that can also be used as a study, a sewing room, dining room, sitting room, and play area. By maximizing the general communal living space, the open concept floor plan facilitates the visiting and social interaction that Inuit value.

Extensive community consultation is essential. Consultation allows the creation of homes that support the cultural activities in-

tegral to the lives of residents, and are well adapted to their specific needs (Figure 7).

#### C O N C L U S I O N

Given the existing shortage of quality housing and the rapid population growth expected for Iqaluit, developing a robust and culturally appropriate framework for the design of public housing in the Arctic is urgent. To date, public housing in Iqaluit has not addressed the housing needs of Inuit residents to the full extent possible. Furthermore, the imposition of southern Canadian design standards and norms has produced houses poorly suited to the needs of the Inuit population and the arctic climate. Although the quality and cultural-specificity of public housing built in Iqaluit have dramatically improved in recent years, we recognize that architects can play a pivotal role in improving the design of public housing there.

By adhering to a philosophy of flexible design, architects have the opportunity to design according to the needs of Inuit households. When undertaken in good faith, a flexible approach integrates the contributions of residents and public housing authorities, allowing them to shape the thrust of housing design from its very outset. Flexibility alone will not solve the housing crisis in the Canadi-

an Arctic; however, research demonstrates that user-led, flexible design has the potential to improve the environmental, economic and cultural suitability of public housing in Iqaluit.

#### *Acknowledgements*

We would like to acknowledge the participation and contribution of Shuang Chen, Bassem Eid, Reza Assasi, Scott Mack, Nima Razavi and Huang Qian in the design of the project.

*Avi Friedman is a Professor with the Affordable Homes Program at McGill University School of Architecture. Elizabeth Debicka is a researcher there.*

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## B O O K R E V I E W

*Joanne Tompkins*

**Inuit Education and Schools in the Eastern Arctic**, by Heather McGregor. UBC Press, 2010. 240 pp., \$85.00 hardcover, \$32.95 paperback. ISBN: 9780774817455.

In Nunavut schools dropout rates among Inuit are high and graduation is low – about 25 to 30 percent of Inuit students graduate from high school. To shed light on how this came to be, Heather McGregor has written a book that looks at the way Inuit education and schooling have developed, and examines their foundations. McGregor writes from the perspective of close familiarity with the topic: she is a Euro-Canadian northerner who calls Iqaluit home and whose parents are long-serving northern educators.

*Inuit Education and Schools in the Eastern Arctic* represents an important contribution to the field of Inuit education. Through an analysis of the historical context of education and schooling in the Eastern Arctic the book sheds light on the challenges Inuit faced as they moved from informal camp-based education through formal schooling. Beginning when Inuit lived on the land in small camps and ran their own affairs, the book then discusses the colonial period (1945–1970), the Territorial period (1971–1981), and the local period (1982–1999), and concludes at the creation of Nunavut in 1999. The

role of tradition and the recurrent themes of cultural negotiation and policymaking are central throughout.

The author separates "education" and "schools" in her title, and this is a key notion in the book. In this context education is the process by which one generation prepares the next to take part in society, equipped with the ways of knowing, doing, and being that perpetuate culture. Schools, by contrast, are western, southern constructs intended to prepare children to take their places as citizens. Education may take place, as it once did for Inuit, entirely on the land and in the camps or, sometimes, it may take place in schools; but some of these, like the residential schools many Aboriginal children attended, were hardly educative places. The challenge for Inuit, whose world was disrupted by the move from camps to permanent settlements, has been to enact "education as Inuit did [traditionally] within the confines of formal schooling" (p. 117).

The first chapter acquaints the reader with the geographic, cultural, social and political landscape and, importantly, situates the Inuit experience of education and schooling alongside that of other Aboriginal Canadians. The interconnection of education and culture is raised here. Western, southern models of education and schooling tend to focus on the importance of the individual; Inuit

education emphasizes community and the environment.

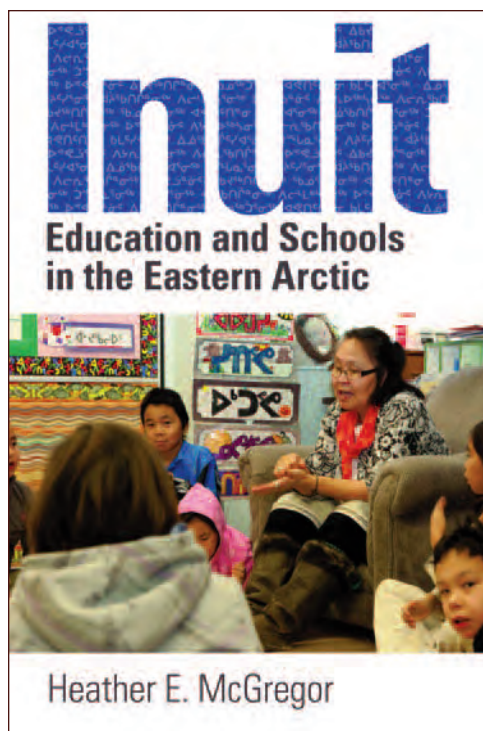
The book then moves on to examine education in the traditional period, when Inuit lived in small camps. Inuit ways of knowing, being and doing were the foundations of the Inuit education that prepared the next generation to live well in their environment with each other. Inuit education centered on environmental knowledge, experiential learning with a focus on demonstration, observation and practice, and informal and learner centered education with the learner often having a close personal and kinship relationship with the person teaching. The "curriculum" focused largely on knowledge and skills related to the environment. The quotations from Inuit elders and philosophers peppered through this chapter attest to the fully coherent view of education that existed and was practiced in this period:

*The Inuit language and culture is designed to help the society to survive in a harsh environment, by putting a lot of emphasis on practical lessons. When teaching a child to think and develop their skill and knowledge base, we should do so with a lot of love, kindness, understanding and patience being continuously present. Recognizing a child's character will help determine the types and methods of teaching that will work best for the child,*

*as each person has a different way of processing how they generate thought or process ideas.* —Joe Karetak (p. 37)

The third chapter discusses the period of accelerating change following the Second World War that saw Inuit leadership displaced by southern administration, with corresponding loss of control of their land, communities, and even of raising their children. Parents were largely excluded from the formal education process by distance (in the case of residential school), by language (inability of the school to accommodate Inuktitut-speaking parents) or by practice (lack of formal mechanisms to include parents in decision-making). It is debatable how much education happened in this period but there clearly was a lot of schooling. Generally the goals of education were imposed upon Inuit by the government and were assimilationist, as it was believed that for Inuit to succeed they had to become employable in the white man's economy. Whether this goal was accurate given the changing hunting and trapping economy is debatable; but more to the point is that Inuit were not part of any discussion about either the goals or the kind of schooling that was developed for their children. The chapter explores the residential school experience, in which children were most disconnected from their families and culture, and moves forward to examine the federal schools that were established in many communities (federal day schools). What stands out in this chapter is the sharp contrast between schooling and the Inuit education of the traditional period. Experiential education was replaced by largely didactic transmission of knowledge; informal teacher-learner relationships with kin were replaced by relationships with Euro-Canadian teachers; and Inuit social, cultural, and land skills were replaced by knowledge reflecting the society, culture, and skills of the South.

The fourth chapter discusses the period when responsibility for education moved from the federal government in Ottawa to the



territorial government in Yellowknife. This coincided with the beginning of Inuit political mobilization. A territorial survey of education provided some acknowledgement of the need for more attention to local culture in Northwest Territories classrooms, inspired by the multiculturalism then being promoted by the Trudeau government. Missing from the survey were the opinions of parents and elders. New policies brought Inuit classroom assistants and teachers into the schools. This period saw a great deal of “good intentions” by the Territorial government to move towards less assimilationist schooling, and there were some attempts to provide direction for more culturally responsive curriculum. Generally however, the goals of education were unclear, teacher support in communities was inadequate, and no mechanism existed for Inuit parents to influence decisions, made by Euro-Canadian administrators, that affected their children's schooling. At times, Yellowknife appeared little closer than Ottawa had been.

Chapter 5 discusses the serious attempts at rebalancing Inuit education so that those most affected by schooling – Inuit par-

ents and communities – would have some say in the goals of education and how it was carried out. Territorial hearings on education, held in communities, gave voice to Inuit and Dene concerns. The report, *Learning, Tradition and Change* (1982) recommended “local involvement in, and responsibility for education as the basis for the future school system” (p. 119). New divisional boards of education created a political dimension of school governance which gave decision-making authority to parents and other community members. McGregor provides an analysis of the Baffin Divisional Board of Education, which was the first divisional board established, modelled after northern Quebec's Kativik Board of Education.

The Baffin Divisional Board centered schooling on Inuit culture. *Learning, Tradition and Change* also recommended improved teacher training and production of materials to support bilingual education and curriculum development. The Baffin Divisional Board employed elders in schools, produced several hundred children's books in Inuktitut, expanded community-based teacher education programs, and established kindergarten to grade 12 education in all communities. After extensive community consultation it produced a curriculum framework document, *Piniaqtavut* (“where we are going”), and a curriculum project *Inuuqatigiit* (“people to people”), which represented a holistic approach to Inuit knowing, being and doing, and reflected a methodology more closely tied to the Inuit way of education. It was more experientially based, student-centered, and dependent on close relationships between teacher and student. In spite of these advances and improving graduation rates, the high school completion rate for Inuit students remained well below national norms. Providing resources to support bilingual education remained a challenge.

The final chapter deals with the integration of Inuit education and schools in the Nunavut period (1999 and beyond). The au-

thor quotes the northern education specialist Ann Vick-Westgate, who states that “one of the greatest challenges facing communities, educators and researchers in the Arctic is that of developing genuinely Inuit, Dene and other approaches to education, not just sprinkling cultural materials into approaches designed for southern systems. Native and other northern educators, most of them trained in southern systems, will have to think outside the boundaries of those systems” (p 165). There is huge irony in the fact that just as Inuit were gaining more control of schooling through the divisional boards, which arguably helped keep priorities focused on Inuit education, the newly established Nunavut government dissolved them. The reason given was that because Nunavut is a public government, divisional boards were redundant. McGregor’s book does not venture into the Nunavut years but she finishes her last chapter by concluding that parental and community involvement in governance is necessary if education is to reflect Inuit aspirations. “Until parents, community members, and local educational leaders, with access to an appropriate framework of support and resources to implement local decisions and goals, are meaningfully engaged and in control of education, the Inuit of the Eastern Arctic will be hindered in their efforts to deliver education that manifests an Inuit vision of the past and future” (p. 169).

McGregor’s work has many strengths. She does a thorough job of describing the context in which Inuit education was set during each period, providing a sense of both the micro and macro politics of each period without drowning the reader in historical detail. She writes with freshness and injects passion into her writing so that it does not feel like a purely academic text, and will appeal both to lay people and educators. Direct quotes from Inuit elders and educators help bring authenticity and veracity to her work. Though not an educator herself, McGregor has created a work that has a great deal of educational insight. Having spent 15 years as a northern

educator during the Local period, I recognized that the book captures much of the challenge and excitement that I lived through during that time.

I have only two regrets after reading the book. I would have loved to have seen more photos, as the ones included enhanced the book. Photographs, particularly of the earlier periods, help the reader unfamiliar with Nunavut to gain a deeper sense of the geographic and cultural differences of a region so dramatically different to other parts of Canada. Secondly – though it was clearly outside the scope of her work – I was disappointed that the text ended with the creation of Nunavut and did not explore more fully the judgments made that led to dissolving the divisional boards. Additionally I would have liked more about the decision by the negotiators for Nunavut not to place education as a priority item in the first round of negotiations – which set Nunavut apart from other First Nations and Inuit groups. I would have been interested in information that would help in understanding these puzzling decisions and their impacts.

In summary, *Inuit Education and Schools in the Eastern Arctic* is an important read for anyone wanting to understand the Inuit experience of education and schooling in Nunavut, past and present, and the book will resonate with those working in First Nations, Metis or Inuit education. McGregor’s work provides important historical evidence to demonstrate that when Inuit have access to political power and decision-making, they can make their voices and aspirations integral to education development – and begin building an education system that meets their needs.

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## NEW BOOKS

***Arctic Naturalist: The Life of J. Dewey Soper***, by Anthony Dalton. Dundurn Press. ISBN: 978-1-55488-746-0.

Dewey Soper was the last of the great pioneer naturalists in Canada, and was a skilled and meticulous explorer. He first travelled to the Arctic in 1923. During the next seven years he had three research postings on Baffin Island, and 1929 discovered the breeding grounds of the blue goose in the southwest corner of Baffin Island. Later in life he worked in the western Arctic.

He was a major contributor to the National Museum of Canada, as well as to the University of Alberta and other museums across the country.

***Circumpolar Health Atlas***, by T. Kue Young (senior editor). University of Toronto Press. ISBN: 9781442644564.

The *Circumpolar Health Atlas* offers a broad, multidisciplinary understanding of the health of diverse populations who inhabit the polar regions of the northern hemisphere. The atlas includes overviews of the physical environment that influences human health; cultures and languages of northern peoples; different diseases and health conditions; and health systems, policies, resources, and services. It concludes with information on how education and research can be used to improve health in these regions.

***Climate, Culture, Change: Inuit and Western Dialogues with a Warming North***, by Timothy B. Leduc. University of Ottawa Press. ISBN: 978-0-7766-0750-4.

Timothy Leduc steps outside scientific and political debates on climate change to engage with various Inuit understandings of northern climate change. He learns that today's climate changes are not only affecting our environments, but also our cultures. By focusing on the changes currently occurring in the North, he highlights the challenges being posed to climate research, Canadian politics, and traditional Inuit knowledge.

*Climate, Culture, Change* sheds light on the cultural challenges posed by northern warming and proposes an intercultural response that is demonstrated by the blending of Inuit and western perspectives.

***Herschel Island Qikiqtaryuk: A Natural and Cultural History of Yukon's Arctic Island***, edited by Christopher R. Burn. University of Calgary Press (distributor). ISBN: 978-0-9880009-0-2.

For centuries Inuvialuit and their ancestors lived and hunted on Qikiqtaryuk, a small island in the Beaufort Sea just off the Yukon coast. In the early 19th century Sir John Franklin named it after a distinguished English scientific family, the Herschels. Later it became a centre of American steamship whaling. During the fur trade of the early 20th century, Inuvialuit trappers made considerable profits from the island's abundant fox population. In the 1970s it was used as a base for offshore oil exploration, and it is now a wilderness park. In this book a wide array of experts bring to life the many-faceted story of Herschel Island.



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**First International Conference on Urbanisation in the Arctic**

Nuuk, Greenland  
28–30 August 2012  
[www.nordregio.se](http://www.nordregio.se)

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**Circumpolar Conference on Education for Indigenous People**

Iqaluit, Nunavut, Canada  
26–30 November 2012  
[www.uarctic.org](http://www.uarctic.org)

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**8th ArcticNet Annual Scientific Meeting**

Vancouver, BC  
11–14 December 2012  
[www.arcticnetmeetings.ca](http://www.arcticnetmeetings.ca)

For more information on events please see the Polar Events Calendar at [www.polarcom.gc.ca](http://www.polarcom.gc.ca).

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