

# Arctic Economics in the 21st Century

*The Benefits and Costs of Cold*

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JULY 2013

*A Report of the  
CSIS Europe Program*

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# 1 Introduction: Arctic Frontiers

From the nineteenth century Alaskan gold rush to today’s modern-day rush to explore for oil, gas, and mineral resources, economic interests have and will continue to powerfully shape the Arctic’s future development. As the polar ice cap rapidly melts, the choices Arctic states make regarding the development of these economic resources, the protection of a fragile ecosystem, and the balance these states strike between development and preservation will define the Arctic for the next century.

Arctic coastal states historically have pursued very different economic models of development. The Soviet Union, for example, promoted “extensive” Arctic development in which territorial control was interlinked with economic development and population dispersion across vast territories. The Soviet regime relied largely on the work of Gulag prisoners to industrialize the region. It heavily subsidized unprofitable industries in Siberia and the Arctic although the populations of this territory were less productive than others in the country. In a 2003 work titled “The Siberian Curse,” scholars Fiona Hill and Clifford Gaddy attempted to establish the cost, in technical, financial, and human terms, of developing Siberian regions that were unfavorable to modern human settlement. They created a “temperature per capita” system to provide a measure of the “costs of cold” when it came to Arctic development.<sup>1</sup> They concluded that the Soviet interventions in the region were terribly expensive and inefficient, creating a difficult environmental and infrastructure-related legacy for Russia as it seeks to modernize and develop its Arctic resources today.

Both Canada and the United States, on the other hand, employed intensive economic development models. For these countries, economic development centered predominantly on extractive industries with minimal population centers and infrastructure requirements. America’s Arctic economic development primarily focused on North Slope oil (which currently holds approximately 6.1 billion barrels of oil,<sup>2</sup> worth an estimated \$561 billion<sup>3</sup>) with minimal seasonal population presence in Barrow, Alaska (total population

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1. Fiona Hill and Clifford Gaddy, *The Siberian Curse: How Communist Planners Left Russia out in the Cold* (Washington, D.C.: Brookings Institution Press, 2003).

2. National Energy Technology Laboratory, “Alaska North Slope Oil and Gas: A Promising Future or an Area in Decline?,” April 2009, [http://www.netl.doe.gov/technologies/oil-gas/publications/AEO/ANS\\_Potential.pdf](http://www.netl.doe.gov/technologies/oil-gas/publications/AEO/ANS_Potential.pdf).

3. Based on the current oil price of \$92 per barrel. The EIA estimates that the price of oil will be \$145 by 2035, which would put the value of North Slope oil at an estimated \$884 billion. U.S. Energy Information Administration, “AEO2012 considers three cases for the future of world oil prices, June 28, 2012, <http://www.eia.gov/todayinenergy/detail.cfm?id=6890>.

**Photo 1.1. On July 6, 2011, the U.S. Coast Guard Cutter *Healy* parked in an ice floe for the 2011 Impacts of Climate on the Eco-Systems and Chemistry of the Arctic Pacific Environment (ICESCAPE) mission's third ice station in the Chukchi Sea.**



Source: NASA, <http://www.fotopedia.com/items/flickr-7348328890>.

4,212<sup>4</sup>) and even less infrastructure presence. The United States also struggles with a legacy of very limited infrastructure.

What are the costs and benefits of economic development in today's circumpolar Arctic? For the United States, it will be essential to develop a national economic strategy for the American Arctic, albeit in an increasingly resource-constrained and politically polarized environment. The estimated 90 billion barrels of oil and 1,669 trillion cubic feet of natural gas now believed to be located in the Arctic may incentivize the formulation of this strategy. However, the discovery of unconventional gas in the United States has increased the global supply of liquefied natural gas (LNG), and therefore the discovery of gas in the Arctic may not be of near-term economic interest or benefit. New oil production in the Arctic, particularly from offshore discoveries, could potentially take decades to bring to market at great expense. The potential economic bonanza of exploiting the Arctic's vast mineral resources appears more promising.<sup>5</sup> Estimates for the economic potential of hydrocarbon

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4. Profile of General Population and Housing Characteristics: 2010 Demographic Profile Data, 2010 United States Census Bureau, <http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk>.

5. James Kraska, "From Pariah to Partner: Russian-American Security Cooperation in the Arctic Ocean," *ILSA Journal of International & Comparative Law* 16, no. 2 (2009), <http://ssrn.com/abstract=1648907>.



resources alone exceed \$1 trillion<sup>6</sup> in the U.S. Arctic and \$1.7 trillion in the Russian Arctic.<sup>7</sup> The exploitation of mineral resources, particularly rare earth or so-called strategic minerals, iron ore, nickel, and palladium, may be a more important economic driver in the Arctic than natural resources in the near term. Whether the resources developed are mineral or hydrocarbon, however, they must find their way to receptive markets via shipping routes or pipelines. Double-hulled shipping vessels, deep water ports, improved navigation and satellite communication as well as improved icebreaker, search and rescue, and aviation infrastructure must be developed as well.

Yet this increasingly vulnerable ecosystem presents significant environmental and societal risks and costs to Arctic economic development. Increased onshore and offshore Arctic drilling enhances the risk of potential oil spills. The rapid expansion of transshipping and tourism has increased pollutants released from large vessels into Arctic waters. Intensive fishing could lead to rapidly diminishing fish stocks. What are the implications of this increased human and commercial activity for indigenous populations and the fragile Arctic ecosystem?

To examine these issues, this report will evaluate both the economic benefits of an increasingly open Arctic region and the costs of exploring the riches of the American Arctic by framing an economic strategy built upon six critical economic components: oil and gas development, mineral resources, shipping, fisheries, tourism, and, finally, the regional infrastructure required to support and sustain the first five components. The report will also analyze the increasingly prominent role of the private sector in Arctic development and its interplay with the potentially diminished traditional role of governments in the region. As a conclusion, this paper will seek to answer the question: Can the United States craft a balanced Arctic economic strategy that enjoys the benefits of Arctic economic development while minimizing the “costs of cold”?

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6. “The Arctic Circle: Development and Risk,” National Defense University, 2010, 3, [http://www.ndu.edu/CTNSP/docUploaded/TFX\\_Arctic%20Summary.pdf](http://www.ndu.edu/CTNSP/docUploaded/TFX_Arctic%20Summary.pdf).

7. Alexey Eremenko, “Russia’s Arctic Rush ‘Potential Gravy Train’—Analysis,” *RIA Novosti*, October 23, 2012, <http://en.rian.ru/analysis/20121023/176850003.html>.

## 2 | U.S. Arctic Oil and Gas Development

According to the U.S. Geological Survey, the Arctic holds 13 percent of the world's undiscovered oil resources (90 billion barrels of oil) and 30 percent of the world's undiscovered gas resources (1,669 trillion cubic feet of natural gas and 44 billion barrels of natural gas liquids).<sup>1</sup> An estimated 84 percent of these resources are located in offshore areas.<sup>2</sup> The Alaskan Arctic is the second most prospective Arctic province (after the West Siberian Basin), containing an estimated 29.9 billion barrels of oil, over 221 trillion cubic feet of natural gas, and 5.9 billion barrels of natural gas liquids.<sup>3</sup>

The Alaskan Arctic has five major areas to be explored for future oil and gas production: offshore in the Beaufort and Chukchi seas; land controlled and owned by the state of Alaska in the Central North Slope; and federally controlled lands in the National Petroleum Reserve–Alaska (NPR-A) and the Arctic National Wildlife Refuge (ANWR).

As the Arctic region becomes increasingly accessible due to receding sea ice and technological advancements, multinational corporations view exploration of these untapped hydrocarbon resources as attractive commercial opportunities and long-term investments that would significantly boost their reserves. Developing these resources could bring significant economic benefits to the region and contribute to securing future U.S. energy supplies or export commodities, but concerns remain regarding infrastructure capabilities and environmental protection.

### Outer Continental Shelf Lease Program

Much development in the Alaskan Arctic has centered on the offshore leases in the Beaufort and Chukchi seas. According to Bureau of Ocean Energy Management (BOEM) mean estimates, there are about 26 billion barrels of oil and 131 trillion cubic feet of gas resources in undiscovered fields in Alaska's outer continental shelf (OCS) that are technically

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1. U.S. Geological Survey, "Circum-Arctic Resource Appraisal: Estimates of Undiscovered Oil and Gas North of the Arctic Circle," 2008, 1, <http://pubs.usgs.gov/fs/2008/3049/fs2008-3049.pdf>.

2. Ibid.

3. Ibid., 4.

recoverable.<sup>4</sup> Of the oil resources, 8.2 billion barrels are located in the Beaufort Sea and 15.3 billion barrels in the Chukchi Sea. The Beaufort Sea has seen some development on artificial islands near the coastline where there are extensions of the North Slope oil resources. The Chukchi Sea has not yet seen any oil or gas development.

Between 2003 and 2007 the federal government issued 241 leases covering 1.28 million acres in the Beaufort Sea and received \$97 million in bids.<sup>5</sup> In 2008, 487 leases covering 2.7 million acres were sold in the Chukchi Sea for \$2.66 billion.<sup>6</sup> Shell was the highest bidder, purchasing 133 leases in the Beaufort Sea for \$83 million<sup>7</sup> and 275 lease blocks in the Chukchi Sea for \$2.1 billion.<sup>8</sup> Another high bidder was ConocoPhillips, which purchased 98 leases for \$506 million in the Chukchi Sea.<sup>9</sup> These leases, originally approved by the Bush administration, were contested in federal court in 2010 due to environmental concerns and then reapproved in October 2011 by the Obama administration.<sup>10</sup>

In November 2011 the administration unveiled a five-year drilling plan that scheduled lease sales in the Beaufort and Chukchi seas for 2017, marking the first lease sales in the area since 2008.<sup>11</sup> These sales have been postponed until the end of the lease program period to allow for thorough environmental assessments and evaluation of subsistence impact and infrastructure capabilities.<sup>12</sup> The planning area excludes a 25-mile subsistence area along the Chukchi Sea shore and two subsistence whaling areas near Barrow and Kaktovik in the Beaufort Sea.<sup>13</sup>

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4. Bureau of Ocean Energy Management, "Assessment of Undiscovered Technically Recoverable Oil and Gas Resources of the Nation's Outer Continental Shelf, 2011," <http://www.boem.gov/Oil-and-Gas-Energy-Program/Resource-Evaluation/Resource-Assessment/2011-RA-Assessments.aspx>.

5. Bureau of Ocean Energy Management, "Lease Sales, Alaska OCS Region," September 1, 2011, [http://www.boem.gov/uploadedFiles/BOEM/About\\_BOEM/BOEM\\_Regions/Alaska\\_Region/Leasing\\_and\\_Plans/Leasing/Alaska%20Region%20Lease%20Sales%20To%20Date.pdf](http://www.boem.gov/uploadedFiles/BOEM/About_BOEM/BOEM_Regions/Alaska_Region/Leasing_and_Plans/Leasing/Alaska%20Region%20Lease%20Sales%20To%20Date.pdf).

6. Bureau of Ocean Energy Management, "Lease Sales, Alaska OCS Region," September 1, 2011, [http://www.boem.gov/uploadedFiles/BOEM/About\\_BOEM/BOEM\\_Regions/Alaska\\_Region/Leasing\\_and\\_Plans/Leasing/Alaska%20Region%20Lease%20Sales%20To%20Date.pdf](http://www.boem.gov/uploadedFiles/BOEM/About_BOEM/BOEM_Regions/Alaska_Region/Leasing_and_Plans/Leasing/Alaska%20Region%20Lease%20Sales%20To%20Date.pdf).

7. Kristen Nelson, "Shell leads sale," *Petroleum News*, April 22, 2007, <http://www.petroleumnews.com/pntruncate/874890136.shtml>.

8. AP, "Shell Is High Bidder to Drill for Oil and Gas Off Alaska," *New York Times*, February 7, 2008, [http://www.nytimes.com/2008/02/07/business/07oil.html?\\_r=0](http://www.nytimes.com/2008/02/07/business/07oil.html?_r=0).

9. Ibid.

10. Steve Mufson, "Chukchi Sea Oil Lease Sale Reaffirmed," *Washington Post*, October 3, 2011, [http://www.washingtonpost.com/business/economy/2011/10/03/gIQAWi9eJL\\_story.html](http://www.washingtonpost.com/business/economy/2011/10/03/gIQAWi9eJL_story.html).

11. Dina Cappiello, "Obama to Expand Drilling off Alaska, in Gulf," Associated Press, November 8, 2011, <http://news.yahoo.com/obama-expand-drilling-off-alaska-gulf-165453778.html>.

12. Bureau of Ocean Energy Management, "Proposed Outer Continental Shelf Oil & Gas Leasing Program 2012-2017," November 2011, [http://www.boem.gov/uploadedFiles/Proposed\\_OCS\\_Oil\\_Gas\\_Lease\\_Program\\_2012-2017.pdf](http://www.boem.gov/uploadedFiles/Proposed_OCS_Oil_Gas_Lease_Program_2012-2017.pdf); Katarzyna Klimasinska, "Oil Lease Sale In U.S. Beaufort Sea Delayed By Two Years To 2017," Bloomberg, June 26, 2012, <http://www.bloomberg.com/news/2012-06-26/oil-lease-sale-in-u-s-beaufort-sea-delayed-by-two-years-to-2017.html>.

13. Bureau of Ocean Energy Management, "Alaska OCS Leasing Strategy: Factsheet" [http://www.boem.gov/uploadedFiles/BOEM/Oil\\_and\\_Gas\\_Energy\\_Program/Leasing/Five\\_Year\\_Program/2012-2017\\_Five\\_Year\\_Program/Alaska\\_Fact\\_Sheet.pdf](http://www.boem.gov/uploadedFiles/BOEM/Oil_and_Gas_Energy_Program/Leasing/Five_Year_Program/2012-2017_Five_Year_Program/Alaska_Fact_Sheet.pdf).

## Potential Economic Benefits

According to a December 2011 assessment of Arctic oil and gas offshore resources by the U.S. Energy Information Administration, “while risks associated with economics, the region’s harsh environment, and ongoing territorial disputes are considerable, potential rewards are immense.”<sup>14</sup>

Production in the Beaufort Sea could generate \$97 billion over the next fifty years in federal lease revenues and in federal, state and local government tax revenue and would support an average of 30,100 nationwide jobs annually.<sup>15</sup> This estimate assumes that 5.1 billion barrels of oil will be produced from 2019 to 2045, as well as 7 trillion cubic feet of gas between 2029 and 2057.<sup>16</sup> Development of the Chukchi Sea OCS is estimated to generate \$96 billion in revenues and support an annual average of 24,600 jobs nationwide over the same period.<sup>17</sup> This estimate is based on the assumption that production will total 4.8 billion barrels of oil from 2022 to 2057 and 7.8 trillion cubic feet of gas from 2036 to 2057.<sup>18</sup> Depending on the price of oil (between a low of \$65 per barrel and a high of \$120 per barrel), the cumulative government revenue generated from both OCS areas would range between \$193 billion and \$312 billion.<sup>19</sup>

## Production Costs and Risks

The estimates of potentially recoverable quantities of oil and gas in the Alaskan Arctic are large and include areas like the Alaska North Slope, which have been in production for a number of years. Nevertheless, the financial, technical, and environmental risks of operating in the Arctic create substantial challenges for future production in the region. After discovery, oil and gas production in the Arctic faces a number of barriers such as high capital and operating costs. The costs of building infrastructure also require companies to carefully consider whether production volumes will be commercially feasible to make these investments worthwhile.

Every aspect of development in Arctic areas is likely to be more expensive: distance from consumption centers increases transportation times and costs; distance from manufacturing centers requires that companies maintain equipment redundancies and a large inventory of spare parts; harsh weather requires specially designed equipment that can withstand the frigid temperatures; and higher wages are needed to bring on and keep personnel in the remote areas. Additionally, poor soil conditions can require additional site

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14. U.S. Energy Information Administration, “Arctic Oil and Natural Gas Potential,” December 21, 2011, <http://www.eia.gov/oog/info/twip/twiparch/111221/twipprint.html>.

15. “Economic Report Overview: Potential National-Level Benefits of Oil and Gas Development in the Beaufort Sea and Chukchi Sea,” *Northern Economics*, February 2011, ES-2, <http://www.northerneconomics.com/pdfs/ShellOCS/National%20Effects%20Report%20FINAL.pdf>.

16. *Ibid.*, 3.

17. *Ibid.*, ES-3.

18. *Ibid.*, 3.

19. *Ibid.*, ES-4.

preparations for onshore facilities to prevent equipment from sinking; softening tundra from thawing permafrost can limit exploration during warm months; offshore production facilities can be damaged by ice flows and severe storms; and unpredictable weather can hinder shipments of equipment and personnel.

## Concerns over Drilling in the Arctic Region

A wide range of stakeholders, from governmental agencies and environmental nongovernmental organizations (NGOs) to insurance groups and oil corporations, have voiced concerns over the environmental risks associated with Arctic offshore drilling. The most cited risk is that of an oil spill incident in the fragile Arctic ecosystem. Serious questions remain as to whether companies and public authorities are sufficiently prepared and equipped to prevent, respond to, contain, or clean up an oil spill in icy waters.

In April 2012 Lloyd's, a large U.K.-based insurance market, and Chatham House, a British think tank, issued a report that concluded that oil spill response in the Arctic would present "multiple obstacles, which together constitute a unique and hard-to-manage risk."<sup>20</sup> Companies drilling for resources in the "highly sensitive to damage" Arctic environment also face high reputational risk.<sup>21</sup> The report cites concerns such as logistical and operational challenges due to the harsh and unpredictable Arctic conditions, the weak resilience of ecosystems to withstand risk events, and the potentially severe and long term environmental consequences of disasters. Given the high political and corporate sensitivity to disaster in the fragile Arctic ecosystem, the report recommended that companies operating in the Arctic adopt and implement "robust and comprehensive" risk management strategies that encompass not only best practices, but also "worst case scenarios, crisis response plans and full-scale exercises."<sup>22</sup>

Within a week of this report being issued, German bank WestLB became the first financial institution to issue a new policy for financing offshore drilling that precluded funding for companies seeking to conduct exploration or production activities in the Arctic. The bank concluded that the "risks and costs are simply too high," citing hard to manage risks, in particular the difficult and costly remediation of spills in icy waters.<sup>23</sup>

Companies diverge in their assessment of risks and opportunities in the Arctic. Shell argues that it has adequate technology and extensive expertise to "tackle extreme conditions safely and to operate responsibly in this sensitive environment."<sup>24</sup> Conversely, Total's

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20. Charles Emmerson, "Arctic Opening: Opportunity and Risk in the High North," Lloyd's and Chatham House, April 2012, 39, [http://www.lloyds.com/~media/Files/News%20and%20Insight/360%20Risk%20Insight/Arctic\\_Risk\\_Report\\_20120412.pdf](http://www.lloyds.com/~media/Files/News%20and%20Insight/360%20Risk%20Insight/Arctic_Risk_Report_20120412.pdf).

21. Ibid., 46.

22. Ibid., 7.

23. Mark Nicholls, "WestLB is the First Bank to Refuse Finance to Offshore Oil Rigs in the Arctic," *Oil Price*, April 20, 2012, <http://oilprice.com/Energy/General/WestLB-is-the-First-Bank-to-Refuse-Finance-to-Offshore-Oil-Rigs-in-the-Arctic.html>.

24. Royal Dutch Shell, "How we operate in the Arctic," <http://www.shell.com/global/future-energy/meeting-demand/arctic/shell-in-the-arctic.html>.

**Photo 2.1. *Alopex lagopus* (Arctic fox) coiled in Alaskan snow.**



Source: Photo by Keith Morehouse, [http://commons.wikimedia.org/wiki/File:Alopex\\_lagopus\\_coiled\\_up\\_in\\_snow.jpg](http://commons.wikimedia.org/wiki/File:Alopex_lagopus_coiled_up_in_snow.jpg).

chief executive officer (CEO), Christophe de Margerie, admitted that the risk of an oil spill in the Arctic was simply too high, concluding that such an incident in the environmentally sensitive region “would do too much damage to the image of the company.”<sup>25</sup> Statoil has been extremely active in the Arctic, with eighty-nine exploration wells drilled in the Norwegian Barents Sea at present and nine more planned for 2013.<sup>26</sup> BP, however, has backed off its ambitions for drilling in the Arctic, deciding not to place a bid to obtain an exploration license in Greenland.

## North Slope Oil and Gas

The first significant U.S. Arctic oil and gas discovery was made in the Prudhoe Bay field in 1968.<sup>27</sup> Prudhoe Bay was originally estimated to hold 25 billion barrels of oil, with total

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25. Guy Chazan, “Total warns against oil drilling in Arctic,” *Financial Times*, September 25, 2012, <http://www.ft.com/intl/cms/s/0/350be724-070a-11e2-92ef-00144feabdc0.html#axzz2FXEKGR4o>.

26. Statoil, “Statoil stepping up in the Arctic,” August 28, 2012, [http://www.statoil.com/en/NewsAndMedia/News/2012/Pages/28aug\\_Arctic.aspx](http://www.statoil.com/en/NewsAndMedia/News/2012/Pages/28aug_Arctic.aspx).

27. Alaska Oil and Gas Association, “History-1960s,” 2011, <http://www.aoga.org/industry/history-1960/>.

recoverable oil at 13 billion barrels. It quickly became clear that this field was the largest ever discovered in the United States.<sup>28</sup>

Transportation infrastructure from the Prudhoe Bay field to the rest of the United States became the most immediate concern and major obstacle to development of the field.<sup>29</sup> Opposition to pipeline construction led to a long series of litigation and new legislation. The 1973 Arab oil embargo provided the final impetus to passage of the Trans-Alaska Pipeline Authorization Act, which set the legal framework and provided financial incentives for the project.

In 1988 North Slope oil production peaked at nearly 2 million barrels per day, representing 24 percent of U.S. domestic crude oil production and 11 percent of total U.S. petroleum consumption. Since 1988 oil production has declined significantly; average daily production in 2012 is about 500,000 barrels per day, a near 75 percent drop from its peak in 1988.<sup>30</sup>

The resulting decline in flow rates in the trans-Alaska pipeline system (TAPS) raises serious concerns about the longer-term viability of the pipeline. The lower limit of flow rates for the pipeline is estimated to be in the 200,000 to 300,000 barrel-per-day range.<sup>31</sup> As the flow rate declines, the pipeline will start to encounter a growing number of technical problems that will threaten its continued viability, including ice formation, water settlement, and increased wax settlement in the pipeline.<sup>32</sup> Without maintaining at least the lower limit of flow rate, TAPS is not economically viable for continued use and faces the threat of closure. An investment that could exceed \$30 billion dollars would be needed to maintain the pipeline below the recommended levels.

Sustaining TAPS requires increased production of oil from either state or federal areas. The state of Alaska has implemented a leasing plan to attract industry interest in exploring and developing resources in the Central North Slope near the pipeline. Governor Sean Parnell of Alaska has reiterated the industry and government call for complete use of TAPS, vowing to keep the pipeline operational.<sup>33</sup> Also, the federal government is offering leases in the National Petroleum Reserve–Alaska with development incentives in the hopes of providing additional volume in the interim. Offshore development in the Arctic will take perhaps a

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28. Resource Development Council for Alaska, “Alaska’s Oil and Gas Industry,” <http://www.akrdc.org/issues/oilgas/overview.html>.

29. Tony Knowles and John T. Shively, “Historical and Projected Oil and Gas Consumption,” Alaska Department of Oil and Gas Resources, State of Alaska, May 1998, [http://dog.dnr.alaska.gov/Publications/Documents/AnnualReports/H&P\\_May1998.pdf](http://dog.dnr.alaska.gov/Publications/Documents/AnnualReports/H&P_May1998.pdf).

30. U.S. Energy Information Administration, “Alaska North Slope Crude Oil Production (Thousand Barrels per Day),” <http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=p&s=manfpak2&f=m>.

31. *Ibid.*

32. Tom Barrett, “Arctic Oil and Gas Conference,” Center for Strategic & International Studies, July 12, 2011.

33. Erika Bolstad, “Alaska governor vows to accelerate state oil-drilling leases,” McClatchy Washington Bureau, June 30, 2011, <http://www.mcclatchydc.com/2011/06/30/116823/alaska-governor-vows-to-accelerate.html>.

decade or longer to reach meaningful levels and will be too slow to maintain adequate flow in the near term, reinforcing the importance of efforts to find onshore options.

## The National Petroleum Reserve–Alaska

The National Petroleum Reserve–Alaska (NPR-A) is a 22.8-million acre area on Alaska’s North Slope owned by the federal government and managed by the Department of the Interior (DOI). According to the U.S. Geological Survey, the reserve is estimated to hold undiscovered, technically recoverable resources totaling 896 million barrels of oil and 53 trillion cubic feet of gas.<sup>34</sup> This assessment from 2010, supported by the drilling of over thirty exploration wells and three-dimensional seismic surveys, downgrades oil resource estimates to less than 10 percent of the 2002 estimates, which stood at 10.6 billion barrels of oil.<sup>35</sup> The primary reason cited for the reduction was the fact that recent exploration drilling has shown gas occurrence rather than oil in much of the NPR-A. Since 1999 the federal government has conducted eight lease sales, authorizing two hundred oil and gas leases on a total of 1.64 million acres.<sup>36</sup>

In August 2012 Interior Secretary Ken Salazar proposed a plan for management of the NPR-A, and in December the Interior Department’s Bureau of Land Management (BLM) released its final integrated activity plan/environmental impact statement (IAP/EIS).<sup>37</sup> The plan expands leasing for oil and gas development on 11.8 million acres, which accounts for more than half of the NPR-A acreage, opening access to 72 percent of the economically recoverable mineral resources (549 million barrels of oil and 8.7 trillion cubic feet of gas).<sup>38</sup> The DOI, however, has sought to balance energy needs with wildlife protection and subsistence needs of Alaska natives. As such, the plan makes the remainder of the NPR-A acreage unavailable for development and grants special protection to calving areas for caribou herds, nesting areas for migratory birds, and coastal areas inhabited by marine mammals.<sup>39</sup>

The Interior Department contends that the plan allows for a pipeline and other infrastructure to be built across the NPR-A to transport potential oil and gas extracted from the Beaufort and Chukchi seas to the trans-Alaska pipeline system (TAPS).<sup>40</sup> Senators Lisa

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34. U.S. Geological Survey, “USGS Oil and Gas Resource Estimates Updated for the National Petroleum Reserve in Alaska (NPR-A),” October 26, 2010, <http://www.usgs.gov/newsroom/article.asp?ID=2622#.UPRVs2OODX4>.

35. Ibid.

36. Bureau of Land Management, “Administration Announces NPR-A Oil & Gas Lease Sale in November,” September 25, 2012, [http://www.blm.gov/wo/st/en/info/newsroom/2012/september/nr\\_09\\_25\\_2012.html](http://www.blm.gov/wo/st/en/info/newsroom/2012/september/nr_09_25_2012.html); Bureau of Land Management, “NPR-A Sale 2012: November 7, 2012 Bid Recap,” October 18, 2012, [http://www.blm.gov/pgdata/etc/medialib/blm/ak/aktest/energy/2012\\_NPR-A\\_Lease\\_Sale\\_Docs.Par.53369.File.pdf/2012\\_NPR-A\\_Lease\\_Sale\\_Bid\\_Recap.pdf](http://www.blm.gov/pgdata/etc/medialib/blm/ak/aktest/energy/2012_NPR-A_Lease_Sale_Docs.Par.53369.File.pdf/2012_NPR-A_Lease_Sale_Bid_Recap.pdf).

37. U.S. Department of the Interior, “Secretary Salazar Announces Plan for Additional Development, Wildlife Protection in 23 Million Acre National Petroleum Reserve-Alaska,” press release, December 19, 2012, <http://www.doi.gov/news/pressreleases/secretary-salazar-announces-plan-for-additional-development-wildlife-protection-in-23-million-acre-national-petroleum-reserve-alaska.cfm>.

38. Ibid.

39. Ibid.

40. “Plan for Alaska petroleum reserve may permit Arctic oil pipeline,” *Alaska Dispatch*, August 13, 2012, <http://www.alaskadispatch.com/article/plan-alaska-petroleum-reserve-may-permit-arctic-oil-pipeline>.



Murkowski (R-AK) and Mark Begich (D-AK), however, have expressed concern that the restrictive plan “sets up roadblocks to an economically feasible” pipeline project<sup>41</sup> and that unnecessary regulatory hurdles still remain for development of oil resources and transportation in the NPR-A.<sup>42</sup>

In response to state calls for improved offshore exploration in the NPR-A, the Obama administration announced in June 2011 plans to extend leases affected by the recent offshore drilling moratorium in the wake of the BP Gulf of Mexico spill.<sup>43</sup> In 2011 and 2012 the BLM sold thirty-one leases covering over 280,000 acres in the NPR-A. The winning bids generated \$4.5 million in revenue (\$3.6 million<sup>44</sup> and \$900,000<sup>45</sup> in 2012 and 2011, respectively), split equally between federal and state authorities.

In December 2011 ConocoPhillips was granted a permit by the Army Corps of Engineers for construction of a bridge and pipeline on its NPR-A leases.<sup>46</sup> The permit paves the way for what would be the first commercial oil and gas production in the NPR-A. By October 2012 ConocoPhillips had staked nine wells in several of its NPR-A leases, but has yet to announce drilling plans or apply for drilling permits.<sup>47</sup>

## The Arctic National Wildlife Refuge

The Arctic National Wildlife Refuge (ANWR) is a 19 million acre protected wilderness area established by the Alaska National Interest Lands Conservation Act of 1980. Managed by the U.S. Fish and Wildlife Service, the refuge conserves wildlife and wilderness in north-east Alaska, including caribou herds, polar bears, and mammals as well as numerous fish and bird species.<sup>48</sup>

Congress has specifically prohibited petroleum development in the ANWR. However, interest is high in exploring a subsection of the ANWR coastal plain, known as the “1002

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41. U.S. Senate Committee on Energy and Natural Resources, “Murkowski Comments on Decision Restricting Access to Petroleum Reserve,” December 19, 2012, <http://www.energy.senate.gov/public/index.cfm/republican-news?ID=3c92d298-5bd2-4343-af3c-10096f5eb8bc>.

42. U.S. Senate, “Begich Cites Progress But Demands More Action On NPR-A Plan,” press release, December 19, 2012, <http://www.begich.senate.gov/public/index.cfm/pressreleases?ID=607c01da-477f-4e57-b7e3-c8daf1ed17f6>.

43. Jennifer Dlouhy, “U.S. to extend offshore oil leases, will sell drilling rights in Alaska,” *Cleveland Plain Dealer*, June 16, 2011, [http://www.cleveland.com/nation/index.ssf/2011/06/us\\_to\\_extend\\_offshore\\_oil\\_leas.html](http://www.cleveland.com/nation/index.ssf/2011/06/us_to_extend_offshore_oil_leas.html).

44. Bureau of Land Management, “NPR-A Sale 2012: November 7, 2012 Bid Recap,” October 18, 2012, [http://www.blm.gov/pgdata/etc/medialib/blm/ak/aktest/energy/2012\\_NPR-A\\_Lease\\_Sale\\_Docs.Par.53369.File.pdf/2012\\_NPR-A\\_Lease\\_Sale\\_Bid\\_Recap.pdf](http://www.blm.gov/pgdata/etc/medialib/blm/ak/aktest/energy/2012_NPR-A_Lease_Sale_Docs.Par.53369.File.pdf/2012_NPR-A_Lease_Sale_Bid_Recap.pdf).

45. Bureau of Land Management, “NPR-A Sale 2011: December 7, 2011 Bid Recap,” October 3, 2012, [http://www.blm.gov/pgdata/etc/medialib/blm/ak/aktest/energy/2011\\_NPR-A\\_Lease\\_Sale\\_Docs.Par.44360.File.pdf/2011\\_Final\\_NPR-A\\_Bid\\_Recap.pdf](http://www.blm.gov/pgdata/etc/medialib/blm/ak/aktest/energy/2011_NPR-A_Lease_Sale_Docs.Par.44360.File.pdf/2011_Final_NPR-A_Bid_Recap.pdf).

46. Eric Adams, “Federal support for NPR-A bridge, pipeline comes with a twist,” *Alaska Dispatch*, December 5, 2011, <http://www.alaskadispatch.com/article/federal-support-npr-bridge-pipeline-comes-twist>.

47. Eric Lidji, “Conoco stakes 9 NPR-A wells,” *Petroleum News*, October 7, 2012, <http://www.petroleumnews.com/pntruncate/211918572.shtml>.

48. U.S. Fish and Wildlife Service, “Arctic National Wildlife Refuge: Wildlife and Wild Landscapes,” [http://arctic.fws.gov/wildlife\\_habitat.htm](http://arctic.fws.gov/wildlife_habitat.htm).

area,” which is rich in hydrocarbon resources. The 1998 U.S. Geological Survey estimated that the Arctic National Wildlife Refuge could hold 10.4 billion barrels of undiscovered, recoverable oil.<sup>49</sup> The Obama administration has opposed proposals to open up the ANWR to oil development, and in August 2011 the U.S. Fish and Wildlife Service nominated the ANWR “1002 area” for wilderness designation. This marks the first step to obtain increased federal protection for the oil-rich subsection of the refuge.<sup>50</sup>

It is critical to note that questions over whether the United States should drill in the ANWR region are far from new. The refuge was initially declared a federal protected area in 1960 by President Dwight D. Eisenhower. Fierce debates continue about how best to strike the balance between preservation (and subsequent state tourism) and economic development of the territory in the form of exploratory drilling.<sup>51</sup>

## Alaska Natural Gas Projects

For natural gas, the estimated mean value of recoverable gas in Alaska is 221 trillion cubic feet, about 13 percent of the total Arctic gas resources. The Central North Slope is estimated to hold natural gas reserves of 33 trillion cubic feet,<sup>52</sup> the NPR-A is assessed at about 62,<sup>53</sup> and the ANWR at 4.<sup>54</sup> Offshore, gas resources in the Chukchi Sea stand at 77 trillion cubic feet<sup>55</sup> and in the Beaufort Sea at 28.<sup>56</sup> The Prudhoe Bay field also includes significant reserves of natural gas; current estimates of proved reserves are 26 trillion cubic feet.<sup>57</sup> Development of each of these large natural gas reserves has been constrained, however, by the lack of a transportation system to move the gas to market.

Interest in promoting the construction of a gas pipeline has waxed and waned over the last three decades with changing natural gas market conditions. In 2004 Congress passed legislation to provide up to \$18 billion in loan guarantees and to consolidate the regulatory process. Yet the estimated cost of the potential pipelines has continued to rise and is now

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49. U.S. Geological Survey, “Arctic National Wildlife Refuge, 1002 Area, Petroleum Assessment, 1998, Including Economic Analysis,” 2008, <http://pubs.usgs.gov/fs/fs-0028-01/fs-0028-01.htm>.

50. Tim McDonnell, “Obama Administration Moves Against Alaska Oil Drilling,” *Mother Jones*, August 17, 2011, <http://www.motherjones.com/blue-marble/2011/08/anwr-wilderness-designation>.

51. Mia Bennett, “ANWR drilling debate reaches a new low,” *Alaska Dispatch*, November 30, 2011, <http://www.alaskadispatch.com/article/anwr-drilling-debate-reaches-new-low>.

52. Christopher P. Garrity et al., “U.S. Geological Survey 2005 Oil and Gas Resource Assessment of the Central North Slope, Alaska: Play Maps and Results,” U.S. Geological Survey, 2005, <http://pubs.usgs.gov/of/2005/1182/2005-1182.pdf>.

53. Alan Bailey, “USGS says NPR-A exploration depends on viable gas line,” *Anchorage Daily News*, May 10, 2013, <http://www.adn.com/2011/05/10/1855983/usgs-says-npr-a-exploration-depends.html>.

54. Chandra M. Nautiyal, Brent Sheets, and Sally Kornfiel, “Arctic National Wildlife Refuge (ANWR),” U.S. Department of Energy, 2004, <http://www.netl.doe.gov/publications/factsheets/policy/policy006.pdf>.

55. Matt Irwin, “Polar Bears, Oil, and the Chukchi Sea: The Federal Government Sells Mineral Rights in Polar Bear Habitat,” *Sustainable Development Law & Policy* 8, issue 3 (Spring 2008), <http://digitalcommons.wcl.american.edu/cgi/viewcontent.cgi?article=1069&context=sdlp>.

56. Aboriginal Affairs and Northern Development Canada, “Beaufort Sea and Mackenzie Delta Open for Posting,” *Bulletin* 5, no. 1 (January 1988), <http://www.aadnc-aandc.gc.ca/eng/1100100037092/1100100037099>.

57. Bill White, “North Slope Called Promising Shale Play,” *Alaska Natural Gas Transportation Projects*, August 7, 2012, <http://www.arcticgas.gov/north-slope-called-promising-shale-play>.

**Photo 2.2. Trans-Alaska pipeline in Fairbanks, Alaska, off the Steese Highway.**



Source: Photo by Carl Chapman, <http://www.fotopedia.com/items/flickr-1392728191/slideshow>.

estimated to be \$30–40 billion. In 2007 the Alaska state legislature passed the Alaska Gasline Inducement Act (AGIA) as a means to increase the speed of gas pipeline construction. AGIA provides \$500 million to a selected project.<sup>58</sup>

Nevertheless, the delivered cost of this gas will not be able to compete with shale gas in the lower forty-eight states. The emergence of shale gas and other unconventional gas resources has again changed the U.S. gas market, and the commercial viability of any transport system bringing gas from northern Alaska to the lower states is questionable. New production from previously noncommercial natural gas deposits has radically lowered gas price curves, making it difficult for Alaskan resources to compete. The development of unconventional natural gas resources elsewhere in the United States will lessen the perceived need to develop a system for transporting natural gas from the Alaskan Arctic to the U.S. market.

Development of Alaskan natural gas may now require reexamination of various liquefied natural gas (LNG) export options. There have been LNG exports from southern Alaska, although in limited amounts, since the 1960s. Access to international markets may be critical given differential regional pricing. For example, Asian gas markets have prices that

<sup>58</sup>. State of Alaska Gas Pipeline Project Office, “Background Information,” 2011, [http://gasline.alaska.gov/background\\_info/background\\_information.html](http://gasline.alaska.gov/background_info/background_information.html).

are significantly higher than in the United States. Governor Sean Parnell and Alaskan senator Lisa Murkowski have been actively promoting Alaskan gas for export to Asia, but LNG exports would face major financial and regulatory hurdles. A consortium of energy companies (ExxonMobil, ConocoPhillips, BP, and TransCanada) have developed plans to move gas from the North Slope via the proposed Alaska pipeline project to a southern port, where gas would be processed at a proposed liquefaction plant and sent to Asia via LNG vessels. The cost of building the infrastructure to pipe, liquefy, and export Alaskan gas could cost as much as \$65 billion, a hefty sum given the low natural gas prices seen in the contiguous United States.<sup>59</sup> Although Alaskan officials will seek to develop LNG export capabilities, it is difficult to imagine that new pipeline infrastructure will be constructed to supply energy to the rest of the United States due to shale gas developments.

## Case Study: Shell Drilling Efforts in the Beaufort and Chukchi Seas

Shell's operations in the Beaufort and Chukchi seas are considered a litmus test for other multinational companies seeking to tap into the Arctic's vast hydrocarbon resources. Shell first drilled exploration wells in the Beaufort and Chukchi seas in the late 1980s, but relinquished leases and halted exploration in the early 1990s to pursue more lucrative opportunities in the Gulf of Mexico (the price of oil was below \$20 per barrel at the time). Shell reentered Alaska in 2005 with the acquisition of 179 exploration licenses in the Beaufort Sea, which holds 8.2 billion barrels of oil and 27.6 trillion cubic feet of natural gas, according to the U.S. Minerals Management Service estimates.<sup>60</sup> In 2008 Shell purchased 275 licenses in the Chukchi Sea, which is estimated to contain 15.3 billion barrels of oil and 76.7 trillion cubic feet of natural gas.<sup>61</sup>

### INVESTMENT COSTS AND OPPORTUNITIES

Before the 2012 exploratory drilling season started, Shell had already invested upward of \$4.5 billion in the Alaskan project, almost one sixth of Shell's annual capital spending budget,<sup>62</sup> including \$2.2 billion to secure the leases and drilling permits and \$2.3 billion spent on equipment and personnel.<sup>63</sup> The upfront investment before it even begins production in eight to ten years is expected to amount to over \$7 billion,<sup>64</sup> and total investment

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59. Rakteem Katakey and Jim Polson, "Exxon, BP Estimate Alaska LNG Export Project at \$65 Billion," Bloomberg, October 4, 2012, <http://www.bloomberg.com/news/2012-10-04/exxon-bp-estimate-alaska-lng-export-project-at-65-billion.html>.

60. Royal Dutch Shell, "Shell in the Arctic," April 2011, [http://www-static.shell.com/static/future\\_energy/downloads/arctic/shell\\_in\\_the\\_arctic.pdf](http://www-static.shell.com/static/future_energy/downloads/arctic/shell_in_the_arctic.pdf).

61. Bureau of Ocean Energy Management, "Alaska OCS Leasing Strategy—Factsheet," [http://www.boem.gov/uploadedFiles/BOEM/Oil\\_and\\_Gas\\_Energy\\_Program/Leasing/Five\\_Year\\_Program/2012-2017\\_Five\\_Year\\_Program/Alaska\\_Fact\\_Sheet.pdf](http://www.boem.gov/uploadedFiles/BOEM/Oil_and_Gas_Energy_Program/Leasing/Five_Year_Program/2012-2017_Five_Year_Program/Alaska_Fact_Sheet.pdf).

62. Andrew Callus, "Shell admits Arctic drilling defeat, for now," Reuters, September 18, 2012, <http://www.reuters.com/article/2012/09/17/us-royaldutchshell-idUSBRE88G11Q20120917>.

63. Marin Katusa, "An Icy Saga Is Emblematic of Oil Price's Inevitable Climb," Casey Research, <http://www.caseyresearch.com/cdd/icy-saga-emblematic-oil-prices-inevitable-climb>.

64. Ibid.

may exceed \$40–50 billion.<sup>65</sup> The expected payoffs, however, suggest solid returns that warrant the long-term investment.

If successfully developed, the leases in the Chukchi and Beaufort seas could become Shell's largest source of oil within the next two decades. Shell expects to eventually produce as much as 400,000 barrels of oil a day in the Chukchi Sea and 100,000 barrels a day in the Beaufort.<sup>66</sup> By extracting just 10 percent of the oil in the Chukchi and Beaufort seas, the company would supplement its proven oil reserves, currently totaling 4.3 billion barrels, by an astounding 2.7 billion barrels.<sup>67</sup>

## REGULATORY HURDLES

To obtain U.S. government approval for its Beaufort and Chukchi seas exploration activities, as the first company to develop offshore Alaska leases, Shell has had to go through a lengthy and costly process to overcome numerous federal regulatory hurdles and fight legal opposition from environmental and indigenous groups.

In May 2009 Shell submitted to the Department of the Interior draft exploration plans for its outer continental shelf leases in the Chukchi Sea. Interior's Minerals Management Service (MMS) conducted an environmental assessment (EA) and in December 2009 approved Shell's proposed plan to start exploratory drilling activities in the summer of 2010. In the aftermath of the Deepwater Horizon incident, however, the Obama administration decided to suspend all exploratory drilling activities in the Arctic Ocean until 2011, effectively halting Shell's previously approved drilling program.<sup>68</sup>

Shell submitted a revised Chukchi Sea exploration plan for the 2012 season which detailed plans to start six exploratory drill wells within the Burger Prospect.<sup>69</sup> The Interior Department conditionally approved Shell's plan in December 2011, but required that the company comply with a new range of safety and environmental protection measures put into place following the Gulf of Mexico oil spill before receiving permission to start drilling exploratory wells.<sup>70</sup> Such requirements included submitting oil spill prevention plans, obtaining authorizations for incidental harassment or taking of marine mammals, and deploying an effective well capping and containment system. Similar requirements were

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65. Alex DeMarban, "Shell readies to roll dice on multibillion-dollar bet in Arctic Alaska," *Alaska Dispatch*, June 30, 2012, <http://www.alaskadispatch.com/article/shell-readies-roll-dice-multibillion-dollar-bet-arctic-alaska>.

66. Clifford Krauss, "Shell Presses for Drilling in Arctic," *New York Times*, November 5, 2010, [http://www.nytimes.com/2010/11/06/business/energy-environment/06shell.html?\\_r=0](http://www.nytimes.com/2010/11/06/business/energy-environment/06shell.html?_r=0).

67. Jon Birger, "Why Shell is betting billions to drill for oil in Alaska," CNN Money, May 24, 2012, <http://features.blogs.fortune.cnn.com/2012/05/24/oil-shell-alaska-drilling/>.

68. Steven Thomma, "Obama suspends oil drilling in Arctic Ocean," *Anchorage Daily News*, May 27, 2010, <http://www.adn.com/2010/05/27/1296014/arctic-drilling-suspended-at-least.html>.

69. Bureau of Ocean Energy Management, "Revised Outer Continental Shelf Lease Exploration Plan, Chukchi Sea, Alaska," May 2011, [http://www.boem.gov/uploadedFiles/BOEM/Oil\\_and\\_Gas\\_Energy\\_Program/Plans/Regional\\_Plans/Alaska\\_Exploration\\_Plans/2012\\_Shell\\_Chukchi\\_EP/CS-EP-Public.pdf](http://www.boem.gov/uploadedFiles/BOEM/Oil_and_Gas_Energy_Program/Plans/Regional_Plans/Alaska_Exploration_Plans/2012_Shell_Chukchi_EP/CS-EP-Public.pdf).

70. Bureau of Ocean Energy Management, "BOEM Issues Conditional Approval for Shell 2012 Chukchi Sea Exploration Plan," December 16, 2011, <http://www.boem.gov/BOEM-Newsroom/Press-Releases/2011/press12162011.aspx>.

imposed for Shell's exploration plan for leases near Camden Bay in the Beaufort Sea, which was conditionally approved in August 2011.<sup>71</sup>

Shell also needed to obtain air permits from the Environmental Protection Agency (EPA) for its drill ships, rigs, and supporting vessels.<sup>72</sup> The EPA issued these permits for Shell's *Noble Discoverer* drill ship and a support fleet of icebreakers in March and April 2010 for planned oil exploration activities, but they were remanded later that year after concerns were raised by environmental and indigenous groups.<sup>73</sup> In September 2011 the EPA approved revised permits for Shell, which required the company to reduce its fleet emissions by more than 50 percent compared to the 2010 allowances.<sup>74</sup>

Shell also faced regulations related to the marine mammal population of the region, creating a "Marine Mammal Monitoring and Mitigation Plan" to collect data on sightings of marine mammals, to document the effects of exploratory activities, and to ensure that disturbance was minimized.<sup>75</sup> In May 2011 Shell applied for an incidental harassment authorization (IHA) for the non-lethal taking of whales and seals in the Beaufort and Chukchi seas from the National Oceanographic and Atmospheric Administration's National Marine Fisheries Service (NMFS), which was approved in May 2012. Shell also applied for letters of authorization for both the incidental and intentional taking of polar bears and Pacific walrus from the U.S. Fish and Wildlife Service (FWS), which were approved in June 2012.<sup>76</sup>

Shell and any other company planning offshore exploration projects in the Arctic will have to go through similar permitting process for every drilling season, and will have to subject their activities to strict federal oversight. However, as more information, data, and experiences are gained in the offshore U.S. Arctic, federal regulations may be updated accordingly.

## SETBACKS AND DELAYS IN THE 2012 DRILLING SEASON

During the summer of 2012 Shell Oil Company deployed twenty-two vessels (two drill ships and twenty support vessels) for its Chukchi and Beaufort seas drilling operations.<sup>77</sup> Shell's 2012 exploratory drilling season, however, was fraught with a number of

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71. Bureau of Ocean Energy Management, "Shell 2012 Exploration Plan—Beaufort Sea," <http://www.boem.gov/About-BOEM/BOEM-Regions/Alaska-Region/Leasing-and-Plans/Plans/2012-Shell-Beaufort-EP/Index.aspx>.

72. In December 2011, Congress transferred the EPA's authority to regulate Arctic offshore exploration to the Bureau of Ocean Energy Management (BOEM), with the exception of pending permits, which continue to be processed by the EPA.

73. Environmental Protection Agency, "Supplemental Response To Comments For Outer Continental Shelf Prevention Of Significant Deterioration Permits Noble Discoverer Drillship," September 19, 2011, 6, [http://www.epa.gov/region10/pdf/permits/ocs/shell/discoverer\\_air\\_permits\\_response\\_to\\_comments\\_9-19-2011.pdf](http://www.epa.gov/region10/pdf/permits/ocs/shell/discoverer_air_permits_response_to_comments_9-19-2011.pdf).

74. Environmental Protection Agency, "EPA issues final air quality permits to Shell for Arctic oil and gas exploration," press release, September 19, 2011, <http://yosemite.epa.gov/opa/admpress.nsf/d0cf6618525a9efb85257359003fb69d/accab409c8ecc15285257910007ba027!OpenDocument>.

75. Royal Dutch Shell, "Marine Mammal Monitoring and Mitigation Plan," May 2011, [http://www.boem.gov/uploadedFiles/BOEM/Oil\\_and\\_Gas\\_Energy\\_Program/Plans/Regional\\_Plans/Alaska\\_Exploration\\_Plans/2012\\_Shell\\_Beaufort\\_EP/Appendix%20D%20-%20Marine%20Mammal%20Plan.pdf](http://www.boem.gov/uploadedFiles/BOEM/Oil_and_Gas_Energy_Program/Plans/Regional_Plans/Alaska_Exploration_Plans/2012_Shell_Beaufort_EP/Appendix%20D%20-%20Marine%20Mammal%20Plan.pdf).

76. Fish and Wildlife Service, "Letter of Authorization," June 4, 2012, [http://alaska.fws.gov/fisheries/mmm/Chukchi\\_Sea/pdf/12-13,%2012-CS-02,12-CS-03,%2012-14,%2012-INT-11,%2012-INT-12%20Shell.pdf](http://alaska.fws.gov/fisheries/mmm/Chukchi_Sea/pdf/12-13,%2012-CS-02,12-CS-03,%2012-14,%2012-INT-11,%2012-INT-12%20Shell.pdf).

77. Royal Dutch Shell, "Royal Dutch Shell Alaska drilling update," September 17, 2012, [http://www.shell.com/home/content/media/news\\_and\\_media\\_releases/2012/alaska\\_drilling\\_update\\_17092012.html](http://www.shell.com/home/content/media/news_and_media_releases/2012/alaska_drilling_update_17092012.html).

environmental, logistical, and technical challenges that set back its drilling plans and prompted heightened concern over the company's preparedness to operate in the remote Arctic region.

In July 2012 Shell's *Noble Discoverer* rig slipped off its moorings, drifted close to the shore, and nearly ran aground in Dutch Harbor on its way to the Chukchi and Beaufort seas, prompting a U.S. Coast Guard inspection.<sup>78</sup> Less than two weeks before the drilling season was supposed to start, Shell failed to obtain Coast Guard certification for its oil spill response barge, the *Arctic Challenger*.<sup>79</sup> It was not until September 2012 that Shell was granted approval to start top-hole drilling operations in the absence of its containment equipment. However, the company was forced to suspend drilling after just one day due to encroaching ice floes. It was not able to resume drilling for another two weeks.<sup>80</sup> After the containment dome aboard the oil spill response barge was damaged during a test accident, Shell decided to postpone drilling exploratory wells in oil-bearing zones until the 2014 season and drilled only two top holes.<sup>81</sup>

In late December 2012 the *Kulluk* drilling rig, which was being towed from the Beaufort Sea to a Seattle shipyard for maintenance, ran aground near Alaska's Kodiak Island.<sup>82</sup> Following the rescue of the crew, the rig was towed to a safer harbor in a neighboring bay nearly two weeks later. The refloating operation to recover the *Kulluk* involved more than 730 people, including representatives from the U.S. Coast Guard, the Alaska Department of Environmental Conservation, and Shell.<sup>83</sup> While no oil spills were reported from the grounded rig, which was carrying over 15,000 gallons of fuel, the incident drew serious attention from federal regulators and lawmakers.<sup>84</sup> The EPA issued air pollution citations for both of Shell's drilling rigs, the *Kulluk* and the *Noble Discoverer*, for "multiple permit violations" during the 2012 drilling season.<sup>85</sup> The Department of the Interior opened an

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78. "Shell offshore drilling vessel Noble Discoverer drifts near shore in Unalaska," *Alaska Dispatch*, July 14, 2012, <http://www.alaskadispatch.com/article/shell-offshore-drilling-vessel-noble-discoverer-drifts-near-shore-unalaska>.

79. Kim Murphy, "Shell's Arctic oil spill containment vessel plagued by delays," *Los Angeles Times*, July 19, 2012, <http://www.latimes.com/news/nation/nationnow/la-na-nn-arctic-challenger-20120719,0,3468832.story>.

80. Kim Murphy, "Ice threat halts Shell's drilling in Arctic Ocean after one day," *Los Angeles Times*, September 10, 2012, <http://www.latimes.com/news/nation/nationnow/la-na-nn-shell-ice-arctic-drilling-chukchi-20120910,0,5850732.story>.

81. Clifford Krauss, "Shell Delays Arctic Oil Drilling Until 2013," *New York Times*, September 17, 2012, [Wall Street Journal, February 27, 2013, <http://online.wsj.com/article/SB10001424127887324662404578330423854552576.html>.](http://www.nytimes.com/2012/09/18/business/global/shell-delays-arctic-oil-drilling-until-next-year.html?pagewanted=all; Tom Fowler and Ben Lefebvre, )

82. Neil Torquiano and Chris Klint, "Shell Drilling Unit Kulluk Aground, 'Stable' near Kodiak," KTUU, January 1, 2013, [http://articles.ktuu.com/2013-01-01/kulluk\\_36098984](http://articles.ktuu.com/2013-01-01/kulluk_36098984).

83. Dan Joling, "Shell Kulluk Repairs: Inspections Planned To Assess Drill Rig In Alaska," *Huffington Post*, January 8, 2013, [http://www.huffingtonpost.com/2013/01/08/ishell-kulluk-repairs-drill-rig\\_n\\_2429952.html](http://www.huffingtonpost.com/2013/01/08/ishell-kulluk-repairs-drill-rig_n_2429952.html).

84. Ben Anderson, "Shell oil rig successfully towed 30 miles to safer Kodiak Island bay in Alaska," *Alaska Dispatch*, January 6, 2013, <http://www.alaskadispatch.com/article/shell-oil-rig-successfully-towed-30-miles-safer-kodiak-island-bay-alaska>.

85. Kim Murphy, "EPA cites Shell Arctic drilling rigs for air emissions violations," *Los Angeles Times*, January 10, 2013, <http://www.latimes.com/news/nation/nationnow/la-na-nn-epa-shell-emissions-violations-20130110,0,345864.story>.

expedited review of Shell's Arctic offshore drilling operations.<sup>86</sup> The U.S. Coast Guard also will conduct a rapid assessment of the safety of the equipment used by Shell.

The March 2013 Department of the Interior report<sup>87</sup> concluded that, while Shell generally performed safely during in-theater drilling operations, it ran into “significant problems during phases of the operation that were outside its core drilling-related competencies.”<sup>88</sup> The report was also critical of Shell's reliance on contractors who did not fully understand and prepare for the unique Arctic conditions.<sup>89</sup> Coordination and information sharing on issues such as ice forecasting and tracking were positively reported. Shell received high marks for its respect for and coordination with Alaska's native and local communities while working in the region.<sup>90</sup> The report recommended that Shell continue to cooperate with federal agencies in the regulation and oversight processes through increased transparency and opportunities for public input.<sup>91</sup>

Shell's difficult 2012 season may discourage other oil companies from pursuing Arctic drilling projects or negatively impact their plans if federal restrictions tighten. There are a number of other oil companies with a stake in Alaskan Arctic offshore exploration. BP, which holds a lease for a field with about 100 million barrels of recoverable oil in shallow Beaufort Sea waters, announced in July 2012 that it would indefinitely suspend the \$1.5 billion project due to “cost overruns and technical setbacks.”<sup>92</sup> In a cautious approach likely influenced by Shell's difficulties, Statoil announced that it would delay drilling in Devil's Paw Prospect on the Chukchi Sea at least until 2015.<sup>93</sup> Similarly, ConocoPhillips recently put its offshore drilling plans in Chukchi on hold, citing regulatory uncertainty and unpredictable permitting standards.<sup>94</sup> Shell signed an agreement on April 8, 2013, with Russia state company Gazprom to jointly explore oil and gas fields in Western Siberia and the Arctic, the results of which remain to be seen.<sup>95</sup>

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86. John M. Broder and Clifford Krauss, “Interior Dept. Expedites Review of Arctic Drilling after Accidents,” *New York Times*, January 9, 2013, [http://www.nytimes.com/2013/01/09/us/arctic-drilling-to-be-reviewed-in-light-of-accidents.html?\\_r=0](http://www.nytimes.com/2013/01/09/us/arctic-drilling-to-be-reviewed-in-light-of-accidents.html?_r=0).

87. “Review of Shell's 2012 Alaska Offshore Oil and Gas Exploration Program,” U.S. Department of the Interior, March 8, 2013, <http://www.doi.gov/news/pressreleases/upload/Shell-report-3-8-13-Final.pdf>.

88. *Ibid.*, 3.

89. *Ibid.*, 1.

90. *Ibid.*, 24.

91. *Ibid.*, 6.

92. Yereth Rosen, “BP suspends costly Alaska oil project,” Reuters, July 9, 2012, <http://www.reuters.com/article/2012/07/09/bp-alaska-suspension-idUSL2E819FFG20120709>.

93. *Ibid.*

94. Guy Chazan, “Conoco puts Arctic drilling plans on ice,” *Financial Times*, April 10, 2013, <http://www.ft.com/intl/cms/s/0/a80f62dc-a1fb-11e2-ad0c-00144feabdc0.html#axzz2Q5ifhP00>.

95. Euractiv, “Gazprom, Shell ink Arctic cooperation deal,” April 9, 2013, <http://www.euractiv.com/energy/gazprom-shell-sign-arctic-deal-news-518980>.



# 3 | Arctic Mineral Resource Exploration

## Mineral Resources in the Alaskan Arctic Region

Alaskan Arctic mineral resources, although explored since the nineteenth century, produce an extraordinary amount of annual state export income. In 2010 alone exports of mineral resources in Alaska generated \$1.3 billion and accounted for 36.8 percent of Alaska's foreign export earnings.<sup>1</sup> The American Arctic accounts for over half of Alaska's mineral production, but significant deposits of zinc, lead, gold, and coal have so far been underexplored. Given technological advancements, increased access to these resources, and the probability of improved infrastructure, there is significant potential for growth for mining operations in the Arctic. In recent years extraction companies have staked numerous claims for prospecting mineral resources and developing extraction capabilities in the American Arctic. These proposals have not been without controversy, however, drawing significant opposition from environmental groups and indigenous populations.

### LEADING THE WAY: ZINC AND LEAD MINING

The largest industrial-scale mine in the U.S. Arctic region is the Red Dog mine, an open-pit lead-zinc mine located in northwestern Alaska in the remote mountains of the western Brooks Range. With an annual production of over half a million tons of zinc, Red Dog is the second largest zinc mine in the world, accounting for 5 percent of the global (and 79 percent of the U.S.) zinc production.<sup>2</sup> Red Dog is also a significant producer of lead, ranking fourth in the world and accounting for 3 percent of global (and 33 percent of U.S.) lead production.<sup>3</sup> The mining operation is a joint venture between the mine operator, Teck Alaska Incorporated (a U.S. subsidiary of Canadian company Teck Resources Limited), and

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1. Charles Emmerson and Glada Lahn, "Arctic Opening: Opportunity and Risk in the High North," Lloyd's and Chatham House, April 2012, 26, [http://www.lloyds.com/~media/Files/News%20and%20Insight/360%20Risk%20Insight/Arctic\\_Risk\\_Report\\_20120412.pdf](http://www.lloyds.com/~media/Files/News%20and%20Insight/360%20Risk%20Insight/Arctic_Risk_Report_20120412.pdf).

2. Teck Resources Limited, "2011 Annual Report," February 28, 2012, <http://www.teck.com/Generic.aspx?portalName=tc&PAGE=2011+Online+Annual+Report%2fHome>; Red Dog Alaska, "Red Dog Operations," <http://www.reddogalaska.com/Generic.aspx?PAGE=Red+Dog+Site%2fZinc+and+Lead&portalName=tc>.

3. Red Dog Alaska, "Red Dog Operations," 2009, <http://www.reddogalaska.com/Generic.aspx?PAGE=Red+Dog+Site%2fZinc+and+Lead&portalName=tc>.

the land owner, NANA Regional Corporation, a regional Alaska native corporation owned entirely by Iñupiat shareholders.<sup>4</sup>

With the main deposit expected to be depleted by the end of 2012, Teck requested a water discharge permit to expand its mining operations into the adjacent Aqqaluk deposit in 2010. Despite an appeal by environmental groups and native groups, Teck received U.S. Environmental Protection Agency (EPA) approval and started mining operations in mid-2010.<sup>5</sup> With over 60 million tons of ore reserves, the operations in Aqqaluk are estimated to continue until 2031.<sup>6</sup>

The Red Dog mine has had a significant economic impact on the regional and state economy. In 2011, the mining operations provided over \$129 million in royalty payments to NANA and supported over six hundred full-time jobs.<sup>7</sup> Indirect economic benefits come from state and federal taxes, purchases of goods and services from local suppliers, and community investment projects. It is estimated that the Red Dog mine has contributed \$558 million to the statewide economy and \$66 million to the Northwest Arctic Borough.<sup>8</sup>

Teck is currently collaborating with a small Canadian company, Zazu Metals Corporation, to explore prospects for the Lik project, a zinc, lead, and silver mine twenty-two miles northwest of the Red Dog mine. One of the largest undeveloped zinc assets in the United States, the open-pit Lik South deposit is estimated to hold 18 million tons of mineral resources (grading 8 percent zinc, 2.6 percent lead, and 52 grams per ton silver), while the deeper Lik North deposit (which requires underground mining) is estimated to hold an additional 5 million tons of inferred resources (grading 9.6 percent zinc, 3.2 percent lead, and 51 grams per ton silver).<sup>9</sup> The project is still in its early phases, however. Zazu is currently undertaking exploratory drilling and conducting environmental, metallurgical, and infrastructural studies to compile the data required to enter the feasibility and permitting stage of the project.<sup>10</sup> In September 2012 the company announced the transfer of the Lik deposit federal claims to Alaska Large Mine Permitting Group, a division of the Alaska Department of Natural Resources, in an effort to simplify the permitting process for the development of the zinc mine.<sup>11</sup>

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4. Red Dog Alaska, "NANA Regional Corporation," <http://www.reddogalaska.com/Generic.aspx?PAGE=Red+Dog+Site%2fNANA&portalName=tc>.

5. Yereth Rosen and Euan Rocha, "U.S. EPA says Red Dog cleared for mine extension," Reuters, March 18, 2010, <http://www.reuters.com/article/2010/03/18/teck-reddog-idUSN1717852620100318>.

6. Environmental Protection Agency, "Record of Decision for the Red Dog Mine Extension Aqqaluk Project," 2010, <http://www.epa.gov/region10/pdf/permits/npdes/ak/red-dog-aqqaluk-rod.pdf>.

7. Teck Resources Limited, "2011 Annual Report," February 28, 2012, <http://www.teck.com/Generic.aspx?portalName=tc&PAGE=2011+Online+Annual+Report%2fHome>.

8. NANA Regional Corporation, Inc., "Red Dog by the Numbers," 2010, <http://nana.com/regional/resources/red-dog-mine/red-dog-faq/>.

9. Zazu Metals Corporation, "Pre-Financing Due Diligence Started on Zazu's Lik Deposit," March 3, 2011, [http://www.zazumetals.com/s/NewsReleases.asp?ReportID=446052&\\_Title=Pre-Financing-Due-Diligence-Started-on-Zazus-Lik-Deposit](http://www.zazumetals.com/s/NewsReleases.asp?ReportID=446052&_Title=Pre-Financing-Due-Diligence-Started-on-Zazus-Lik-Deposit).

10. Zazu Metals Corporation, "Lik Project," <http://www.zazumetals.com/s/Projects.asp>.

11. Zazu Metals Corporation, "Zazu Simplifies Permitting for Zinc Mine Development," September 11, 2012, [http://www.zazumetals.com/s/NewsReleases.asp?ReportID=548075&\\_Type=News-Releases&\\_Title=Zazu-Simplifies-Permitting-for-Zinc-Mine-Development](http://www.zazumetals.com/s/NewsReleases.asp?ReportID=548075&_Type=News-Releases&_Title=Zazu-Simplifies-Permitting-for-Zinc-Mine-Development).

**Photo 3.1.** The oil drilling ship *Noble Discoverer*, seen April 5, 2012, in the port of Seattle before its trip to Alaska for the summer Arctic drilling season.



Source: Photo by James Brooks, <http://www.flickr.com/photos/jkbrooks85/7453389126/>.

## GOLD RUSH 2.0: GOLD MINING PROSPECTS

The Rock Creek gold mine on Alaska's Seward Peninsula (near Nome) was purchased in June 2012 from NovaGold Resources.<sup>12</sup> The Bering Straits Native Corporation (BSNC), the owner of the mine, is evaluating the prospects for reopening the open-pit mine, which has estimated reserves of 500,000 ounces of gold. The mine operated briefly during 2008 until it closed due to mechanical problems, environmental concerns, and financial woes.<sup>13</sup> With gold prices forecast to rise to \$1,900 per ounce by 2014, the value of these reserves stands at over \$950 million.<sup>14</sup>

BSNC also purchased NovaGold, a subsidiary of the Alaska Gold Company, which holds mining claims to the nearby Big Hurrah site.<sup>15</sup> The renewed interest in gold mining projects is part of a larger gold rush across Alaska, including the proposed development of the Pebble mine in Bristol Bay and the Donlin Creek mine in the Yukon-Kuskokwim region, which have estimated reserves of 107 and 42 million ounces of gold, respectively.<sup>16</sup>

Mining in the western Alaska Arctic region of Nome, however, will be challenging due to Arctic weather conditions and the need to limit environmental impact. BSNC is evaluating options for restarting mining operations on a smaller scale than previously planned (NovaGold's planned production was 100,000 ounces of gold annually), but it could decide on full closure of the mine if it cannot operate profitably.<sup>17</sup>

## COPPER EXPLORATION

Located in the upper Kobuk River Valley in the northwest Alaskan Arctic, the Ambler Mining District is one of the largest undeveloped copper and zinc districts in the world, hosting three volcanogenic massive sulfide deposits rich in copper, zinc, lead, silver, and gold resources.<sup>18</sup>

NovaCopper, a NovaGold subsidiary established in March 2012, owns the largest deposit, the Arctic deposit, which hosts over 19 million tons of indicated mineral resources (grading 4.1 percent copper and 5.8 percent zinc) and an additional 11 million tons of inferred resources.<sup>19</sup>

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12. "NOVAGOLD Achieves Multiple Significant Milestones in 2012; Permitting of Donlin Gold Project in Alaska is Underway", Yahoo Finance, February 12, 2013, <http://finance.yahoo.com/news/novagold-achieves-multiple-significant-milestones-120000763.html>.

13. Elizabeth Bluemink, "NovaGold forced to suspend operation of Rock Creek mine," *Anchorage Daily News*, November 24, 2008, <http://www.adn.com/2008/11/24/600762/novagold-forced-to-suspend-operation.html#storylink=cpy>.

14. Glenys Sim, "Goldman Cuts Gold Price Forecast Through 2014 as Cycle Turns", Bloomberg, April 10, 2013, <http://www.bloomberg.com/news/2013-04-10/goldman-lowers-gold-price-forecast-through-2014-as-cycle-turns.html>.

15. Bering Straits Native Corporation, "Bering Straits Native Corporation Announces Acquisition of Alaska Gold Company, LLC," November 1, 2012, [http://beringstraits.com/pr/BSNC\\_AGC\\_Purchase\\_Press\\_Release\\_110112\\_.pdf](http://beringstraits.com/pr/BSNC_AGC_Purchase_Press_Release_110112_.pdf).

16. Lasley, Shane, "Fortune Hunt Alaska: Gold's allure draws fortune hunters," *Petroleum News*, May 8, 2011, <http://www.petroleumnews.com/pntruncate/41782135.shtml>.

17. "Agreement Will Transfer Rock Creek Mine Assets to BSNC," *Alaska Business Monthly*, June 12, 2012, <http://www.akbizmag.com/Alaska-Business-Monthly/June-2012/Agreement-Will-Transfer-Rock-Creek-Mine-Assets-to-BSNC/>.

18. "Welcome to the Upper Kobuk Mineral Projects," NOVA Copper, 2012, [http://www.novacopper.com/s/Ambler\\_District.asp?ReportID=577396](http://www.novacopper.com/s/Ambler_District.asp?ReportID=577396).

19. Travis Leach, Joanna Poeck, Russ White, Jeffrey Volk, "NI 43-101 Preliminary Economic Assessment

The underground mining operation is expected to yield 1.7 billion pounds of copper, 2.4 billion pounds of zinc, 328 million pounds of lead, 265,000 ounces of gold, and 21 million ounces of silver over a twenty-five-year mine life, generating a post-tax net present value between \$0.5 and \$1.7 billion.<sup>20</sup> NovaCopper signed a cooperation agreement with NANA (which owns the adjacent Bornite deposit of 50 million tons of ore with copper grades of 1.2 to 4 percent) in 2011 to consolidate their land holdings and jointly explore and develop the Ambler district.<sup>21</sup>

According to a preliminary economic assessment, a mine with a 4,000-ton-per-day production rate could be built with a \$262 million initial capital investment.<sup>22</sup> The development of the mine would require three years of further exploration and three to four years for completing the permitting process, including conducting feasibility studies and environmental impact assessments. It is also contingent on the construction of a 211-mile access road from the Dalton Highway, which is estimated to cost an additional \$300 million.<sup>23</sup> The company is discussing with the State of Alaska the development of a public-private partnership, whereby the access road would be built by state authorities and the company would reimburse the costs over the operating life of the mine.

Two other deposits are under exploration by other mining companies: the Sun deposit owned by Andover Ventures Inc., and the Smucker deposit owned by Teck Alaska Inc. According to a 1977 historical resource assessment, the Main Sun deposit holds 2.4 million tons of ore averaging 81.77 grams per ton silver, 1.93 percent copper, 4.51 percent zinc, and 1.2 percent lead; and an additional underground resource of 17.89 million tons averaging 81.09 grams per ton silver, 1.91 percent copper, 2.46 percent zinc, and 1.18 percent lead.<sup>24</sup> With a 2012 budget of \$3.5 million, Andover completed 20 diamond drill holes and intersected significant mineral deposits.<sup>25</sup> The company intends to release the first modern resource calculation of the Sun deposit and a preliminary economic assessment in 2013.

The Alaska Department of Transportation and Public Facilities is evaluating potential road or rail corridors to connect the Ambler Mining District to the existing surface transportation system to facilitate exploration and development of mineral resources in the district.<sup>26</sup> The proposed road corridor would connect the Fairbanks area to the Seward

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Ambler Project Kobuk, AK,” NOVA Copper, March 9, 2012, [http://www.novacopper.com/i/pdf/reports/Ambler\\_PEAUpdate\\_168400\\_020\\_070\\_20120309.pdf](http://www.novacopper.com/i/pdf/reports/Ambler_PEAUpdate_168400_020_070_20120309.pdf), p.v.

20. Ibid. The net present value is calculated at an 8 percent discount rate, with an internal rate of return of 50 percent, at a range of assumed commodity prices.

21. “A NANA-NovaCopper Partnership to Develop the Ambler Mining district”, Nova Copper, 2012, [http://www.novacopper.com/i/pdf/presentations/2012-02-xx\\_NCPPT\\_Rick\\_ENGO-Talk\\_sm.pdf](http://www.novacopper.com/i/pdf/presentations/2012-02-xx_NCPPT_Rick_ENGO-Talk_sm.pdf).

22. NovaCopper, “Preliminary Economic Assessment Ambler Project Kobuk, AK,” March 9, 2012, [http://www.novacopper.com/i/pdf/reports/Ambler\\_PEAUpdate\\_168400\\_020\\_070\\_20120309.pdf](http://www.novacopper.com/i/pdf/reports/Ambler_PEAUpdate_168400_020_070_20120309.pdf).

23. Ibid.

24. Andover Mining Company, “Main SUN Deposit,” <http://www.andovermining.com/portfolio/main-sun-deposit>.

25. Andover Mining Company, “Andover Reports Drill Assay Summary from 2012 Drilling and Exploration Program at Sun District, Ambler Mineral Belt, Alaska,” <http://www.andovermining.com/wp-content/uploads/2012/10/Andover-News-Release-Assay-Summary-Oct-18-2012.pdf>.

26. Alaska Department of Transportation and Public Facilities, “Ambler Mining District Access,” September 2011, [http://www.dot.state.ak.us/stwdplng/cip/stip/projects/Assets/Ambler\\_COC.pdf](http://www.dot.state.ak.us/stwdplng/cip/stip/projects/Assets/Ambler_COC.pdf).

**Photo 3.2. Alaska railroad locomotive.**



Source: Photo by James Brooks, [http://upload.wikimedia.org/wikipedia/commons/0/01/Alaska\\_Railroad\\_Locomotive.jpg](http://upload.wikimedia.org/wikipedia/commons/0/01/Alaska_Railroad_Locomotive.jpg).

Peninsula. The 2010 Western Alaska Access Planning Study estimated the cost of the 500-mile corridor at between \$2.3 and \$2.7 billion.<sup>27</sup> As part of the Roads to Resources initiative, Alaska's Governor Sean Parnell allotted \$4 million in the fiscal year (FY) 2013 budget to start the environmental impact study for the Ambler road project.<sup>28</sup>

## **ARCTIC COAL**

Over 80 percent of Alaska's identified coal resources lie in deposits in the Arctic region of the state. According to a U.S. Geological Survey in 2004 the Nanushuk formation in the North Slope region holds approximately 3.2 trillion tons of hypothetical coal resources that have not yet been explored.<sup>29</sup>

27. Andover Mining, "Ambler Mineral Belt—Alaska," <http://www.andovermining.com/portfolio/sun-alaska>.

28. "Parnell's Road to Resources plan slammed by environmental groups," *Alaska Dispatch*, April 2, 2012, <http://www.alaskadispatch.com/article/parnell-s-road-resources-plan-slammed-environmental-groups>.

29. Romeo M. Flores, Gary D. Stricker, and Scott A. Kinney, "Alaska Coal Geology, Resources, and Coalbed Methane Potential," U.S. Geological Survey, April 2004, <http://pubs.usgs.gov/dds/dds-077/dds77text.html#heading154883360>.

The Alaska Department of Natural Resources issued in 2010 a preliminary decision to issue coal prospecting permits for exploration of 116,000 acres of land in Nanushuk.<sup>30</sup> However, the Naqragmiut tribal government for the village of Anaktuvuk Pass has opposed the coal exploration plans due to concerns over potential damage to the environment and subsistence resources vital to the tribe.<sup>31</sup> The site-specific plan classifying the area as resource management land has been appealed and is still awaiting adjudication.<sup>32</sup>

Coal mining in permafrost remains difficult and expensive, and previous exploration of Alaskan Arctic coal deposits has been problematic. In 2006 BHP Billiton signed an agreement with the Arctic Slope Regional Corporation to conduct a five-year exploration project in the Northwest Arctic near the Chukchi Sea. In 2009 the mining company discontinued exploration drilling due to the high costs that kept the Western Arctic coal project from being sufficiently profitable.<sup>33</sup> In August 2010 BHP Billiton applied for renewal of its exploration permits and is expected to begin to reclamation of the site.<sup>34</sup>

## URANIUM MINING PROSPECTS

The Boulder Creek uranium deposit, located near Elim Village on the Seward Peninsula in northwestern Alaska, is the largest identified uranium deposit in Alaska, holding an estimated 1 million pounds of uranium oxide resources.<sup>35</sup> The Canadian Triex Minerals Corporation<sup>36</sup> started exploratory drilling in 2006, investing \$3.5 million dollars.<sup>37</sup>

The project, however, met with fierce local opposition due to concern over toxic contamination of the Tubuktulik River and other health and environmental impacts associated with extraction of radioactive materials. The Elim Students Against Uranium staged

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30. State of Alaska Department of Natural Resources, "Preliminary Decision: Nanushuk Coal Prospecting Permits," March 5, 2010, <http://aws.state.ak.us/OnlinePublicNotices/Notices/View.aspx?id=148641>.

31. Alaska State Legislature, "Resolution of the Naqragmiut Tribal Council Opposing Coal Development in the Nanushuk Area," February 3, 2011, [http://www.legis.state.ak.us/basis/get\\_documents.asp?session=27&doid=4525](http://www.legis.state.ak.us/basis/get_documents.asp?session=27&doid=4525).

32. State of Alaska Department of Natural Resources, "Final Nanushuk Site Specific Plan," July 22, 2010, <http://aws.state.ak.us/OnlinePublicNotices/Notices/View.aspx?id=150713>.

33. BHP Billiton, "Exploration Termination Letter to Alaska Division of Natural Resources: Western Arctic Coal Project Coal Exploration Permit: 03-84-295," September 1, 2009, [http://www.groundtruthtrekking.org/Documents/Letter\\_090901\\_Exploration\\_Termination%20Ltr\\_to\\_DNR.pdf](http://www.groundtruthtrekking.org/Documents/Letter_090901_Exploration_Termination%20Ltr_to_DNR.pdf).

34. BHP Billiton, "BHP Billiton Western Arctic Coal Project Alaska Application for Renewal of DNR Coal Exploration Permit," August 5, 2010, [http://dnr.alaska.gov/mlw/mining/coal/w\\_arctic/permit\\_1008\\_coalpermirenewalapplication.pdf](http://dnr.alaska.gov/mlw/mining/coal/w_arctic/permit_1008_coalpermirenewalapplication.pdf).

35. State of Alaska Department of Transportation and Public Facilities, "Western Alaska Access Planning Study: Inventory Report," March 2009, [http://dot.alaska.gov/nreg/westernaccess/documents/inventory\\_report.pdf](http://dot.alaska.gov/nreg/westernaccess/documents/inventory_report.pdf).

36. The Triex Minerals Corporation signed a joint venture agreement with the Alaskan Full Metal Minerals company in 2005, and was acquired by Canterra Mineral Corporation in 2009. Full Metal Minerals, "Full Metal Options Boulder Creek Uranium Property to Triex," 2005, <http://www.fullmetalminerals.com/full-metal-options-boulder-creek-uranium-property-to-triex/>; Triex Minerals Corporation, "Canterra Minerals Corporation Acquires Triex Minerals Corporation," December 14, 2009, [http://www.triexminerals.com/i/pdf/news/NR\\_20091214.pdf](http://www.triexminerals.com/i/pdf/news/NR_20091214.pdf).

37. Jill Burke, "In Elim, waiting for risks to yield rewards," *Alaska Dispatch*, March 16, 2010, <http://www.alaskadispatch.com/article/elim-waiting-risks-yeild-rewards?page=0,1>.

protests in 2008 and 2009. In 2009 the Center for Water Advocacy campaigned to halt uranium exploration on behalf of the native village.<sup>38</sup> Development of the deposit has stalled following local opposition and allegations that the federal Bureau of Land Management failed to provide adequate public notice regarding the project. Triex dropped its Boulder Creek claims in 2008, but retained interests in nearby claims.<sup>39</sup>

## Mineral Resources in the Circumpolar Arctic: Focus on the North Atlantic

Greenland is fast becoming an attractive Arctic mining destination as accessibility improves with the shrinking of the Greenland ice sheet. Although mineral resources have been underexploited to this point, Greenland has substantial deposits of minerals, including rare earth elements, uranium, iron ore, gold, diamonds, lead, and zinc. Greenland issued prospecting licenses to over thirty mining and exploration companies in 2012 alone.<sup>40</sup> With the recent discovery of large reserves of rare earth metals and increased Chinese interest in these strategically important resources, Greenland has the potential to become a gateway for China's commercial entry into the Arctic region.

### GREENLAND'S RARE EARTH ELEMENTS AND URANIUM

Rare earth elements have become a critical component to a wide range of electronic devices with applications in the defense, automotive, alternative energy, and electronic and communications industries. Examples of civilian and military high technology applications include high-powered permanent magnets for wind turbines, hybrid vehicle motors, and missile guidance systems; rechargeable batteries for consumer electronic products and advanced communications systems; phosphors in liquid crystal displays, fluorescent light bulbs, and night vision goggles; alloys for sonar technology; and lasers in weapons systems.<sup>41</sup>

Under its "zero tolerance" policy, Greenland bans the extraction of all radioactive elements. However, this policy was relaxed in 2010 as the government allowed exploration of sites containing uranium and is considering legislation to approve its extraction as a by-product in mines primarily holding rare earth minerals.<sup>42</sup>

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38. Norell, Brenda, "Alaska Natives protest uranium exploration on Iditarod Trail", *Joostrap Magazine*, March 19, 2009, <http://www.hackitarians.com/latest-news/48-sp-921/8531-alaska-natives-protest-uranium-exploration-on-itarod-trail.html>

39. U.S. Geological Survey, "2008 Minerals Yearbook: Alaska," July 2012, <http://minerals.usgs.gov/minerals/pubs/state/2008/myb2-2008-ak.pdf>.

40. "NunaMinerals upgrades in hunt for gold and base metals," *Greenland Today*, February 20, 2012, <http://greenlandtoday.com/gb/category/nunaminerals-upgrades-in-hunt-for-gold-and-base-metals-195/>.

41. Lee Levkowitz, "China's Rare Earths Industry and its Role in the International Market," U.S.-China Economic and Security Review Commission Staff Backgrounder, November 3, 2010, <http://origin.www.uscc.gov/sites/default/files/Research/RareEarthsBackgrounderFINAL.pdf>; Greenland Minerals and Energy Ltd., "Rare Earth Elements—Applications," <http://www.ggg.gl/rare-earth-elements/rare-earth-elements-applications/>.

42. France Bourgouin and Cindy Vestergaard, "Should Greenland Mine Its Uranium?" Center for Security Studies, May 8, 2012, <http://www.isn.ethz.ch/isn/Security-Watch/Articles/Detail/?lng=en&id=141673>.



**Photo 3.3. Rare earth elements.**



Source: Photo by Alchemist-hp, [http://en.wikipedia.org/wiki/File:Yttrium\\_sublimed\\_dendritic\\_and\\_1cm3\\_cube.jpg](http://en.wikipedia.org/wiki/File:Yttrium_sublimed_dendritic_and_1cm3_cube.jpg).

The Ilimaussaq complex, located on the southwest coast of Greenland, is host to the largest quantities of rare earth elements in the world, estimated to meet a quarter of the global demand for the next fifty years.<sup>43</sup> Deposits at the Kvanefjeld project hold 4.7 million tons of rare earth oxide, 283 million pounds of uranium concentrates, and 1 million tons of zinc, to be mined over a forecasted mine life of twenty-three years.<sup>44</sup> According to a prefeasibility study conducted by Greenland Minerals and Energy Ltd. in 2009, the mine would cost \$2.3 billion, and construction could start in 2013 with production capabilities by 2015.<sup>45</sup> The project's proximity to existing infrastructure makes mining development logistically and economically feasible. The project is expected to be very profitable, generating a pretax internal rate of return of 24 percent.<sup>46</sup> Counting the mineral reserves in the adjacent Zone 2 and Zone 3 deposits, the Ilimaussaq complex holds a total inventory of 10.3

43. Leo Lewis, "Greenland challenge to Chinese over rare earth metals," *The Times*, October 5, 2009, <http://www.thetimes.co.uk/tto/business/industries/naturalresources/article2183054.ece>.

44. Greenland Minerals and Energy Ltd., "Fact Sheet," March 2011, [http://www.ggg.gl/docs/Greenland\\_Minerals\\_and\\_Energy\\_Fact\\_Sheet-march2011.pdf](http://www.ggg.gl/docs/Greenland_Minerals_and_Energy_Fact_Sheet-march2011.pdf).

45. Greenland Minerals and Energy Ltd., "Kvanefjeld Multi-Element Project Prefeasibility Study—Interim Report," May 2012, <http://www.ggg.gl/docs/ASX-announcements/Kvanefjeld-Prefeasibility-Study-4-May-2012.pdf>.

46. Ibid.

million tons of rare earth oxide, 575 million pounds of uranium concentrates, and 2.21 million tons of zinc.<sup>47</sup>

The TANBREEZ project, located near Kringlerne in Southern Greenland and owned by the Greenland company TANBREEZ Mining, also holds one of the largest reserves of rare earth elements in the world. TANBREEZ is projected to contain 4.3 billion tons of eudialyte bearing ore containing extractable rare earth elements.<sup>48</sup> This site is preferable to the Kvanefjeld project deposits because it does not contain uranium and thus avoids the zero tolerance policy for radioactive deposits.<sup>49</sup> With mine construction expected to begin in 2013, mining operations could start in 2015 at an annual production rate of 500,000 tons of ore.<sup>50</sup>

NunaMinerals, the partly government-owned leading minerals exploration company in Greenland, is in the early exploration stages of rare earth elements deposits near Nuuk in West Greenland.<sup>51</sup> The Qeqertaasaq and the Tikiusaaq deposits hold over 200,000 tons of resources each, at 1 to 5 percent total rare earth oxide.<sup>52</sup>

## GREENLAND'S GOLD, DIAMOND, AND IRON ORE RESOURCES

With its rich deposits, Greenland is preparing for a gold rush. The only active gold mine is at Nalunaq near the town of Nanortalik in South Greenland, below the Arctic Circle. The deposit is estimated to carry 400,000 tons of reserves with a gold grade of 21 grams per ton and an additional 1.6 million tons of indicated resources with an average gold grade of 18 grams per ton.<sup>53</sup> Operated by Angel Mining, the Nalunaq started production in May 2011 and is expected to produce about 24,000 ounces of gold annually.<sup>54</sup>

NunaMinerals, in alliance with international mining group Rio Tinto, holds two exploration licenses in the Nanortalik gold province near the Nalunaq mine. Samples in the Vagar and Hugin prospects have revealed very high gold grades of 100 to 1,000 grams per ton.<sup>55</sup> NunaMinerals is also conducting sampling in the Storø and Isua licenses within the Nuuk gold province, in the Ymer Island in Eastern Greenland, and in Inglefield Land in Western Greenland.<sup>56</sup>

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47. Greenland Minerals and Energy Ltd., “Zone 3 Mineral Resource Estimate Takes Kvanefjeld Project Global Resource Inventory to 575 Mlb’s U3O8, 10.3 Mt’s Total Rare Earth Oxide,” June 2012, <http://www.ggg.gl/docs/ASX-announcements/Zone-3-Mineral-Resource-Estimate.pdf>.

48. TANBREEZE, “Resource Estimate,” <http://tanbreez.com/en/project-overview/resource-calculation/?page=1>

49. TANBREEZ, “Key Project Features,” <http://tanbreez.com/en/project-overview/tanbreez-%E2%80%93-what-is-it/>.

50. M. T. Højgaard, “TANBREEZ—Feasibility Study,” <http://mth.com/Projects/Mining/Tanbreez.aspx>.

51. “NunaMinerals Special Situation—April 2012 Update,” *Rare Earth Elements Letter International*, April 2012, [http://nunaminerals.com/fileadmin/user\\_upload/pdf/Ree/NUNAMINERALS\\_REE\\_April2012Update.pdf](http://nunaminerals.com/fileadmin/user_upload/pdf/Ree/NUNAMINERALS_REE_April2012Update.pdf).

52. Karen Hanghøj, “The Greenland potential contribution of critical minerals to EU,” Geological Survey of Denmark and Greenland (GEUS), May 21, 2012, [http://critical-minerals-2012.geus.dk/presentations/2-3\\_Karen\\_Hanghoj\\_GEUS-20120521.pdf](http://critical-minerals-2012.geus.dk/presentations/2-3_Karen_Hanghoj_GEUS-20120521.pdf).

53. “The Nalunaq Gold Mine,” *Geology and Ore*, November 2008, <http://www.geus.dk/minex/go11.pdf>.

54. Angel Mining, “Gold is being produced at Nalunaq,” May 2011, <http://www.angelmining.com/nalunaq-gold-mine>.

55. “NunaMinerals Special Situation—April 2012 Update,” *Rare Earth Elements Letter International*, April 2012, [http://nunaminerals.com/fileadmin/user\\_upload/pdf/Ree/NUNAMINERALS\\_REE\\_April2012Update.pdf](http://nunaminerals.com/fileadmin/user_upload/pdf/Ree/NUNAMINERALS_REE_April2012Update.pdf).

56. *Ibid.*; NunaMinerals, “Nuuk gold province,” <http://nunaminerals.com/en/projects/nuuk-gold-province.html>.

The potential for a diamond rush in Greenland is also high. The Canadian resources exploration company Hudson Resources has taken the lead in diamond exploration in Greenland. The company owns the Garnet Lake project in Western Greenland, where it found several high quality 2-carat stones in 2007. The company has since scaled back its diamond exploration activities, reflecting the downturn in the diamond market.<sup>57</sup> Other companies have shown recent interest in diamond prospecting. Avannaa Resources started exploratory drilling in the Qeqertaa diamond project at Disko Bay, West Greenland, in 2010, and sampling is still in progress.<sup>58</sup> NunaMinerals holds licenses to the Tikiusaaq and Qaamasoq diamond prospects in the Nuuk region and estimated in 2011 that the latter prospect has more abundant resources than the former.<sup>59</sup>

Greenland is also preparing to exploit its rich iron ore resources. London Mining, a U.K.-based company backed by Chinese steelmakers, is proposing a \$2.3 billion iron ore mine project in the Isua greenstone belt near Nuuk, featuring an open-pit mine, an ore processing plant, a port facility, and a small airstrip.<sup>60</sup> The Isua deposit has over 1 billion tons of iron ore resources containing 70 percent iron with low impurities, to be mined starting in 2015 over a fifteen-year mine life (with the potential for thirty years of operations).<sup>61</sup> All environmental baseline studies have been completed, and the project is awaiting approval from the Greenlandic Bureau of Minerals and Petroleum.<sup>62</sup>

## ICELAND'S MINERALS

Iceland has scarce mineral resources, but it has a large aluminum industry, accounting for a seventh of the country's gross domestic product (GDP).<sup>63</sup> There are three aluminum smelting plants currently active in Iceland. One plant is run by Century Aluminum Company and one by Alcoa; both Century and Alcoa are U.S. manufacturers. The plants, fueled by inexpensive geothermal energy and hydropower, produce about 870,000 tons of aluminum per year.<sup>64</sup> Planned expansions include two new plants, which could increase production to over 1.5 million tons annually.<sup>65</sup>

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57. Paul Brown, "Melting ice cap brings diamond hunters and hopes of independence to Greenland," *The Guardian*, October 4, 2007, <http://www.guardian.co.uk/environment/2007/oct/04/1>; Hudson Resources, "Projects," 2003, <http://www.hudsonresources.ca/projects.asp>.

58. Avannaa Resources, "Qeqertaa Diamond," 2011, <http://www.avannaa.com/project-detail/Qeqertaa-diamond/>.

59. NunaMinerals, "The Qaamasoq diamond prospect," <http://nunaminerals.com/en/projects/diamond-projects/the-qaamasoq-diamond-prospect.html>.

60. London Mining PLC, "ISUA Iron Ore Mine Project Greenland," [http://www.londonmining.com/media/48900/2013\\_06\\_14\\_-\\_london\\_mining\\_isua\\_factsheet.pdf](http://www.londonmining.com/media/48900/2013_06_14_-_london_mining_isua_factsheet.pdf).

61. "London Mining PLC, "Isua 15 Mtpa Scoping Study Report," February, 2011, [http://www.londonmining.com/media/43738/2011\\_02\\_-\\_isua\\_analyst\\_workshop.pdf](http://www.londonmining.com/media/43738/2011_02_-_isua_analyst_workshop.pdf).

62. Ray Weaver, "China holds key to Greenland treasure chest," *The Copenhagen Post*, June 13, 2012, <http://cphpost.dk/business/china-holds-key-greenland-treasure-chest>.

63. Henry Chu, "Iceland divided over aluminum's role in its future," *Los Angeles Times*, March 26, 2011, <http://articles.latimes.com/2011/mar/26/business/la-fi-iceland-economy-20110326>.

64. Ibid.

65. "Special feature: Another new aluminium smelter for Iceland," *Ice News*, June 10, 2008, <http://www.icenews.is/2008/06/10/special-feature-another-new-aluminium-smelter-for-iceland/>.

## CANADA'S BAFFIN BAY IRON MINE

Canada's Arctic territories have rich mineral resources, including gold, coal, and quartz in Yukon; gold and diamonds in the Northwest Territories; and iron ore, nickel, lead, and zinc in Nunavut.<sup>66</sup> One of the most significant recent mining developments is the plan to construct a massive open-pit iron ore mine in Baffin Bay in the Nunavut territory. The Mary River property, which contains about 365 million tons of high-grade, high-purity iron ore, is owned and operated by Baffinland Iron Mines Corporation, a joint venture between Luxembourg-based steel giant ArcelorMittal and U.S.-based Iron Ore Holdings LP (each with 50 percent shares).<sup>67</sup>

After a four-year assessment process, in December 2012 the Nunavut Impact Review Board approved construction of the Baffin Bay mine, which will cost \$4 billion to build and is estimated to generate about \$5 billion in taxes and royalties to the Nunavut territory over its expected twenty-one-year mine life.<sup>68</sup> However, in January 2013, Baffinland announced that it was substantially scaling back its plans, aiming to construct a \$740 million mine that will produce only 3.5 million tons per year, compared to the original 18 million tons per year production rate.<sup>69</sup>

## NON-ARCTIC STATE GROWING INTEREST IN ARCTIC MINERAL RESOURCES

China has showed great interest in investing in Arctic mineral resources, particularly in Greenland. Since 2009 two private Chinese mining companies from Jiangxi Province have invested in mineral prospecting projects in Greenland: Jiangxi Zhongrun Mining is exploring copper and gold with U.K.-based Nordic Mining in southern Greenland, and Jiangxi Union Mining is prospecting copper in central Greenland.<sup>70</sup>

According to China's Ministry of Land and Resources, Xinye Mining, a company owned by the Sichuan Province government, is currently discussing with London Mining a possible purchase of the Isua iron ore mine project.<sup>71</sup> Chinese steelmakers Sinosteel and China Communications Construction Corporation have already invested in the Isua project.<sup>72</sup> The mine, which would supply iron to China, is expected to employ about 2,300 Chinese workers.<sup>73</sup>

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66. The Arctic (RIA Novosti), "Natural Resources: Other Minerals," <http://arctic.ru/natural-resources/other-minerals>.

67. Baffinland Iron Mines Corporation, "Who We Are," <http://www.baffinland.com/about-us/company-history-2/?lang=en>.

68. Shawn McCarthy and Pav Jordan, "Ottawa approves Nunavut iron ore project," *The Globe and Mail*, December 3, 2012, <http://www.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/ottawa-approves-nunavut-iron-ore-project/article5915530/>.

69. Pav Jordan, "Baffinland Iron Mines sharply scales back Mary River project," *The Globe and Mail*, January 11, 2013, <http://www.theglobeandmail.com/globe-investor/baffinland-seeks-to-defer-parts-of-mary-river-iron-ore-project/article7227358/>.

70. "Greenland Lures China's Miners with Cold Gold," *Caixin Online*, December 7, 2012, <http://english.caixin.com/2011-12-07/100335609.html>.

71. Ibid.

72. Andrew Erickson and Gabe Collins, "China's New Strategic Target: Arctic Minerals," Asia Pacific International Relations Study Center, May 11, 2011, <http://apircenter.org/policy/chinas-new-strategic-target-arctic-minerals/>.

73. "Greenland rejects EU request to limit rare earths exports," *EurActiv*, January 15, 2013, <http://www.euractiv.com/sustainability/greenland-rejects-eu-request-lim-news-517057>.

China is interested in these Arctic mineral resources not only to satisfy its increasing consumption needs, but also to protect its dominant international market position. China produces more than 95 percent of the world's supply of rare earth elements and also consumes roughly 60 percent of that supply.<sup>74</sup> While it now holds a near monopoly in these strategically important mineral resources, China is competing to gain access to Greenland's newly discovered deposits in order to maintain its stronghold on the global market. The Kvanefjeld project could potentially attract investment from Chinese rare earth metals producer Inner Mongolia Baotou Steel Rare Earth.<sup>75</sup>

Diplomatically, China is heightening its visibility and engagement in the Arctic. In June 2012 China's President Hu Jintao made a three-day visit to Denmark, the first state visit since diplomatic ties were established sixty-two years ago. While access to Greenland's resources was not among the \$3 billion export and investment deals signed during the visit, Arctic experts speculate that China will use improved diplomatic relations with Denmark to capture a stake in the exploitation of Greenland's rare earth mineral resources.<sup>76</sup> In exchange for mineral extraction licenses, Chinese investors and companies are reportedly willing to invest \$219 million in infrastructure projects in Greenland, including building three new airports and expanding the Nuuk port facilities.<sup>77</sup> In January 2013 Prime Minister Kuupik Kleist stated that Greenland would not exclude Chinese investors, despite requests from European Union (EU) parliamentarians to do so.<sup>78</sup>

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74. Marc Humphries, "Rare Earth Elements: The Global Supply Chain," Congressional Research Service, June 8, 2012, <http://www.fas.org/sgp/crs/natsec/R41347.pdf>.

75. Ibid.

76. John Acher and Mette Fraende, "Greenland's minerals loom in China-Denmark ties," Reuters, June 16, 2012, <http://www.reuters.com/article/2012/06/16/china-denmark-greenland-idUSL5E8HG1PZ20120616>.

77. Ray Weaver, "China holds key to Greenland treasure chest," *The Copenhagen Post*, June 13, 2012, <http://cphpost.dk/business/china-holds-key-greenland-treasure-chest>.

78. "Greenland rejects EU request to limit rare earths exports," *EurActiv*, January 15, 2013, <http://www.euractiv.com/sustainability/greenland-rejects-eu-request-lim-news-517057>.

# 4 | Arctic Destination and Trans-Shipping

As ice-free shipping lanes become more prevalent, destination and trans-shipment to and through the Northern Sea Route (NSR), and potentially the Northwest Passage, carrying the Arctic's mineral and natural resources will spur Arctic economic growth. Shipping through the Arctic region could decrease East-West transit times between Asia, Europe, and North America by up to 40 percent as well as reduce fuel consumption and carbon emissions. Arctic shipping routes have already experienced substantial traffic increases in recent years, with the Northern Sea Route experiencing a 53 percent increase in traffic over the past year. This trend appears set to continue, with increased commercial and government-sponsored Arctic shipping and icebreaker construction also taking place among Arctic states and beyond.

## The Northern Sea Route

The Northern Sea Route,<sup>1</sup> the shipping lane along the Russian Arctic coast that connects Europe to the Asia-Pacific region, was open for navigation for 141 days in 2011—one month longer than the norm.<sup>2</sup> In 2012 the traffic along the Northern Sea Route consisted of forty-six vessels transporting over 1.26 million tons of cargo.<sup>3</sup> This represents a 53 percent increase from the previous year, when thirty-four vessels carried 820,000 tons of cargo, and a more than tenfold increase from 2010, when the route was only used by four vessels carrying 111,000 tons of cargo.<sup>4</sup>

These figures are still extremely low compared to the traffic through the Suez Canal, which saw 17,800 ships transport about 690 million tons of cargo in 2011.<sup>5</sup> The trans-Arctic

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1. Under Russia's 2012 law on the Northern Sea Route, the route officially encompasses the eastern coast of the Novaya Zemlya, the Kara Gate, and the straits between the mainland and the island of Vaigach. The new definition excludes the Barents Sea and the Pechora Sea and the port cities of Murmansk and Arkhangelsk. Atle Staalesen, "Northern Sea Route without Murmansk," *Barents Observer*, July 6, 2012, <http://barentsobserver.com/en/arctic/northern-sea-route-without-murmansk-06-07>.

2. Albina Kovalyova and Alissa de Carbonnel, "Arctic ice melt lifts hopes for Russian maritime trade," Reuters, January 30, 2012, <http://us.mobile.reuters.com/article/economicNews/idUSL5E8CU2VF20120130>.

3. Trude Pettersen, "46 vessels through Northern Sea Route," *Barents Observer*, November 23, 2012, <http://barentsobserver.com/en/arctic/2012/11/46-vessels-through-northern-sea-route-23-11>.

4. Trude Pettersen, "Record number of bulk carriers through Northern Sea Route," *Barents Observer*, June 14, 2012, <http://barentsobserver.com/en/business/record-number-bulk-carriers-through-northern-sea-route>.

5. "Traffic Statistics," Suez Canal Authority, <http://www.suezcanal.gov.eg/TRstat.aspx?reportId=4>.

shipping lane cannot be a substitute for existing high-traffic shipping routes, but it can be a logistically advantageous seasonal alternative. The circumpolar route is 4,000 nautical miles (7,400 km) shorter than southern routes,<sup>6</sup> and it could reduce transit time and fuel costs from Asia to Europe and North America by as much as 40 percent compared to passage through the Suez Canal. According to Danish shipping company Nordic Bulk Carriers, transporting cargo from west to east (Murmansk to China) along the northern route instead of through the Suez Canal saves 1,000 tons of fuel (valued at \$650,000) and takes just twenty-three days rather than forty-three.<sup>7</sup> However, to be competitive with transportation costs through the Suez Canal, Russian-required icebreaking fees must decrease by roughly 25 percent, which could be achieved through economies of scale if traffic increases substantially.<sup>8</sup>

It is important to note that there is an ongoing international dispute over the legal status of the Northern Sea Route. While Russia considers it an internal passage, the majority of the international community considers it an international passage. The United States and many other countries assert that the Northern Sea Route is an international strait, granting foreign vessels the right of passage without seeking the permission of the coastal state. Nonetheless, no foreign vessel has traversed the Northern Sea Route without seeking Moscow's permission since the 1965 attempt of a U.S. Coast Guard icebreaker, which was ordered to turn around due to military threats from the Soviet Union.<sup>9</sup> Despite this legal uncertainty, the possibility that the Northern Sea Route will become a viable transport route in the future has sparked strong interest in China, Japan, and South Korea, all export-led economies that would benefit greatly from development of this new shipping lane.

Russia's President Vladimir Putin envisions the Northern Sea Route as a "key transport route of global importance" that could become "an international transport artery capable of being a competitor to more traditional routes, both when it comes to price, safety and quality."<sup>10</sup> For Russia, the Northern Sea Route holds strategic importance. Development of the route for commercial shipping could help Russia enhance the export of its natural and mineral resources through better access to global, particularly Asian, energy markets while simultaneously encouraging greater Western investment and technology transfer to more rapidly develop its oil, gas, and shipbuilding industries. At present, petroleum products, iron ore, and coal constitute the bulk of the cargo transported through the Northern Sea Route, and the shipment of these resources is expected to increase as new natural resource development projects begin to produce. According to Murmansk officials, cargo

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6. Kovalyova and de Carbonnel, "Arctic ice melt lifts hopes for Russian maritime trade."

7. Michelle Wiese Bockmann, "Arctic Ship Cargoes Saving \$650,000 on Fuel Set for Record High," *Bloomberg Businessweek*, June 13, 2012, <http://www.bloomberg.com/news/2012-06-13/arctic-ship-cargoes-saving-650-000-on-fuel-set-for-record-high.html>.

8. Julia Nanay, "Russian Arctic Strategies and Recent Deals," paper presented at Woodrow Wilson Center, July 12, 2012, <http://www.wilsoncenter.org/sites/default/files/NanayArctic7-12-12.pdf>.

9. Michael Byers, "Canada Can Help Russia With Northern Sea Route," *The Moscow Times*, June 8, 2012, <http://www.themoscowtimes.com/opinion/article/canada-can-help-russia-with-northern-sea-route/460127.html>.

10. Trude Pettersen, "First Arctic rescue center to open in August," *Barents Observer*, March 2, 2012, <http://barentsobserver.com/en/topics/first-arctic-rescue-center-open-august>.

**Photo 4.1. The U.S. Coast Guard Cutter *Healy* escorts the Russian-flagged tanker *Renda* 250 miles south of Nome, January 6, 2012. The vessels are transiting through ice up to five feet thick in this area of the Bering Sea.**



Source: U.S. Coast Guard photo by Petty Officer First Class Sara Francis. [http://cgvi.uscg.mil/media/main.php?g2\\_itemId=1489507](http://cgvi.uscg.mil/media/main.php?g2_itemId=1489507). This image is a work of a U.S. military or Department of Defense employee, taken or made as part of that person's official duties. As a work of the U.S. federal government, the image is in the public domain.

transport may increase to 19 million tons by 2020.<sup>11</sup> The port of Sabetam under construction on the Yamal Peninsula is expected to have a handling capacity of approximately 30 million tons of goods per year.<sup>12</sup>

In the summer months of 2011 the Russian nuclear icebreaker fleet escorted fifteen large commercial oil and bulk tankers through the Northern Sea Route.<sup>13</sup> In 2012 twenty-six of the forty-six vessels transported nearly 900,000 tons of diesel and jet fuel, gas

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11. Trude Pettersen, "Cargo transport through Northern Sea Route will tenfold," *Barents Observer*, November 19, 2010, <http://barentsobserver.com/en/sections/topics/cargo-transport-through-northern-sea-route-will-tenfold>.

12. Trude Pettersen, "Agreement on Northern Sea Route LNG transport," *Barents Observer*, November 13, 2012, <http://barentsobserver.com/en/energy/agreement-northern-sea-route-lng-transport-13-11>.

13. Thomas Nilsen, "Season's First Oil-Tanker sails Northern Sea Route," *Barents Observer*, June 30, 2011, <http://barentsobserver.com/en/russia/seasons-first-oil-tanker-sails-northern-sea-route>.



condensate, and liquefied natural gas (LNG).<sup>14</sup> The 2012 season marked the first time the route was used to transport LNG, as the “Ob River” tanker shipped 66,000 tons of LNG from Statoil’s Hammerfest gas plant to Japan.<sup>15</sup> In 2011 the NSR was used for the first time by a supertanker (*Suezmax* class), carrying 162,000 tons of gas condensate from Murmansk to Thailand in a record 7.5 days.<sup>16</sup> The supertanker was contracted by Novatek, Russia’s second largest producer of natural gas, which shipped a total of nine cargoes of over 600,000 tons of stable gas condensate to Asia Pacific markets in 2011.<sup>17</sup> Novatek views the use of the circumpolar route for hydrocarbon transportation as “an integral part of [its] logistical strategy to develop prospective gas fields in the Yamal peninsula,” and has secured a fifteen-year contract with Rosatom to use its nuclear icebreaker fleet to clear the ice for vessels transporting LNG exports and supply shipments.<sup>18</sup>

Development of the new shipping route also holds economic potential for Russia’s strategically important shipbuilding industry. The state-run corporation Rosatom plans to build three nuclear-powered icebreakers by 2020, costing \$1.1 billion each.<sup>19</sup> The state-owned Sevmasht shipyard is also competing for state contracts to build ice-capable support ships.<sup>20</sup> Russian shipyards will probably also be asked to build ice-class LNG carriers to transport exports from the Yamal gas field.<sup>21</sup>

Preempting the increase in shipping activity, Russia recently amended legislation for regulating commercial shipping along the Northern Sea Route. The new law on the Northern Sea Route, adopted by the Russian legislature in July 2012, introduced a new definition of the route (which excludes Murmansk and the Barents Sea) and imposed regulations for shipping vessels using the route, including new insurance requirements and shipping fees.<sup>22</sup> It also established a new Northern Sea Route administration (with a budget of €660,000) to manage icebreaker services, provide radio communication and hydrographic information, and organize search and rescue operations.<sup>23</sup>

## The Northwest Passage

The other circumpolar shipping route, the Northwest Passage, is also becoming increasingly ice-free, although not to the same extent as the Northern Sea Route. However, it has to

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14. Pettersen, “46 vessels through Northern Sea Route.”

15. Thomas Nilsen, “Hammerfest LNG set sails for Japan via Arctic route,” *Barents Observer*, November 6, 2012, <http://www.barentsobserver.com/en/arctic/hammerfest-lng-set-sails-japan-arctic-route-06-11>.

16. Trude Pettersen, “Supertanker sets speed record on Northern Sea Route,” *Barents Observer*, September 1, 2011, <http://barentsobserver.com/en/briefs/supertanker-sets-speed-record-northern-sea-route>.

17. “Russian Northern Sea Route Critical to Development of Yamal Megaproject,” *Focus on Russia*, March 8, 2012, <http://focusonrussia.com/blog/2012/03/08/russian-northern-sea-route-critical-to-development-of-yamal-megaproject/>.

18. Pettersen, “Agreement on Northern Sea Route LNG transport.”

19. “Russia to build new nuclear icebreaker,” *Voice of Russia*, July 4, 2012, [http://english.ruvr.ru/2012\\_07\\_04/Russia-to-build-new-nuclear-icebreaker/](http://english.ruvr.ru/2012_07_04/Russia-to-build-new-nuclear-icebreaker/).

20. Kovalyova and de Carbonnel, “Arctic ice melt lifts hopes for Russian maritime trade.”

21. Nanay, “Russian Arctic Strategies and Recent Deals.”

22. Staalesen, “Northern Sea Route without Murmansk.”

23. *Ibid.*

this point seen lower shipping traffic than the Northern Sea Route due not only to the extent of ice that prevents greater navigable action, but also due to the more cost-efficient use of rail transit. In 2008 a commercial vessel traversed the Arctic waterway along the North American coastline for the first time: the cargo ship delivered supplies from Montreal to communities in western Nunavut.<sup>24</sup> Traffic along the route increased from seven ships in 2009 to eighteen ships in 2010 and twenty-two ships in 2011.<sup>25</sup> Cargo tonnage shipped through the port of Churchill, Canada's only deep water Arctic seaport, increased from 400,000 metric tons in 2008 to 700,000 metric tons in 2010.<sup>26</sup> Development of the Northwest Passage could potentially yield an alternative supply and service route from North America and Europe to Asia. A trip from London to Tokyo would be 4,350 miles and 3,050 miles shorter than using the Panama or Suez Canals, respectively.<sup>27</sup>

Similar to the Russian perspective on the legal status of the Northern Sea Route, Canada also views the Northwest Passage as an internal waterway, going so far as to call it "the Canadian Northwest Passage." The international community views the passage as an international passage although, unlike the Soviets in 1965, U.S. vessels have twice used the Northwest Passage without requesting Canada's permission (in 1960 and 1985) without facing opposition from Ottawa.<sup>28</sup>

In addition to international legal questions, increased use of the Northwest Passage raises other challenges. Experts have urged the Canadian government to increase its infrastructure and capabilities along the passage, including improving Arctic surveillance, port infrastructure, search and rescue preparedness, and environmental response capacities.<sup>29</sup> However, if foreign vessels increasingly seek access to the Northwest Passage, this could challenge Canada's long-held view that the passage is an internal waterway.

## The Bering Strait

When naval planners think of the world's most strategic straits, the straits of Hormuz and Malacca and the Panama and Suez canals immediately come to mind. In the future, the Arctic's Bering Strait will be added to the strategic list. This 53-mile strait between Russia and the United States represents an important choke point for shipping along the Northern Sea Route or the Northwest Passage. The U.S. Coast Guard estimates that traffic

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24. "First commercial ship sails through Northwest Passage," Canadian Broadcasting Company, November 28, 2008, <http://www.cbc.ca/news/canada/north/story/2008/11/28/nwest-vessel.html>.

25. "Northwest Passage traffic up in 2010," Canadian Broadcasting Company, September 20, 2010, <http://www.cbc.ca/news/canada/north/story/2010/09/20/northwest-passage-ships-inuvik.html>; Bill Mann, "Northwest Passage's risky tourism popularity," *Wall Street Journal Market Watch*, August 28, 2012, [http://articles.marketwatch.com/2012-08-28/commentary/33426866\\_1\\_arctic-tourism-northwest-passage-canadian-arctic](http://articles.marketwatch.com/2012-08-28/commentary/33426866_1_arctic-tourism-northwest-passage-canadian-arctic).

26. Pete Evans, "Arctic thaw heats up Northwest Passage dreams," Canadian Broadcasting Company, September 13, 2012, <http://www.cbc.ca/news/business/story/2012/09/11/f-franklin-northwest-passage-arctic.html>.

27. Eric Jackson, "The Panama Canal's new competition is opening up," *Panama News*, October 6, 2007, [http://www.thepanamanews.com/pn/v\\_13/issue\\_18/business\\_01.html](http://www.thepanamanews.com/pn/v_13/issue_18/business_01.html).

28. Ibid.

29. Ibid.

**Photo 4.2. A U.S. Coast Guard HC-130 Hercules airplane, based at Barrow, Alaska, flies over pack ice during a patrol of the Bering Strait.**



Source: Official U.S. Coast Guard photo by Petty Officer First Class Kurt Fredrickson. [http://cgvi.uscg.mil/media/main.php?g2\\_itemId=184952](http://cgvi.uscg.mil/media/main.php?g2_itemId=184952). This image is a work of a U.S. military or Department of Defense employee, taken or made as part of that person's official duties. As a work of the U.S. federal government, the image is in the public domain.

through the Bering Strait has nearly doubled from 245 vessels in 2008 to over 400 vessels in 2011.<sup>30</sup>

The Arctic Council's 2009 *Arctic Marine Shipping Assessment* criticized both the scarcity of navigational aids in the U.S. Arctic and the absence of a vessel routing system in the Bering Strait.<sup>31</sup> There have been calls for increased U.S.-Russian cooperation to manage the narrow and shallow strait, such as a joint vessel traffic service (VTS) to monitor the increased marine traffic and minimize the risks of accidents.<sup>32</sup> The United States and Russia also must negotiate a traffic separation plan for the Bering Strait, which must be submitted and approved by the International Maritime Organization (IMO).<sup>33</sup>

In 2010 the U.S. Coast Guard (USCG) launched a port access route study (PARS) to assess the need for new vessel routing measures in the Bering Strait with the goal of increasing efficiency of vessel traffic and reducing the risk of marine accidents.<sup>34</sup> With input from concerned stakeholders, the USCG will evaluate navigational hazards to vessels, safety implications of increasing traffic density, environmental concerns, and costs and benefits of establishing new routing measures in the strait.<sup>35</sup>

## Polar Code

A wide range of navigational hazards and specific ship hull construction demands pose challenges to the safety and profitability of trans-Arctic shipping. According to industry analysts, ships operating in the Arctic face navigational hazards such as poor weather conditions, ice floes, narrow straits, and shallow waters, with limited satellite communication, poor infrastructure, and few navigational aids.<sup>36</sup> In the case of maritime accidents involving shipping vessels in the harsh and remote Arctic environment, search and rescue operations as well as environmental damage response would be difficult and costly to undertake.

To address the safety concerns facing ships operating in Arctic waters, the International Maritime Organization (IMO) has developed voluntary guidelines for polar ship construction and safety standards for passenger ships and other vessels operating in

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30. Alex DeMarban, "Alaska sprints to build up Arctic infrastructure as development looms," *Alaska Dispatch*, August 27, 2012, <http://www.alaskadispatch.com/article/alaska-sprints-build-arctic-infrastructure-development-looms>.

31. Arctic Council, *Arctic Marine Shipping Assessment 2009 Report*, 2009, [http://pame.is/images/stories/AMSA\\_2009\\_Report/AMSA\\_2009\\_Report\\_2nd\\_print.pdf](http://pame.is/images/stories/AMSA_2009_Report/AMSA_2009_Report_2nd_print.pdf).

32. Olin Strader, "Critical for the opening Arctic: A Bering Strait vessel traffic service," *Alaska Dispatch*, February 8, 2012, <http://www.alaskadispatch.com/article/critical-opening-arctic-bering-strait-vessel-traffic-service>.

33. Ibid.

34. U.S. Coast Guard, "Port Access Route Study: In the Bering Strait," November 8, 2010, <https://www.federalregister.gov/articles/2010/11/08/2010-28115/port-access-route-study-in-the-bering-strait#p-3>.

35. Capt. Jason Fosdick (USCG), "Bering Strait Port Access Route Study," presentation at the 2011 Alaska Coastal Management Program (ACMP) Statewide Conference, May 4, 2011, [http://www.alaskacoast.state.ak.us/conference/2011\\_acmp\\_conference/presentations/fosdick.pdf](http://www.alaskacoast.state.ak.us/conference/2011_acmp_conference/presentations/fosdick.pdf).

36. Kovalyova and de Carbonnel, "Arctic ice melt lifts hopes for Russian maritime trade."

ice-covered waters. These voluntary guidelines took over ten years to negotiate with the 170-country international body. There is currently an effort under way to develop a mandatory polar code that establishes comprehensive rules for the design, construction, and equipment of vessels, and provides strict procedures regarding operational, training, search and rescue, and environmental protection matters.<sup>37</sup> The goal is to create a harmonized international regulatory framework that protects the Arctic and Antarctic regions from the risks of increased shipping and also safeguards ships from the risks of navigating polar waters.

This effort is led by the IMO's Sub-Committee on Ship Design and Equipment, in coordination with national authorities from the International Organization for Standardization (ISO), such as the U.S. Maritime Administration.<sup>38</sup> Private-sector stakeholders, such as representatives of the shipping, fishing, and cruise industries, have also been active participants in the development of the Polar Code.

The code will establish different ice-cover classifications and corresponding vessel requirements. For example, only polar-class ships may operate in ice-covered waters with more than 10 percent ice, and ships will need to take ice-strengthening measures if operating in waters with less than 10 percent ice cover that are considered to pose a structural risk.<sup>39</sup>

With increased shipping in the Arctic, there is higher risk of pollutants, such as aquatic invasive species and pathogens, entering the pristine Arctic waters through ships' ballast water discharges. In 2004 the IMO adopted the Ballast Water Management Convention, which established ballast water management procedures and standards, to be adopted between 2009 and 2016.<sup>40</sup> There are specific concerns regarding ballast water in the icy Arctic waters, particularly the risk of freezing pipes, and numerous associated construction and management guidelines that ships must adhere to in order to prevent freezing of ballast water.<sup>41</sup> This represents a significant financial cost to ships operating in the Arctic region, in addition to those posed by the Arctic's lack of maritime infrastructure such as fuel depots or maintenance facilities.

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37. International Maritime Organization, "Development of an international code of safety for ships operating in polar waters (Polar Code)," <http://www.imo.org/mediacentre/hottopics/polar/Pages/default.aspx>.

38. U.S. Maritime Administration, "Maritime Administration Policy Paper: Shipbuilding and Repair," <http://www.marad.dot.gov/documents/Shipbuilding.pdf>.

39. Turid Stemre, "Background and status of the IMO initiative to develop a mandatory Polar Code," presentation at IMO Workshop, Cambridge, September 27–30, 2011, <http://www.imo.org/MediaCentre/HotTopics/polar/Documents/Polarkoden%20-Cambridge-clean%20session%201-1.pdf>.

40. International Maritime Organization, "International Convention for the Control and Management of Ships' Ballast Water and Sediments," [http://www.imo.org/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Control-and-Management-of-Ships%27-Ballast-Water-and-Sediments-\(BWM\).aspx](http://www.imo.org/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Control-and-Management-of-Ships%27-Ballast-Water-and-Sediments-(BWM).aspx).

41. Transport Canada, "Ballast Water Management in the Arctic," January 19, 2010, <http://www.tc.gc.ca/eng/marinesafety/debs-arctic-shipping-operations-ballast-241.htm>.

# 5 | Arctic Commercial Fisheries

Commercial fisheries have long been an economic driver in Alaska. More than 50 percent of all commercially captured U.S. seafood is harvested from Alaska. Alaska leads all states in both catch volume (5.4 billion pounds) and catch value (\$1.9 billion).<sup>1</sup> Alaska's fishing industry is also a critical employer for the state, accounting for over 50 percent of basic private-sector employment in coastal communities.<sup>2</sup>

The Arctic waters along the Alaskan coastline, including the Bering Strait, provide breeding grounds for several fish stocks. However, the sensitive marine ecosystem is undergoing significant changes due to warming ocean temperatures. According to the National Oceanic and Atmospheric Administration (NOAA), fishing stocks have been moving northward for the past forty years to increase their chances of survival.<sup>3</sup> As a reshifting of fish stocks takes place, some fish populations are nearly disappearing from U.S. waters. Simultaneously, increased commercial fishing opportunities are developing for commercially significant species such as Arctic cod, saffron cod, and snow crab. Due to the unprecedented decline in sea ice cover, 40 percent of the international Central Arctic Ocean waters were ice-free in 2012, removing physical barriers to commercial fishing.<sup>4</sup>

## Arctic Fishery Management Plan

Fearing depletion of fish stocks and adverse impacts on the fragile Arctic ecosystem, the North Pacific Fishery Management Council decided in 2009 to ban all commercial fishing in a 200,000-square-mile area extending from the Bering Strait to the disputed U.S.-Canadian maritime border, an area including the Chukchi and Beaufort seas.<sup>5</sup> While the Arctic Fishery Management Plan (Arctic FMP) prohibits commercial fishing for finfish and shellfish in federal waters, subsistence fishing by Arctic indigenous communities or

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1. "Alaska leads nation in seafood catch with 5.4 billion pounds last year," *Alaska Dispatch*, September 20, 2012, <http://www.alaskadispatch.com/article/alaska-leads-nation-seafood-catch-54-billion-pounds-last-year>.

2. Olin Strader, "Critical for the opening Arctic: A Bering Strait vessel traffic service," *Alaska Dispatch*, February 8, 2012, <http://www.alaskadispatch.com/article/critical-opening-arctic-bering-strait-vessel-traffic-service>.

3. "Ocean Warming Affecting Fish Populations," United Press International, November 3, 2009, [http://www.upi.com/Science\\_News/2009/11/03/Ocean-warming-affecting-fish-populations/UPI-17961257275663/](http://www.upi.com/Science_News/2009/11/03/Ocean-warming-affecting-fish-populations/UPI-17961257275663/).

4. Pew Environment Group, "New Maps of Melting Ice," September 2012, <http://oceansnorth.org/new-maps-melting-ice>.

5. North Pacific Fishery Management Council, "Arctic Fishery Management," <http://www.fakr.noaa.gov/npfmc/fishery-management-plans/arctic.html>.

fisheries in state waters near the northern coastline of Alaska is exempted.<sup>6</sup> Created under the authority of the U.S. Magnuson-Stevens Fishery Conservation and Management Act, the Arctic FMP seeks to keep unregulated, or inadequately regulated, commercial fisheries in the U.S. exclusive economic zone (EEZ) in the Arctic (200 nautical miles from Alaska's coast) from developing in the region. The FMP seeks to protect the area's sensitive ecosystem and marine resources as well as the subsistence way of life of Arctic communities.<sup>7</sup>

The North Pacific Fishery Management Council is tasked with managing the U.S. Arctic EEZ. Decisions made by the council are driven by ecosystem-based management policy to ensure the sustainability of fishery resources.<sup>8</sup> Enhanced with scientific data, consultations are carried out with the native populations to incorporate local and traditional knowledge in fishery management.<sup>9</sup> However, there is not yet enough information available to ensure sustainable management of commercial fisheries north of the Bering Strait, and further study is needed to understand the effects of salinity and temperature changes, the loss of sea ice, ocean acidification, and increased human activity in general.<sup>10</sup>

The Arctic FMP could be opened for future commercial fishery development, but only when sufficient information to ensure sustainability, economic viability, and benefits to local Arctic communities becomes available.<sup>11</sup> Until this occurs the Arctic FMP is being enforced through cooperation and coordination by the Alaska Board of Fisheries, the Alaska Department of Fish and Game, a division of Alaska Wildlife Troopers, the U.S. Coast Guard, National Marine Fisheries Service (NMFS) Office for Law Enforcement, the International Halibut Commission, and others.<sup>12</sup>

In 2010 the Alaska state legislature formed the Northern Waters Task Force (NWTF) to examine the status of Alaskan Arctic fisheries. The task force agreed with Alaska's precautionary policies toward Arctic fisheries, but stressed the need for further research and for continued engagement by Alaska on fisheries issues, including trans-boundary accords with other nations, and the need to develop forward-looking strategies for commercial fisheries infrastructure requirements and management in the region.<sup>13</sup> The task force also

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6. National Oceanic and Atmospheric Administration, "Secretary of Commerce Gary Locke Approves Fisheries Plan for Arctic," August 20, 2009, [http://www.noaanews.noaa.gov/stories2009/20090820\\_arctic.html](http://www.noaanews.noaa.gov/stories2009/20090820_arctic.html).

7. National Oceanic and Atmospheric Administration, "Arctic Fishery Management," <http://www.fakr.noaa.gov/npfmc/fishery-management-plans/arctic.html>.

8. Ibid.

9. National Oceanic and Atmospheric Administration, "Fishery Management Plan for Fish Resources of the Arctic Management Area," August 2009, <http://www.fakr.noaa.gov/npfmc/PDFdocuments/fmp/Arctic/ArcticFMP.pdf>.

10. Alaska State House of Representatives, "Findings and Recommendations of the Alaska Northern Waters Task Force," January 2012, 22–23, [http://housemajority.org/coms/anw/pdfs/27/NWTF\\_Full\\_Report\\_Color.pdf](http://housemajority.org/coms/anw/pdfs/27/NWTF_Full_Report_Color.pdf).

11. National Oceanic and Atmospheric Administration, "Arctic Fishery Management Plan," <http://www.fakr.noaa.gov/npfmc/PDFdocuments/fmp/Arctic/ARCTICflier209.pdf>.

12. National Oceanic and Atmospheric Administration, "Fishery Management Plan for Fish Resources of the Arctic Management Area," August 2009, <http://www.fakr.noaa.gov/npfmc/PDFdocuments/fmp/Arctic/ArcticFMP.pdf>.

13. Alaska State House of Representatives, "Findings and Recommendations of the Alaska Northern Waters Task Force," 22–23, January 2012, [http://housemajority.org/coms/anw/pdfs/27/NWTF\\_Full\\_Report\\_Color.pdf](http://housemajority.org/coms/anw/pdfs/27/NWTF_Full_Report_Color.pdf).

emphasized the need for engagement with the indigenous populations, including efforts to ensure a substantial degree of local ownership, participation, and stewardship by these individuals in the development of future commercial Arctic fisheries.<sup>14</sup>

## King Salmon Fishery Collapse

There has been a recent and disturbing trend impacting Alaskan fisheries, right on the doorstep of the Arctic Circle. King salmon have started to disappear from the state's rivers. Salmon is the most valuable commercial fishery managed by the state, worth \$512 million.<sup>15</sup> The number of king salmon caught in Alaskan rivers has declined over the past five years. In the Yukon-Kuskokwim delta, less than 20,000 king salmon were caught between January and September 2012, down from the previous average harvest of about 80,000.<sup>16</sup> While this rapid decline has hurt commerce and tourism in the region, the gravest implications involve the peoples of the region that depend on the fish for food and survival.

In August 2012 Governor Sean Parnell requested that a state of emergency be declared as a result of the decline of king salmon and the resulting impact on the state's fisheries industry in the Upper Cook Inlet. Parnell described Alaskan fisheries as essential "economic drivers for the local and regional economy, providing direct and indirect jobs, income to families, bringing in tens of thousands of visitors, and supporting local businesses."<sup>17</sup>

In response the acting U.S. secretary of commerce, Rebecca Blank, declared a commercial fishery failure on Alaska's Yukon and Kuskokwim rivers, as well as in the Upper Cook Inlet, in September 2012. This declaration allows Congress to appropriate relief funds to the subsistence and commercial fisheries, as well as coastal communities, impacted by the disaster. In making the declaration, Blank noted that "some Cook Inlet salmon fisheries have experienced revenue losses of up to 90 percent of their historical average during the 2012 season," adding that this has "seriously hurt" the local economy.<sup>18</sup>

Scientists are continuing to research the dramatic disappearance of the king salmon. While state and federal fisheries biologists have seen good numbers of king salmon spawning in the region, they are swimming out to sea and not returning as adults.<sup>19</sup> There are a number of theories as to why this is taking place, ranging from an increase in ocean

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14. Ibid.

15. Lynsea Garrison, "Alaska and the mysterious disappearing king salmon," BBC News, September 18, 2012, <http://www.bbc.co.uk/news/magazine-19349265>.

16. Ibid.

17. "Parnell requests federal fishery disaster declaration for Cook Inlet," *Alaska Dispatch*, August 16, 2012, <http://www.alaskadispatch.com/article/parnell-requests-federal-fishery-disaster-declaration-cook-inlet>.

18. National Marine Fisheries Service, "Secretary of Commerce declares disaster for Alaska King Salmon," September 13, 2012, [http://www.nmfs.noaa.gov/mediacenter/2012/09/13\\_secretary\\_of\\_commerce\\_declares\\_disaster\\_for\\_alaska\\_king\\_salmon.html](http://www.nmfs.noaa.gov/mediacenter/2012/09/13_secretary_of_commerce_declares_disaster_for_alaska_king_salmon.html).

19. Craig Medred, "Biologists look to ocean for clues in Alaska king salmon collapse," *Alaska Dispatch*, June 28, 2012, <http://www.alaskadispatch.com/article/biologists-look-ocean-clues-alaska-king-salmon-collapse>.



predators eating the salmon to excessive incidental or by-catch of the salmon by large fishing trawlers using large nets.<sup>20</sup> Others have suggested that rising acidity in the ocean water due to climate change is to blame.<sup>21</sup> Many scientists, including those at NOAA's Northwest Fisheries Science Center, have suggested that the change could be related to cyclical changes in ocean temperatures known as Pacific decadal oscillation.<sup>22</sup> While this means that the fish could conceivably return when the cycle changes back, there are serious questions as to when this might be and if similar problems will appear related to other types of valuable fish stocks.

While there are not yet any definitive answers regarding the science behind the disappearing king salmon, the impacts have been painfully real for the state of Alaska as well as the industries and peoples dependent on the fish. The case of the disappearing king salmon showcases how climate change can impact fisheries, local peoples, and the economy. It is estimated the situation has resulted in more than \$16 million in losses to state revenue in 2012.<sup>23</sup> While the future of the Alaskan king salmon is uncertain, this incident may be a harbinger for the challenges that Arctic fisheries could face moving forward.

## International Relations and Arctic Fisheries

On June 3, 2008, President George W. Bush signed Public Law 110-243, which requires that the United States enter into international discussions with other Arctic nations to agree on management of migratory, trans-boundary, and straddling fish stocks in the Arctic Ocean and establish new international fishery management organizations for the Arctic. The North Pacific Fishery Management Council and native Alaskan Arctic communities have acted as key voices in this process. In 2009 the U.S. State Department and the Institute of the North organized the International Arctic Fisheries Symposium in Anchorage, Alaska, which brought together more than 180 delegates from the eight Arctic states to discuss Arctic fisheries conservation and management.<sup>24</sup>

Arctic fisheries are often discussed at the annual International Polar Year (IPY) Conference; in 2012 topics included marine ecosystems and fisheries governance and sustainability.<sup>25</sup> On the first day of the IPY 2012 Conference, the Pew Environment Group released an open letter signed by two thousand scientists from sixty-seven countries calling for the development of an international fisheries agreement to protect the Central Arctic Ocean

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20. Ibid.

21. Garrison, "Alaska and the mysterious disappearing king salmon."

22. Medred, "Biologists look to ocean for clues in Alaska king salmon collapse."

23. Dan Joling, "Alaska increases estimate of salmon disaster," *Alaska Journal of Commerce*, November 15, 2012, <http://www.alaskajournal.com/Alaska-Journal-of-Commerce/November-Issue-3-2012/Alaska-increases-estimate-of-salmon-disaster/>.

24. International Arctic Fisheries Symposium, "Managing Resources for a Changing Arctic," 2009, <http://www.nprb.org/iafs2009/>.

25. International Polar Year 2012 Conference Montreal, "Theme," [http://132.246.11.198/2012-ipy/Abstracts\\_On\\_the\\_Web/by\\_theme.html](http://132.246.11.198/2012-ipy/Abstracts_On_the_Web/by_theme.html).

from unregulated commercial fishing.<sup>26</sup> The scientists proposed catch quotas to prevent overfishing and precautionary management.

Increased fishing opportunities in Arctic waters demand greater and improved capacity from national coast guards. This is particularly important in the areas of law enforcement and marine stewardship, as well as in search and rescue operations and icebreaking assistance to fishing vessels. Disputes among the Arctic states over fishing rights and quotas could also emerge as fishing activities intensify in the Arctic. According to the 2012 U.S. Coast Guard (USCG) posture statement, the USCG participated in 102 boardings of foreign vessels to suppress illegal, unregulated, and unreported fishing on the high seas and in the EEZs of partner unions in 2011.<sup>27</sup> While this number encompasses all USCG activity and is not isolated to the Arctic region, it could increase further as Arctic fishing grows.

The United States has already experienced some tension in its relations with Russia due to overfishing and boundary disputes in the Bering Sea, which is regularly patrolled by the U.S. Coast Guard.<sup>28</sup> Also, the commercial fishing ban imposed by the United States in the Beaufort Sea has caused diplomatic tension with Canada, as a 6,250-square-mile area of disputed border territory was included in the Arctic FMP area.<sup>29</sup> In April 2009 the Canadian government sent a diplomatic note to the United States “officially rejecting the purported exercise of jurisdiction by the United States or Alaska in the Beaufort Sea,” citing Canadian sovereignty in the area.<sup>30</sup>

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26. Pew Environment Group, “More than 2,000 Scientists Worldwide Urge Protection of Central Arctic Ocean Fisheries,” April 22, 2012, <http://www.pewenvironment.org/news-room/press-releases/more-than-2000-scientists-worldwide-urge-protection-of-central-arctic-ocean-fisheries-85899382122>.

27. U.S. Coast Guard, “U.S. Coast Guard 2012 Posture Statement,” February 2012, [http://www.uscg.mil/history/docs/USCG\\_2012\\_Posture\\_Statement.pdf](http://www.uscg.mil/history/docs/USCG_2012_Posture_Statement.pdf).

28. Vlad Kaczynski, “US-Russian Bering Sea Marine Border Dispute: Conflict over Strategic Assets, Fisheries and Energy Resources,” *Russian Analytical Digest* 20, no. 7 (May 2007), <http://www.css.ethz.ch/publications/pdfs/RAD-20.pdf>.

29. Randy Boswell, “Canada files protest over U.S. fishing ban in Arctic Ocean,” Canwest News Service, September 3, 2009, <http://www.globalnews.ca/canada+files+protest+over+us+fishing+ban+in+arctic+ocean/64478/story.html>.

30. Ibid.

# 6 Arctic Ecotourism

Arctic ecotourism is playing an increasingly important role in the economics of the Arctic region. The number of tourists traveling on large cruise ships throughout the Arctic region has significantly risen in recent years. According to the U.S. Coast Guard, 400 ships traversed the Bering Strait in 2011, compared to 245 ships in 2008, and it is expected that the increase in activity will continue.<sup>1</sup> There has also been an increase in tourism to Alaska's wilderness parks in the Arctic, as the number of visitors to the Noatak National Preserve and Kobuk Valley National Park have more than tripled from 2010 to 2011, matching the popularity of the Gates of the Arctic National Park and Preserve at over 11,000 visitors each.<sup>2</sup>

While these increases in Arctic tourism are economically beneficial to the state of Alaska, increasing cruise ship traffic along Arctic waterways poses challenges for maritime safety. The international community was reminded of its limited Arctic emergency response capabilities in August 2010 when the Canadian Coast Guard had to rescue over 120 stranded passengers and crew from a cruise ship that struck an unmapped rock in the waters of western Nunavut.<sup>3</sup>

## Arctic Cruise Ships

The Alaskan tourism industry generates \$2 billion annually in direct visitor spending and \$3.4 billion when including labor income.<sup>4</sup> Tourism is the state's third largest private-sector industry, with more than half of Alaska's annual visitors arriving on cruise ships.<sup>5</sup> While the majority of tourist activity takes place south of the Arctic Circle, cruise ships in the Arctic region are on the rise for the United States as well as the other Arctic coastal nations. The number of cruise ships traveling north of the 66th parallel over the past

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1. U.S. Coast Guard, "USCG D17 Arctic Brief," January 27, 2011, <http://www.uscg.mil/d17/Arctic%20Overview%20Feb2011.pdf>; Alex DeMarban, "Alaska sprints to build up Arctic infrastructure as development looms," *Alaska Dispatch*, August 27, 2012, <http://www.alaskadispatch.com/article/alaska-sprints-build-arctic-infrastructure-development-looms>.

2. National Park Service, "National Park Service Statistics," <http://www.nature.nps.gov/stats/state.cfm?st=ak>.

3. Tobi Cohen, "Canadian Rescue Capacity Questioned in Wake of Arctic Ship Grounding," *Postmedia News*, August 29, 2010, <http://www.canada.com/news/Canadian+rescue+capacity+questioned+wake+Arctic+ship+grounding/3457291/story.html>.

4. Resource Development Council for Alaska, "Alaska's Tourism Industry," <http://www.akrdc.org/issues/tourism/overview.html>.

5. U.S. Senate, "Begich to EPA: One Size Fits All Doesn't Fit Alaska," press release, December 14, 2012, <http://www.begich.senate.gov/public/index.cfm/pressreleases?ID=4bed64db-5e8f-40b6-9851-a3878eef76c2>.

eight years has more than doubled, a much faster rate than cruise ship activity in the Antarctic.<sup>6</sup>

Numerous cruise lines are now offering trips throughout the Arctic region. Cruise North Expeditions offers a variety of options, including the “Heart of the Arctic” and “Arctic Explorer,” aboard the ice-strengthened *Sea Adventurer* cruise ship. These trips promise sightings of polar bears, walrus, glaciers, and more, with prices ranging from \$3,895 for a small cabin to \$10,995 for a deluxe suite.<sup>7</sup> For the most ambitious Arctic tourists, Quark Expeditions offers a fourteen-day North Pole cruise onboard the nuclear-powered icebreaker *50 Years of Victory*. This includes an option to take a hot air balloon ride upon reaching the North Pole, with prices ranging between \$23,995 and \$34,995 per person.<sup>8</sup>

In spite of the growing economic interests in the Arctic cruise industry, fears remain about the dangers and potential costs of an accident. The journal *Arctic* has pointed out that reports of the rapidly melting polar ice cap may lead to a false sense of optimism about the ease of tourism in Arctic waters, which conversely will become more difficult to navigate as a result of the shifting ice charge.<sup>9</sup> Several experts, including Lawson Brigham of the University of Alaska Fairbanks, have warned that the Arctic remains ill-equipped to deal with a potential cruise ship disaster. If a large cruise line were to sink in frigid Arctic waters, Professor Lawson warns “there’s no infrastructure or very little . . . if a ship like that has that kind of problem, loss of life would be catastrophic.”<sup>10</sup> Professor Jackie Dawson of Ottawa University agrees that “it’s a matter of time before we see some sort of major disaster in the Arctic,” citing the lack of clear guidelines and formal policy structure for cruise ships in Canada.<sup>11</sup>

In fact, there have been several close calls already with Arctic cruise ships in recent years. Most notably, in 2010 the MV *Clipper Adventurer* ran aground in the Canadian Arctic in Coronation Gulf, Nunavut. The ship was fortunate to be 55 nautical miles east of Kugluktuk, Nunavut and on the last day of its fifteen-day Arctic expedition.<sup>12</sup> The accident also took place on a sunny day when the sea was quiet, with high visibility and low winds. These conditions gave a coast guard icebreaker sufficient time to travel to the site and conduct a successful rescue in which all the passengers and crew were brought to shore safely. Arctic expert Michael Byers of the University of British Columbia warned that things could have gone differently had the weather been bad, stating: “we dodged a bullet

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6. David Rosenfeld, “Cruising the Arctic,” Natural Resources News Service, July 23, 2012, <http://www.dcbureau.org/201207237493/natural-resources-news-service/cruising-the-arctic.html>.

7. Cruise North Expeditions, “Heart of the Arctic 2013,” 2012, <http://www.cruisenorthexpeditions.com/adventures/heart-of-the-arctic-2013/>.

8. Quark Expeditions, “Dates and Rates—For Your North Pole Expedition,” 2012, <http://www.quarkexpeditions.com/arctic-expeditions/your-north-pole-expedition/dates-rates>.

9. Alison Weisburger, “Cruise Tourism in the Arctic: Recipe for Disaster?” Arctic Institute, February 2, 2012, <http://www.thearcticinstitute.org/2012/02/5489-cruise-tourism-in-arctic-recipe.html>.

10. Rosenfeld, “Cruising the Arctic.”

11. Ibid.

12. Cohen, “Canadian Rescue Capacity Questioned in Wake of Arctic Ship Grounding.”

on this.”<sup>13</sup> Professor Byers added concerns about the need for improved navigation charts, ports of refuge, deep water harbors, search-and-rescue equipment, particularly Cormorant helicopters, and personnel in the region.<sup>14</sup>

In addition to safety concerns for passengers and crew members on Arctic cruise liners, there are also questions about potential damage to the environment. The Environmental Protection Agency (EPA) has been working to regulate air emissions for cruise ships under the North American emission control area (ECA). ECA requires that cruise ships burn more expensive, cleaner-burning fuel in geographic areas such as Alaska’s Inside Passage through the Gulf of Alaska and the major cruise ports of Whittier and Seward.<sup>15</sup> These requirements have met with resistance from Alaska’s tourism organizations as well as cruise-dependent coastal communities, who worry that increased fuel prices will hurt demand for cruises and tourism in the state. Senator Mark Begich (D-AK) has requested that a “hybrid approach” be used for his state, in which cleaner fuels are used when the ships are proximate to Alaskan communities, but standard fuels can be burned in remote areas. This approach seeks to balance costs and environmental concerns, but a final decision has not been reached. Heavy diesel fuels used by cruise ships, also known as bunker fuel, contribute to the pollution of the pristine Arctic environment when combusted, and the particulate matter, known as black carbon, accelerates the decline in sea ice by absorbing light and heat more quickly.<sup>16</sup> A worst case environmental scenario would be an oil spill as the result of an oil tanker leak or a cruise line wreck.

In light of growing concerns surrounding the potential for human and environmental disasters in the Arctic, the international community has undertaken several efforts to prepare for the region’s increased ship traffic. To facilitate international coordination in response to such incidents, the Arctic Council states adopted the Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic in May 2011.<sup>17</sup> This agreement was the first legally binding instrument negotiated by the eight members of the Arctic Council<sup>18</sup> designed to coordinate lifesaving international maritime and aeronautical search and rescue coverage and response across 13 million square miles of the Arctic.<sup>19</sup>

The United Nations International Maritime Organization (IMO) is also working to establish a Polar Code, which would set international safety and environmental standards for cruise ships and other vessels in the Arctic.<sup>20</sup> Such standards would include require-

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13. Ibid.

14. Ibid.

15. U.S. Senate, “Begich to EPA: One Size Fits All Doesn’t Fit Alaska.”

16. Rosenfeld, “Cruising the Arctic.”

17. U.S. Department of State, “Secretary Clinton Signs the Arctic Search and Rescue Agreement with Other Arctic Nations,” fact sheet, May 12, 2011, <http://www.state.gov/r/pa/prs/ps/2011/05/163285.htm>.

18. The eight member states of the Arctic Council are the United States, Canada, Norway, Russia, Denmark, Sweden, Finland, and Iceland.

19. Ibid.

20. U.S. Department of Transportation, “Maritime Administration Policy Paper: Shipbuilding and Repair,” <http://www.marad.dot.gov/documents/Shipbuilding.pdf>.

**Photo 6.1. Sow polar bear near Kaktovik, Barter Island, Alaska.**



Source: Photo by Alan Wilson, [http://commons.wikimedia.org/wiki/File:Polar\\_Bear\\_-\\_Alaska.jpg](http://commons.wikimedia.org/wiki/File:Polar_Bear_-_Alaska.jpg).

ments for ship design, construction, equipment, training, search and rescue, and environmental protection for ships operating in the Arctic.<sup>21</sup> Focus on developing a mandatory Polar Code has increased following the adoption of nonbinding guidelines for ships operating in polar waters (Resolution A.1024(26) in 2009 and Resolution A.999(25) on voyage planning for passenger ships operating in remote areas in 2007).<sup>22</sup>

There is some disagreement within the private cruise line industry regarding the scope of a mandatory Polar Code, or even the need for one at all. The code may require that the hulls of ships traveling to the Arctic be ice-strengthened to better withstand a collision with an iceberg. It might also require multiple vessels in the same vicinity as a safety measure, which would impede on unique itineraries for specific companies.<sup>23</sup> As Professor Brigham notes, the industry “may not want to spend a lot of extra money to retool their big ships to make them polar capable.”<sup>24</sup>

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21. International Maritime Organization, “Development of an international code of safety for ships operating in polar waters (Polar Code),” 2011, <http://www.imo.org/mediacentre/hottopics/polar/Pages/default.aspx>.

22. Ibid.

23. Rosenfeld, “Cruising the Arctic.”

24. Ibid.

There have also been voices of strong support for a Polar Code from industry. The aforementioned Quark Expeditions cruise line has advocated for the development of high standards for a Polar Code. The Cruise Lines International Association (CLIA) does not have a vote at the IMO assembly, but has been actively involved in developing the code. Sigur Gude, deputy director general of the Norwegian Maritime Authority, has described CLIA as “a very positive contributor to the code.”<sup>25</sup> While there have been debates on questions such as a cap on the number of guests allowed on cruise ships and other technical requirements that have prolonged the creation of the code, Gude believes that this dialogue will ultimately make the code stronger. The inclusion of private actors will ensure that the IMO is engaging organizations with the right competencies.<sup>26</sup>

As the assembly continues to iron out the details of the Polar Code, it seems unlikely that it will be ratified earlier than 2014. Professor Brigham predicts that, even at that point, environmental concerns will not yet be fully addressed by the agreement.<sup>27</sup> In the meantime, private industry officials such as Arctic Expedition Cruise Operators maintain that cruise ship travel in the Arctic is safe and environmentally conscious, stressing the move away from heavy diesel fuel by the group’s twenty-three members.<sup>28</sup> While progress has been made, establishing clear rules through a mandatory Polar Code is the best way forward to ensure that both environmental and safety concerns are addressed as the lucrative Arctic tourism industry continues to grow.

## Arctic Alaska National Parks

As Arctic tourism increases via the cruise industry, there has also been increased interest in Arctic national parks. For the state of Alaska, many of its most iconic landscapes lie above the Arctic Circle, including the North Slope coastal plain and the rugged mountains of the Brooks Range. The region is also home to a vast array of wildlife, including caribou, moose, seal, brown and black bear, Dall sheep, wolf, and wolverine. This combination of scenic beauty and wildlife draws tourists interested in a range of activities, including fishing, boating, hunting, camping, wildlife observation, photography, and hiking.<sup>29</sup> Wilderness parks such as the Arctic National Wildlife Refuge, Gates of the Arctic National Park and Preserve, Kobuk Valley National Park, and Noatak National Preserve are the most popular destinations.<sup>30</sup>

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25. Det Norske Veritas (DNV), “Polar Code: Defining the Rules of Arctic Shipping,” March 20, 2012, [http://www.dnv.com/industry/maritime/publicationsanddownloads/publications/updates/cruise/2012/01\\_2012/Polarcode.asp](http://www.dnv.com/industry/maritime/publicationsanddownloads/publications/updates/cruise/2012/01_2012/Polarcode.asp).

26. Ibid.

27. Rosenfeld, “Cruising the Arctic.”

28. Ibid.

29. U.S. Fish and Wildlife Service, “Public Use Summary: Arctic National Wildlife Refuge,” April 2010, <http://arctic.fws.gov/pdf/pureportap2010.pdf>.

30. Alaska Wilderness Recreation & Tourism Association, “Northern Alaska,” [http://www.visitwildalaska.com/Northern\\_Alaska](http://www.visitwildalaska.com/Northern_Alaska).

While in some cases visitation to these parks has been steady over the last several decades, there have been marked increases in others. For example, Kobuk Valley National Park had 11,485 recreational visitors in 2011, up from 3,164 in 2010 and just 847 in 2007.<sup>31</sup> Similarly, Noatak National Preserve saw visitors increase from 1,384 in 2007 to 11,722 in 2011.<sup>32</sup> The U.S. Fish and Wildlife Service reports that there has been a steady increase in permits for commercially supported visitation typically required of air operators and hunting or recreation guides.<sup>33</sup> As human activity increases throughout the Arctic region and increased media attention spotlights Alaska, there is reason to believe that these numbers, and subsequent revenue to the state's booming tourist industry, will continue to rise.

If the decision by three sailors to navigate the Northwest Passage by themselves in their small sailboat, the *Belzebub II*, in the summer of 2012 is any indication, Arctic actors must prepare for an increase in adventure tourism and be prepared to deal with the potential costs of increased rescue operations. While the *Belzebub II*'s operation was successful, should another attempt be less fortunate, the cost of a search and rescue operation would be high. For example, a U.S. Coast Guard (USCG) helicopter costs roughly \$4,400 an hour to operate, cutters cost about \$1,550 an hour, and smaller USCG search boats can cost between \$300 and \$400 an hour to run. Both U.S. Park Services and the USCG will have to prepare for additional search and rescue costs as Arctic expeditions, similar to the journey of the *Belzebub II*, increase in number.

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31. National Park Service, "National Park Service Statistics," <http://www.nature.nps.gov/stats/state.cfm?st=ak>.

32. Ibid.

33. U.S. Fish and Wildlife Service, "Public Use Summary: Arctic National Wildlife Refuge," April 2010, <http://arctic.fws.gov/pdf/pureportap2010.pdf>.



# 7 | Arctic Infrastructure Investment

Should the United States choose to fully maximize the economic benefits of the American Arctic, the United States will need to make significant and long-term investments in its Arctic infrastructure to develop the region’s potential as well as to cope with challenges of working in extreme climatic conditions and an increasingly fragile ecosystem. The range of infrastructure includes new ports, including deep water ports, and icebreaking capabilities and support vessels, improved satellites, aviation assets, as well as maintenance of airstrips, roads and pipelines.

The cost of such infrastructure development exceeds state and national infrastructure budgets. Clearly, the private sector will play a prominent role in Arctic infrastructure development, particularly in the form of innovative public-private partnerships between state or federal governments and private corporations seeking to tap into the Arctic’s natural resource wealth.

## Brother, Can You Spare an Icebreaker?

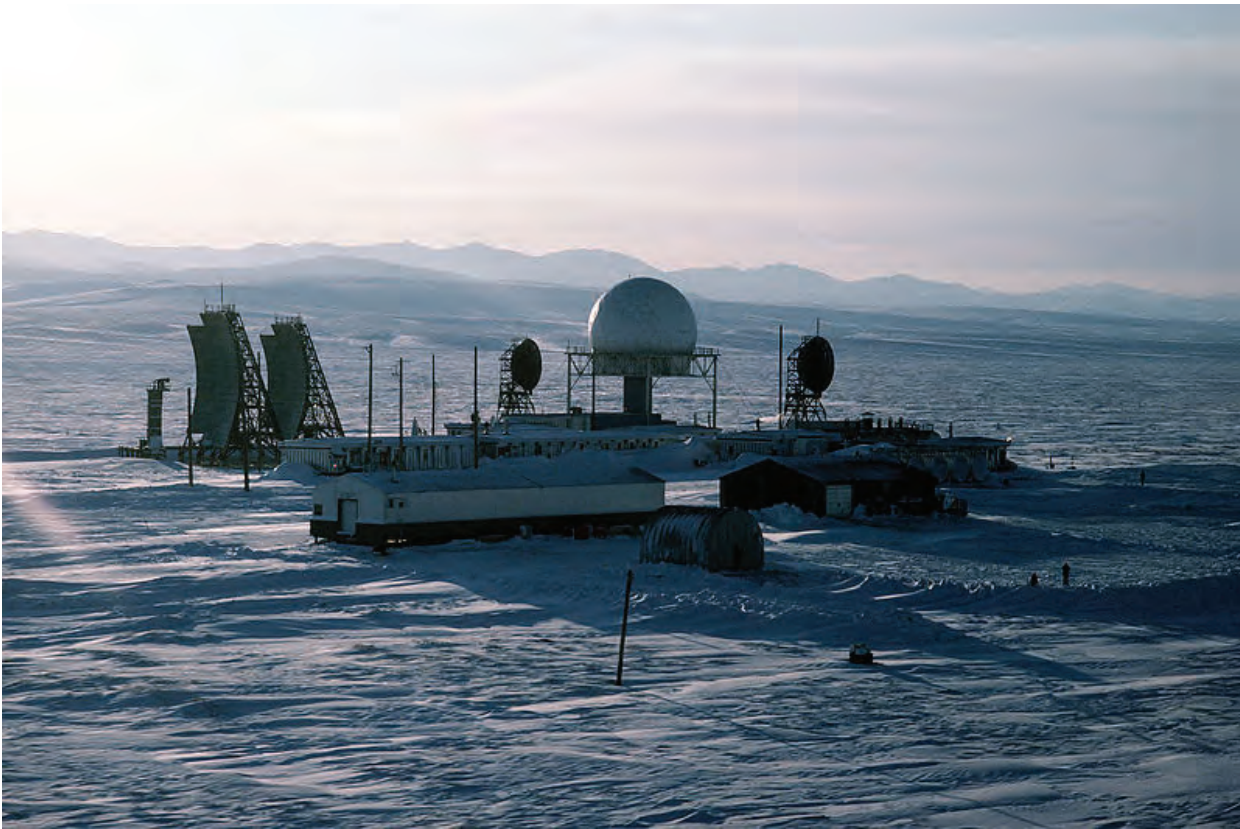
The U.S. Coast Guard (USCG) faces challenges in fulfilling its Arctic mission due to insufficient infrastructure and capabilities, specifically the scarcity of icebreakers and ice-hardened vessels. Currently, the USCG has only one fully operational medium polar icebreaker, the USCGC *Healy*, which was originally designed as a research vessel and has been retrofitted to function as a multiple-purpose vessel. The *Polar Star*, the USCG’s only heavy polar icebreaker, is thirty years old. The ship had been in caretaker status since 2006, and was returned to service on June 17, 2013. It is projected to remain in service for another seven to ten years.<sup>1</sup> The United States’ other icebreaker, the *Polar Sea*, has been in the process of decommissioning, but congressional action has suspended the process temporarily.<sup>2</sup> When the U.S. government requires additional icebreaker capability, it seeks to lease icebreakers from foreign governments. For example, the Swedish icebreaker *Oden* had been used to resupply the U.S. McMurdo Research Station in Antarctica, but Sweden recalled the vessel as

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1. Statement by Lieutenant Commander Mike Krause, Mobility and Ice Operations, U.S. Coast Guard, on “State and Outlook of U.S. Icebreaker Fleet,” at the Fourth Symposium on the Impacts of an Ice-Diminishing Arctic on Naval and Maritime Operations, June 20–22, 2011, <http://www.star.nesdis.noaa.gov/star/documents/meetings/Ice2011/dayTwo/Krause.pdf>.

2. U.S. Senate, “Cantwell, Begich, Murkowski Announce Plan to Halt Scrapping of Key Icebreaker,” June 15, 2012, <http://www.cantwell.senate.gov/public/index.cfm/press-releases?ID=67e99265-88ca-4141-928a-d1e8d9a66dba>.

**Photo 7.1. An aerial view of the radar station LIZ-2 located at Point Lay, Alaska, one of thirty stations under U.S. Air Force control on the distant early warning (DEW) line, which runs approximately 3,600 miles, from Alaska across Northern Canada to Greenland.**



Source: [http://upload.wikimedia.org/wikipedia/commons/c/c7/Point\\_Lay\\_Alaska\\_DEW\\_Line.jpg](http://upload.wikimedia.org/wikipedia/commons/c/c7/Point_Lay_Alaska_DEW_Line.jpg).

it was need to provide icebreaking services in the Baltic Sea.<sup>3</sup> Russian commercial icebreakers have also been leased, as was the case in December 2011 to supply fuel to Nome, Alaska.<sup>4</sup>

The United States' limited icebreaking capabilities stand in stark contrast with the icebreaker fleets of other Arctic states: Russia has a fleet of over twenty icebreakers<sup>5</sup> and plans to build three new icebreakers by 2020;<sup>6</sup> Canada, Finland, and Sweden each have at

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3. "Change in Sweden's icebreaker plans causes controversy," *Alaska Dispatch*, September 18, 2011, <http://www.alaskadispatch.com/article/change-swedens-icebreaker-plans-causes-controversy>.

4. Alex DeMarban, "Russian icebreaker to deliver fuel to Nome, highlighting shortage of U.S. icebreakers," *Alaska Dispatch*, December 5, 2011, <http://www.alaskadispatch.com/article/russian-icebreaker-deliver-fuel-nome-highlighting-shortage-us-icebreakers>.

5. Ronald O'Rourke, "Coast Guard Polar Icebreaker Modernization: Background and Issues for Congress," Congressional Research Service, June 14, 2012, <http://www.fas.org/sgp/crs/weapons/RL34391.pdf>.

6. "Russia to build world's largest nuclear icebreaker of new generation," *Pravda*, August 24, 2012, [http://english.pravda.ru/news/science/24-08-2012/121976-russia\\_new\\_icebreaker-0/](http://english.pravda.ru/news/science/24-08-2012/121976-russia_new_icebreaker-0/).

least six icebreakers;<sup>7</sup> and Denmark relies on three icebreaking vessels.<sup>8</sup> Even non-Arctic states have icebreaking capabilities: China has one large light icebreaker and is planning to construct its second vessel for 2014; Japan has one light-medium icebreaker; and South Korea has one ice-strengthened research vessel.

According to Rear Admiral Christopher C. Colvin, the USCG requires additional icebreakers or ice-hardened vessels with embarked helicopters to accomplish its objectives to project a sovereign U.S. maritime presence in the Arctic. Additional icebreakers are required to carry out USCG duties to protect maritime commerce, critical infrastructure, and key resources in the Arctic region.<sup>9</sup> The U.S. Coast Guard has requested \$8 million in the fiscal year (FY) 2013 budget to initiate design activities for a new polar icebreaker, and it plans to ask for another \$852 million over the next five years to incrementally fund its acquisition, with more funding (up to \$1 billion) required to complete the order.<sup>10</sup> Congress must decide whether the acquisition costs should be incrementally funded, as the Coast Guard proposes, or if the funds should be fully allocated in one fiscal year, as typically required by the Office of Management and Budget. Congress might also consider whether the funding should be allocated in the Coast Guard's budget (part of the Department of Homeland Security), or if it should be partly funded through the Department of Defense and/or the National Science Foundation's budgets, in accordance with the USCG commandant's assessment that "an icebreaker ought to be a shared cost across the government."<sup>11</sup> According to the commandant, Admiral Robert Papp, the Coast Guard's goal is to have a fleet of three heavy-duty and three medium-duty icebreakers to fulfill its mission in the Arctic and Antarctic regions; this requires an investment estimated at \$3.2 billion.<sup>12</sup>

In addition to the icebreaker fleet, the U.S. Coast Guard also has other vessels capable of operating in the frigid Arctic waters. The USCG has three cutters stationed at the base support unit in Kodiak, Alaska: a high endurance cutter, a medium endurance cutter, and a seagoing buoy tender. It also has two ice-strengthened research vessels, but these are used in Antarctica.

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7. Canadian Coast Guard, "Icebreaking Program," [http://www.ccg-gcc.gc.ca/eng/CCG/Ice\\_Fleet](http://www.ccg-gcc.gc.ca/eng/CCG/Ice_Fleet); "Finland to modernize icebreaker fleet," *Alaska Dispatch*, July 27, 2011, <http://www.alaskadispatch.com/article/finland-modernize-icebreaker-fleet>; "Icebreakers do battle with Swedish waters," *The Local*, January 4, 2010, <http://www.thelocal.se/24200/20100104/>.

8. "Danish Icebreakers," Virtual Globetrotting, <http://virtualglobetrotting.com/map/danish-icebreakers/>.

9. U.S. Coast Guard, "USCG D17 Arctic Brief," January 27, 2011, <http://www.uscg.mil/d17/Arctic%20Overview%20Feb2011.pdf>.

10. O'Rourke, "Coast Guard Polar Icebreaker Modernization,"

11. Hearings before the Subcommittee on Homeland Security, Committee on Appropriations, House of Representatives, Statement by U.S. Coast Guard Commandant Admiral Robert Papp Jr., March 1, 2012, <http://www.gpo.gov/fdsys/pkg/CHRG-112hrg74438/html/CHRG-112hrg74438.htm>.

12. Carol Wolf and Kasia Klimasinska, "As the Arctic Opens for Oil, the Coast Guard Scrambles," *Bloomberg Businessweek*, July 26, 2012, <http://www.businessweek.com/articles/2012-07-26/as-the-arctic-opens-for-oil-the-coast-guard-scrambles>.

# Alaska Deep Draft Arctic Port

There are six deep draft ports across Alaska (Anchorage, Seward, Valdez, Kodiak, Unalaska, and Homer), but none along Alaska's Arctic coastline. Due to increased Arctic traffic and activity in recent years, an Arctic port is necessary to maintain sovereignty, facilitate search and rescue operations, and support economic activities such as improved access to inland and offshore natural resources. This major infrastructure asset would support and greatly facilitate the operations and activities of several U.S. institutional actors, including the Coast Guard, the Navy, the National Oceanic and Atmospheric Administration (NOAA), and the National Science Foundation (NSF).

The Alaska Department of Transportation and Public Facilities (DOT&PF) is sponsoring, in collaboration with the Army Corps of Engineers, a three-year study for a deep draft arctic port in Alaska. The planning team is working to identify and evaluate possible port locations, establish selection criteria, and evaluate the potential for public-private partnerships.<sup>13</sup> Some of the proposed locations include St. Paul Island (existing harbor), St. Lawrence Island (no existing seaport), Nome (existing medium-draft port), Kotzebue (existing shallow-draft port complex), Barrow (no harbor), and Prudhoe Bay (existing causeway and dock system), among others.<sup>14</sup> More detailed site investigations are expected in 2013 and 2014.

A report evaluating public-private partnership opportunities outlined four possible models: (1) public assets leased to a private operator for construction and management; (2) concessions whereby the assets are built and operated by the private sector, and then transferred back to the public authority at the end of the concession; (3) joint ventures with the port owning a large share in and regulating the terminal operating company; and (4) a public port authority investing in a private port.<sup>15</sup> The report identified potential private partner candidates, including mining firms, corporations from the port and shipping industry, financial firms, private pension funds, and sovereign funds.<sup>16</sup> It also recommended that the Alaska DOT&PF take the lead in engineering and permitting, that the Alaska Industrial Development and Export Authority (AIDEA) act as the investment arm, and that a regional port authority be developed to take ownership and responsibility for port development and management.<sup>17</sup>

In August 2012 Senator Mark Begich (D-AK), announced plans to introduce legislation to create "an independent, semi-private U.S. Arctic Deep Water Port Authority" to facilitate

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13. Alaska Department of Transportation and Public Facilities, "Arctic Port Study," March 2013, <http://www.dot.state.ak.us/stwddes/desports/arctic.shtml>.

14. Alaska State Legislature, "Alaska Northern Waters Task Force Findings and Recommendations," January 20, 2012, [http://housemajority.org/joule/pdfs/27/hjr0034\\_anwtf\\_recommendations.pdf](http://housemajority.org/joule/pdfs/27/hjr0034_anwtf_recommendations.pdf).

15. Alaska Department of Transportation and Public Facilities, "Alaska Deep Draft Arctic Ports Study Public-Private Partnership Evaluation," 10, [http://www.dot.state.ak.us/stwddes/desports/assets/pdf/aps\\_p3\\_draft.pdf](http://www.dot.state.ak.us/stwddes/desports/assets/pdf/aps_p3_draft.pdf).

16. *Ibid.*, 13–14.

17. *Ibid.*, 14–15.

planning, financing, construction, and maintenance of the port.<sup>18</sup> In December 2009 Senator Lisa Murkowski (R-AK) introduced a bill that would require the U.S. government to conduct a study of the feasibility of a deep water port in the Arctic, known as the Arctic Deep Water Sea Port Act of 2009, but failed to gain Congressional support for the proposed legislation.<sup>19</sup>

## Arctic Aviation Infrastructure

The U.S. Coast Guard plans to modernize its infrastructure in Alaska and has allocated \$6.1 million in its FY 2013 budget request to recapitalize and/or expand helicopter hangars and aviation refueling facilities in Kodiak.<sup>20</sup> At present the Coast Guard operates an air station at its base support unit in Kodiak, Alaska.

In July 2012 the USCG opened a temporary forward operating location (FOL) in Barrow, Alaska, to establish an Arctic presence for its Arctic Shield operations in the Chukchi and Beaufort seas in response to Shell Oil's exploratory drilling. To house two MH-60 Jayhawk helicopters, the Coast Guard rents a small hangar at the Wiley Post–Will Rogers Memorial Airport, a facility that sunk several feet into the melting permafrost.<sup>21</sup> The Coast Guard will eventually need to expand its base facilities and operations in Barrow if it wants to have the capacity for fast and effective oil spill response and search and rescue operations in Arctic waters.

The future of the Eielson Air Force Base near Fairbanks, Alaska, is also very much in question. In December 2012 the Senate passed an amendment proposed by Senator Murkowski to delay by a year (to mid-2014) a cost-cutting proposal to relocate the F-16 squadron from Eielson to Joint Base Elmendorf-Richardson in Anchorage.<sup>22</sup> Eielson provides closer proximity to the Arctic region and has a superior length runway, more favorable for missions in the Pacific region.

The Joint Base Elmendorf-Richardson in Anchorage, Alaska, hosts the headquarters for the U.S. Alaskan Command (ALCOM), U.S. Northern Command's Joint Task Force–Alaska

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18. Ellen Lockyer, "Sen. Begich To Introduce Legislation Creating Arctic Port Authority," *Alaska Public News*, August 28, 2012, <http://www.alaskapublic.org/2012/08/28/sen-begich-to-introduce-legislation-creating-arctic-port-authority/>.

19. Paula Lowther, "Arctic Deep Water Port," *Alaska Business Monthly*, January 2012, <http://www.akbizmag.com/Alaska-Business-Monthly/January-2012/Arctic-Deep-Water-Port/>.

20. U.S. Department of Homeland Security, "Written testimony of U.S. Coast Guard Commandant Admiral Robert Papp Jr. for a House Committee on Appropriations, Subcommittee on Homeland Security hearing addressing the President's Fiscal Year 2013 budget request for the U.S. Coast Guard," March 7, 2012, <http://www.dhs.gov/news/2012/03/07/written-testimony-us-coast-guard-commandant-papp-house-appropriations-subcommittee>.

21. Kirk Johnson, "For Coast Guard Patrol North of Alaska, Much to Learn in a Remote New Place," *New York Times*, July 22, 2012, <http://www.nytimes.com/2012/07/22/us/coast-guard-strengthens-presence-north-of-alaska.html>.

22. Sam Friedman, "U.S. Senate passes amendment to delay plan to move Eielson F-16s," *Fairbanks Daily News-Miner*, December 1, 2012, [http://newsminer.com/view/full\\_story/20992757/article-U-S-Senate-passes-amendment-to-delay-plan-to-move-Eielson-F-16s?instance=home\\_lead\\_story](http://newsminer.com/view/full_story/20992757/article-U-S-Senate-passes-amendment-to-delay-plan-to-move-Eielson-F-16s?instance=home_lead_story).

**Photo 7.2. An air station Kodiak MH-65 Dolphin helicopter takes off from the flight deck of the U.S. Coast Guard Cutter *Healy* 67 miles south of Nome, Alaska, January 11, 2012. The helicopter crew is forward deployed aboard the cutter as an ice reconnaissance and search and rescue asset.**



Source: U.S. Coast Guard photo by Seaman Mathew Rupp. [http://commons.wikimedia.org/wiki/File:An\\_MH-65\\_Dolphin\\_helicopter\\_crew\\_takes\\_off\\_from\\_the\\_flight\\_deck\\_of\\_the\\_USCGC\\_Healy\\_\(WAGB-20\)\\_67\\_miles\\_south\\_of\\_Nome,\\_Alaska,\\_Jan\\_120111-G-ZZ999-006.jpg](http://commons.wikimedia.org/wiki/File:An_MH-65_Dolphin_helicopter_crew_takes_off_from_the_flight_deck_of_the_USCGC_Healy_(WAGB-20)_67_miles_south_of_Nome,_Alaska,_Jan_120111-G-ZZ999-006.jpg). This image is a work of a U.S. military or Department of Defense employee, taken or made as part of that person's official duties. As a work of the U.S. federal government, the image is in the public domain.

(JTF-AK), and the Alaskan North American Aerospace Defense Command (NORAD) region. The U.S. Air Force also operates the Thule Air Base in Greenland.

There are only three commercial airports in the Alaskan Arctic: Barrow, Point Hope, and Nome, although there are numerous local paved runways for passenger and freight transport. Bunker facilities are at a premium. Many of the airstrips in northwest Alaska that were built on permafrost will need to undergo major repairs or relocation as significant thawing occurs.<sup>23</sup>

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23. U.S. Arctic Research Commission, "Climate Change, Permafrost, and Impacts on Civil Infrastructure," December 2003, 29, <http://www.arctic.gov/publications/permafrost.pdf>.

# Arctic Road Infrastructure

Alaska's Governor Sean Parnell launched an initiative called Roads to Resources to unlock state funding for constructing more transportation infrastructure to provide reliable access to natural resources deposits and to transport fuel and supplies at reduced costs. He proposed \$28.5 million in total funding for this initiative in the FY 2013 budget, including \$10 million for the Foothills West transportation access project and \$4 million for the Ambler mining district access project.<sup>24</sup>

The Foothills West project is a 100-mile all-season road to provide access from the Dalton Highway to Umiat, along the northwestern foothills of the Brooks Range.<sup>25</sup> The road corridor would facilitate a more economically feasible exploration and development of the Gubik oil and gas fields, which are estimated to contain 200 to 300 million barrels of oil.<sup>26</sup> In addition to providing access for exploitation of oil and gas resources, the road would also facilitate land access to the former U.S. Air Force and Navy base in Umiat, which is now used as a refueling station for aircraft and a summer research center for scientists from the Bureau of Land Management (BLM), the U.S. Geological Survey (USGS), and the Alaska Department of Fish and Game.<sup>27</sup> The project previously received \$25 million in funding, and the proposed additional funds would go toward continuing environmental assessment work.<sup>28</sup> The full cost of the project is estimated to range anywhere between \$400 and \$600 million, raising significant questions about whether the investment is justified.<sup>29</sup> The project also prompted significant opposition from North Slope communities and environmental groups, which claim that the road would cross caribou migration routes and affect indigenous subsistence hunting.<sup>30</sup>

Funding is also under way to initiate the environmental impact assessment study for the Ambler mining district access project, which will construct a road or rail corridor connecting the Ambler mining belt to either a port located on the west coast or to the existing surface transportation system in the Alaskan interior.<sup>31</sup> The Alaska Department of Transportation has spent over \$5 million since 2010 to study the effects of a road or rail transportation corridor into the region.<sup>32</sup> The resulting Western Alaska Access Planning

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24. Alaska Department of Transportation and Public Facilities, "Roads to Resources," <http://dot.alaska.gov/roadstoresources/projects.shtml>.

25. Alaska Department of Transportation and Public Facilities, "Foothills West Transportation Access: The Road to Umiat," [http://www.dot.state.ak.us/stwdplng/cip/stip/projects/Assets/Foothills\\_COC.pdf](http://www.dot.state.ak.us/stwdplng/cip/stip/projects/Assets/Foothills_COC.pdf).

26. Foothills West Transportation Access EIS [environmental impact statement], "Project Overview," <http://www.foothillswesteis.com/project-overview>.

27. Umiat, "Umiat Camp and Airfield, Alaska," <http://umiat.com/>.

28. Alaska Department of Transportation and Public Facilities, "Roads to Resources," <http://dot.alaska.gov/roadstoresources/projects.shtml>.

29. Northern Alaska Environmental Center, "Road to Umiat EIS: Public Comment Period Extends to July 26," <http://northern.org/take-action/public-hearings-on-road-to-umiat-eis-first-is-fairbanks-june-8>.

30. Alex DeMarban, "Sierra Club: Alaska's Umiat road among worst US transportation ideas," *Alaska Dispatch*, December 12, 2012, <http://www.alaskadispatch.com/article/sierra-club-alaskas-umiat-road-among-worst-us-transportation-ideas>.

31. Alaska Department of Transportation and Public Facilities, "Ambler Mining District Access," September 2011, [http://www.dot.state.ak.us/stwdplng/cip/stip/projects/Assets/Ambler\\_COC.pdf](http://www.dot.state.ak.us/stwdplng/cip/stip/projects/Assets/Ambler_COC.pdf).

32. Northern Alaska Environmental Center, "Ambler Mining District," <http://northern.org/programs/clean-water-mines/hardrock-mines-in-interior-and-arctic-alaska/arctic-ambler-project/arctic-ambler-project>.

Study estimated the cost of the 500-mile corridor from the Seward Peninsula to the Fairbanks area at between \$2.3 and \$2.7 billion.<sup>33</sup> This is yet another Road to Resources project that has been met with heavy opposition. Environmental advocates formed the Brooks Range Council to stop state subsidies that facilitate industrialization of the Ambler region, which could “have adverse impacts to water resources, wildlife habitat, and subsistence resources.”<sup>34</sup> The council warned about the high risk of acid mine drainage from exploitation of the volcanogenic massive sulfide (VMS) deposits in Ambler, which could contaminate the Kobuk River.<sup>35</sup>

Alaska’s existing road transportation infrastructure is also vulnerable to thawing permafrost. The U.S. Arctic Research Commission (ARC) estimates that over 450 miles of highway in the state are located on continuous permafrost extent, thus making them susceptible to structural instability as the permafrost melts. As a result, these roads will require relocation or rehabilitation as their foundations weaken.<sup>36</sup> These include a large portion of Dalton Highway (Alaska Route 11) from Prospect Creek to Prudhoe Bay. Urban road infrastructure in cities and towns along the northern and western Arctic coastline are also at risk.

## Trans-Alaska Pipeline System

At full capacity, the trans-Alaska pipeline system (TAPS) can carry 2.1 million barrels of oil per day. Because of declining oil production in the North Slope, however, TAPS has been running at less than one third capacity: only 560,320 barrels per day have been shipped on average in 2012.<sup>37</sup> If supplies continue to decrease, TAPS is under threat of shutdown: the lower limit at which TAPS can operate is 200,000 to 300,000 barrels daily.<sup>38</sup>

The ability to maintain sufficient oil flowing through TAPS hinges on the potential for oil from Shell’s future offshore operations in the Beaufort and Chukchi seas. However, a pipeline will have to be constructed to connect these possible future resources to TAPS for transportation to the mainland. Such a pipeline would most likely have to take a more indirect route across the National Petroleum Reserve–Alaska (NPR-A) due to restrictions to protect wilderness proposed by the Department of the Interior (DOI). Senator Murkowski has criticized the DOI management plan for the NPR-A over the additional

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33. Andover Mining, “North Western Alaska Corridor,” <http://www.andovermining.com/portfolio/sun-alaska>.

34. Northern Alaska Environmental Center, “Ambler Mining District,” <http://northern.org/programs/clean-water-mines/hardrock-mines-in-interior-and-arctic-alaska/arctic-ambler-project/arctic-ambler-project>.

35. Brooks Range Council, “Acid Mine Drainage in the Ambler Mining District,” [http://www.brooksrange.org/ARD\\_Ambler.pdf](http://www.brooksrange.org/ARD_Ambler.pdf).

36. U.S. Arctic Research Commission, “Climate Change, Permafrost, and Impacts on Civil Infrastructure,” December 2003, 29, <http://www.arctic.gov/publications/permafrost.pdf>.

37. Juliet Eilperin, “Alaska pursuing unconventional shale oil development to fill its pipeline,” *Washington Post*, August 26, 2012, [http://www.washingtonpost.com/national/health-science/alaska-seeks-unconventional-shale-oil-development-to-fill-its-pipeline/2012/08/26/5ea879c6-ed51-11e1-b09d-07d971dee30a\\_story.html](http://www.washingtonpost.com/national/health-science/alaska-seeks-unconventional-shale-oil-development-to-fill-its-pipeline/2012/08/26/5ea879c6-ed51-11e1-b09d-07d971dee30a_story.html).

38. U.S. Department of Energy, “Trans-Alaska Pipeline System,” <http://www.netl.doe.gov/technologies/oil-gas/aeo/fossilenergy/TransAlaskaPipeline.html>.



costs and possible regulatory impediments these environmental restrictions would bring.<sup>39</sup>

The trans-Alaska pipeline system also crosses permafrost-covered terrain and is threatened by thawing permafrost. Nearly half of the 800 miles of pipeline are elevated on vertical support members (VSMs) in permafrost areas, while the rest of the pipeline is buried underground.<sup>40</sup> The U.S. Arctic Research Commission estimates that 336 miles of pipeline are susceptible to deterioration due to melting permafrost conditions.

Another threat to the aging Alaskan pipeline infrastructure is corrosion. In 2006, BP-owned pipelines in the North Slope were weakened by corrosion and leaked more than five thousand barrels of oil. Production in the Prudhoe Bay oil field had to be temporarily shut down and the pipeline decommissioned and later replaced, resulting in the loss of hundreds of millions of dollars. With generous funding from BP, the University of Alaska–Anchorage opened a new asset integrity and corrosion laboratory to train engineers to diagnose and manage corrosion-affected pipelines and to promote technological innovation in corrosion prevention and management.<sup>41</sup>

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39. Dan Joling, “Alaska delegation critical of proposed NPR-A restrictions,” *Anchorage Daily News*, August 20, 2012, <http://www.adn.com/2012/08/20/v-printer/2594371/alaska-delegation-critical-of.html>.

40. U.S. Arctic Research Commission, “Climate Change, Permafrost, and Impacts on Civil Infrastructure,” December 2003, 33, <http://www.arctic.gov/publications/permafrost.pdf>.

41. Jill Burke, “Warding off corrosion on Alaska’s aging pipelines a new growth industry,” *Alaska Dispatch*, December 4, 2012, <http://www.alaskadispatch.com/article/warding-corrosion-alaskas-aging-pipelines-new-growth-industry>.

# 8 | Conclusions

Is it possible for the United States to craft a balanced Arctic economic strategy that enjoys the benefits of Arctic economic development while minimizing the “costs of cold”? Weighing the costs and benefits of any issue of importance is both an objective and a subjective exercise; the same holds true for developing a national Arctic strategy. However, by using a metaphorical scale to weigh the costs and benefits—one scale weighted for the economic bonanza that the region could be; and the other scale, the costs of achieving those economic gains—we can perhaps understand where the Arctic scales rest today and where they may tip in the future.

The economic benefits are fairly simple to assess and quantify although Arctic economics are highly susceptible to the fluctuation of global energy and commodity prices. Costs are measured primarily through the infrastructure and capabilities required to support increased economic development. Exact measurements regarding the costs to an increasingly fragile environment and the impact on indigenous populations are much more difficult to determine.

Achieving some degree of balance between these scales—defining a strategy influenced by scientific research to responsibly increase economic development while protecting and preserving an increasingly precarious ecosystem—is the preferred policy course of action *if* it can be achieved. Arctic states are attempting to perform this same precarious policy balancing act. Some governments, such as that of Russia, give greater weight to economic development during these uncertain global economic times, while others may be unable to afford costly infrastructure requirements or favor stronger conservation efforts.

In an age of uneven and uncertain global economic growth, the American Arctic presents an attractive new economic opportunity. The Arctic holds an estimated 13 percent of the world’s undiscovered oil resources (90 billion barrels of oil) and 30 percent of the world’s undiscovered gas resources (1,669 trillion cubic feet of natural gas and 44 billion barrels of natural gas liquids)<sup>1</sup> of which approximately 84 percent of these resources are located in offshore areas.<sup>2</sup> The Alaskan Arctic is considered to be the second most prospective Arctic province (after the West Siberian Basin), containing an estimated 29.9 billion barrels of oil, over 221 trillion cubic feet of natural gas, and 5.9 billion barrels of natural gas liquids.<sup>3</sup>

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1. U.S. Geological Survey, “Circum-Arctic Resource Appraisal: Estimates of Undiscovered Oil and Gas North of the Arctic Circle,” 2008, 1, <http://pubs.usgs.gov/fs/2008/3049/fs2008-3049.pdf>.

2. Ibid.

3. Ibid., 4.

Depending on the price of oil (between a low of \$65 per barrel and a high of \$120 per barrel), the cumulative government revenue generated would range between \$193 billion and \$312 billion.<sup>4</sup> For onshore resources, the National Petroleum Reserve–Alaska (NPR-A) could hold undiscovered, technically recoverable resources totaling 896 million barrels of oil and 53 trillion cubic feet of gas.<sup>5</sup> For natural gas, the estimated mean value of recoverable gas in Alaska is 221 trillion cubic feet, about 13 percent of the total Arctic gas resources.

Development of these large natural resources has been constrained, however, by the lack of a transportation system to move them to market, particularly for natural gas. These infrastructure costs needed to pipe, liquefy, and export Alaskan gas could cost as much as \$65 billion, a hefty sum given the low natural gas prices seen in the rest of the United States.<sup>6</sup> Because the emergence of unconventional gas has radically lowered global gas price curves, the delivered cost of Alaskan gas may not be able to compete with shale gas in the rest of the United States.

Therefore, the economic scales will likely tip in economic favor of Arctic mineral resources rather than natural resources in the near term. For example, in 2010 exports of mineral resources in Alaska generated \$1.3 billion and accounted for 36.8 percent of Alaska’s foreign export earnings.<sup>7</sup> Alaska is home to the Red Dog mine, which accounts for 5 percent of the global (and 79 percent of the U.S.) zinc production<sup>8</sup> and 3 percent of the global (and 33 percent of the U.S.) lead production.<sup>9</sup> With over 60 million tons of ore reserves, the operations at Red Dog are estimated to continue until 2031.<sup>10</sup> Alaska is also home to over 80 million tons of copper resources,<sup>11</sup> estimated reserves of 500,000 ounces of gold,<sup>12</sup> 3.2 trillion tons of hypothetical coal resources,<sup>13</sup> and an estimated \$1 million pounds of uranium oxide resources.<sup>14</sup>

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4. Ibid., ES-4.

5. U.S. Geological Survey, “USGS Oil and Gas Resource Estimates Updated for the National Petroleum Reserve in Alaska (NPRA),” October 26, 2010, <http://www.usgs.gov/newsroom/article.asp?ID=2622#.UPRVs2OODX4>.

6. Rakteem Katakey and Jim Polson, “Exxon, BP Estimate Alaska LNG [liquefied natural gas] Export Project at \$65 Billion,” Bloomberg, October 4, 2012, <http://www.bloomberg.com/news/2012-10-04/exxon-bp-estimate-alaska-lng-export-project-at-65-billion.html>.

7. Charles Emmerson and Glada Lahn, “Arctic Opening: Opportunity and Risk in the High North,” Lloyd’s and Chatham House, April 2012, 26, [http://www.lloyds.com/~media/Files/News%20and%20Insight/360%20Risk%20Insight/Arctic\\_Risk\\_Report\\_20120412.pdf](http://www.lloyds.com/~media/Files/News%20and%20Insight/360%20Risk%20Insight/Arctic_Risk_Report_20120412.pdf).

8. Red Dog Alaska, “Red Dog Operations,” <http://www.reddogalaska.com/Generic.aspx?PAGE=Red+Dog+Site%2fZinc+and+Lead&portalName=tc>.

9. Ibid.

10. Environmental Protection Agency, “Record of Decision for the Red Dog Mine Extension Aqqaluk Project,” 2010, <http://www.epa.gov/region10/pdf/permits/npdes/ak/red-dog-aqqaluk-rod.pdf>.

11. Travis Leach, Joanna Poeck, Russ White, Jeffrey Volk, “NI 43-101 Preliminary Economic Assessment Ambler Project Kobuk, AK,” NOVA Copper, March 9, 2012, [http://www.novacopper.com/i/pdf/reports/Ambler\\_PEAUpdate\\_168400\\_020\\_070\\_20120309.pdf](http://www.novacopper.com/i/pdf/reports/Ambler_PEAUpdate_168400_020_070_20120309.pdf), p.v.; “A NANA-NovaCopper Partnership to Develop the Ambler Mining district”, Nova Copper, 2012, [http://www.novacopper.com/i/pdf/presentations/2012-02-xx\\_NCPPT\\_Rick\\_ENGO-Talk\\_sm.pdf](http://www.novacopper.com/i/pdf/presentations/2012-02-xx_NCPPT_Rick_ENGO-Talk_sm.pdf)

12. G.W. Rastopsoff, “Bering Straits Native Corporation Pens Agreement with NovaGold for Rock Creek Mine,” *Alaska Native News*, June 13, 2012, [http://alaska-native-news.com/rural\\_news/5812-bering-straits-native-corporation-pens-agreement-with-novagold-for-rock-creek-mine.html](http://alaska-native-news.com/rural_news/5812-bering-straits-native-corporation-pens-agreement-with-novagold-for-rock-creek-mine.html).

13. Romeo M. Flores, Gary D. Stricker, and Scott A. Kinney, “Alaska Coal Geology, Resources, and Coalbed Methane Potential,” U.S. Geological Survey, April 2004, <http://pubs.usgs.gov/dds/dds-077/dds77text.html#heading154883360>.

14. “Western Alaska Access Planning Study: Inventory Report,” State of Alaska Department of Transportation and Public Facilities, March 2009, [http://dot.alaska.gov/nreg/westernaccess/documents/inventory\\_report.pdf](http://dot.alaska.gov/nreg/westernaccess/documents/inventory_report.pdf).

## Photo 8.1. Mouth of the Matanuska Glacier in Alaska.



Source: Photo by Richard Moore, [http://commons.wikimedia.org/wiki/File:Matanuska\\_Glacier\\_mouth.jpg](http://commons.wikimedia.org/wiki/File:Matanuska_Glacier_mouth.jpg).

Yet again, the costs to gain access to these hydrocarbon and mineral resources and bring them to market are staggering. For example, the construction of a 100-mile road to bring North Slope onshore natural resources to market is estimated to range anywhere between \$400 and \$600 million. The project has prompted significant opposition from North Slope communities and environmental groups which claim that the road would cross caribou migration routes and affect indigenous subsistence hunting.<sup>15</sup> Another study is examining the costs of constructing a 500-mile corridor from the Seward Peninsula to the Fairbanks area to transport mineral resources between \$2.3 and \$2.7 billion.<sup>16</sup> Environmental advocates believe the project would “have adverse impacts to water resources, wildlife habitat, and subsistence resources” as well as high risk of acid mine drainage.<sup>17</sup>

Notwithstanding new infrastructure construction, Alaska’s existing road transportation infrastructure is vulnerable to thawing permafrost with an estimated 450

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15. Alex DeMarban, “Sierra Club: Alaska’s Umiat road among worst US transportation ideas,” *Alaska Dispatch*, December 12, 2012, <http://www.alaskadispatch.com/article/sierra-club-alaskas-umiat-road-among-worst-us-transportation-ideas>

16. Andover Mining, “North Western Alaska Corridor,” <http://www.andovermining.com/portfolio/sun-alaska>.

17. Northern Alaska Environmental Center, “Ambler Mining District,” <http://northern.org/programs/clean-water-mines/hardrock-mines-in-interior-and-arctic-alaska/arctic-ambler-project/arctic-ambler-project>.

miles of highway susceptible to permafrost melt that will require relocation or rehabilitation as their foundations weaken.<sup>18</sup> However, road infrastructure costs pale in comparison to the infrastructure costs related to sea and air. The United States will need to make significant and long-term investments in its Arctic infrastructure, including deep water ports, icebreaking capabilities and support vessels, ice-hardened transit vessels, improved satellites, aviation assets, as well as maintenance of airstrips, roads and pipelines. One icebreaker could cost \$1 billion. A deep water Arctic port is currently being assessed. An expansion of helicopter hangars and aviation refueling is also being considered.

Just as the scales seem to weigh heavily on infrastructure related costs, one cannot dismiss three growing areas of economic benefit: commercial fisheries, shipping, and tourism. For fisheries, more than 50 percent of all commercially captured U.S. seafood is harvested from Alaska, and Alaska leads all states in both catch volume (5.4 billion pounds) and catch value (\$1.9 billion).<sup>19</sup> Alaska's fishing industry is also a critical employer for the state, accounting for over 50 percent of basic private-sector employment in coastal communities.<sup>20</sup> With shipping, traffic along the Northern Sea Route in 2012 consisted of forty-six vessels transporting over 1.26 million tons of cargo, representing a 53 percent increase from the previous year, when thirty-four vessels carried 820,000 tons of cargo, and a more than tenfold increase from 2010, when the route was only used by four vessels carrying 111,000 tons of cargo.<sup>21</sup> The U.S. Coast Guard estimates that traffic through the Bering Strait has nearly doubled from 245 vessels in 2008 to over 400 vessels in 2011.<sup>22</sup> Finally, with tourism, the number of cruise ships venturing in Arctic water has more than doubled over the past eight years.<sup>23</sup> More than 65,000 passengers departed from Svalbard, Norway, and Greenland in 2010, according to the Greenland tourism bureau. A few thousand additional visitors depart from Canada and Russia each year.<sup>24</sup> The tourism industry for the entire state of Alaska generates \$2 billion annually in direct visitor spending<sup>25</sup> and is the third largest private-sector industry, with more than half of Alaska's annual visitors arriving on cruise ships.<sup>26</sup>

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18. "Climate Change, Permafrost, and Impacts on Civil Infrastructure," U.S. Arctic Research Commission, December 2003, 29, <http://www.arctic.gov/publications/permafrost.pdf>.

19. "Alaska leads nation in seafood catch with 5.4 billion pounds last year," *Alaska Dispatch*, September 20, 2012, <http://www.alaskadispatch.com/article/alaska-leads-nation-seafood-catch-54-billion-pounds-last-year>.

20. Olin Strader, "Critical for the opening Arctic: A Bering Strait vessel traffic service," *Alaska Dispatch*, February 8, 2012, <http://www.alaskadispatch.com/article/critical-opening-arctic-bering-strait-vessel-traffic-service>.

21. Trude Pettersen, "46 vessels through Northern Sea Route," *Barents Observer*, November 23, 2012, <http://barentsobserver.com/en/arctic/2012/11/46-vessels-through-northern-sea-route-23-11>.

22. Alex DeMarban, "Alaska sprints to build up Arctic infrastructure as development looms," *Alaska Dispatch*, August 27, 2012, <http://www.alaskadispatch.com/article/alaska-sprints-build-arctic-infrastructure-development-looms>.

23. David Rosenfeld, "Cruising the Arctic," Natural Resources News Service, July 23, 2012, <http://www.dcbureau.org/201207237493/natural-resources-news-service/cruising-the-arctic.html>.

24. *Ibid.*

25. Resource Development Council for Alaska, "Alaska's Tourism Industry," <http://www.akrdc.org/issues/tourism/overview.html>.

26. U.S. Senate, "Begich to EPA: One Size Fits All Doesn't Fit Alaska," December 14, 2012, <http://www.begich.senate.gov/public/index.cfm/pressreleases?ID=4bed64db-5e8f-40b6-9851-a3878eef76c2>.

Unfortunately, these benefits are not cost-free either. Fearing depletion of fish stocks or adverse impacts on the fragile Arctic ecosystem, the North Pacific Fishery Management Council decided in 2009 to ban all commercial fishing in a 200,000-square-mile area extending from the Bering Strait to the disputed U.S.-Canadian maritime border, an area including the Chukchi and Beaufort seas.<sup>27</sup> According to the National Oceanographic and Atmospheric Administration, fishing stocks have been moving northward for the past forty years to increase their chances of survival.<sup>28</sup> As a reshifting of fish stocks takes place, some fish populations are nearly disappearing from U.S. waters. According to the International Maritime Organization (IMO), there are currently no mandatory requirements to address safety concerns for ships operating in Arctic waters. Therefore, there are no comprehensive rules for the design, construction, and equipment of vessels, nor are there clearly defined procedures regarding operational, training, search and rescue, and environmental protection matters.<sup>29</sup>

It is reasonable to conclude that, for the moment, the American Arctic scales tip slightly toward the side of environmental protection and stewardship, although not due to a formal governmental decision. It is tipped toward protection today principally due to the lack of a long-range, national Arctic infrastructure investment plan. Although the state of Alaska is very interested in fully exploring Arctic economic opportunities and eagerly seeks to formulate such an economic development strategy, such a plan would require national financial mobilization due to the extraordinary budgetary resources involved, an understanding of the markets of destination for Arctic economic resources (e.g., the United States for domestic energy consumption or for export to Asia), and an equally robust and mutually reinforcing public-private sector relationship. All three conditions are not present today and will unlikely materialize in the near future.

Although one can approximately tabulate the costs and benefits of Arctic economics, the ultimate cost of an oil spill that destroys the fragile Arctic environment or a catastrophic incident at sea that could cost hundreds of lives cannot be determined. If a disaster took place, America's Arctic scales would likely never achieve balance. This unquantifiable factor tips the American scales toward Arctic environmental protection for the foreseeable future.

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27. North Pacific Fishery Management Council, "Arctic Fishery Management," <http://www.fakr.noaa.gov/npfmc/fishery-management-plans/arctic.html>.

28. "Ocean Warming Affecting Fish Populations," United Press International, November 3, 2009, [http://www.upi.com/Science\\_News/2009/11/03/Ocean-warming-affecting-fish-populations/UPI-17961257275663/](http://www.upi.com/Science_News/2009/11/03/Ocean-warming-affecting-fish-populations/UPI-17961257275663/).

29. International Maritime Organization, "Development of an international code of safety for ships operating in polar waters (Polar Code)," <http://www.imo.org/mediacentre/hottopics/polar/Pages/default.aspx>.

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