Climate Change, Whaling, and Conflict in the Seventeenth-Century Arctic

Midway through the thirteenth century, a series of stratovolcanic eruptions lofted sunlight-scattering particles high into the stratosphere, and shortly thereafter solar activity itself started to decline. Feedback loops working through soil and sea ice intensified initially modest cooling, which changing oceanic and atmospheric circulations then either magnified or mitigated from region to region. This was the beginning of the so-called "Little Ice Age," a generally chilly but ferociously complex period in Earth's climatic history that by most accounts endured until the mid-nineteenth century. Cooling came in a series of particularly cold waves, each no longer than a century, that began and ended at slightly different times from region to region and occasionally avoided some places altogether. Two of the chilliest waves, the "Grindelwald Fluctuation" and "Maunder Minimum," bookended the seventeenth century, which was therefore the coldest century of the Little Ice Age across much of the northern hemisphere.[1]

Scholars in many disciplines have found links between the coldest stretches of the Little Ice Age and harvest failures, outbreaks of epidemic disease, and finally bouts of violence – both within and between states – that responded to but also exacerbated dearth and pestilence. This "fatal synergy," as Geoffrey Parker called it, between climate change and conflict has come to

[1] PAGES2k Consortium, 'A global multiproxy database for temperature reconstructions of the Common Era', *Scientific Data* 4 (2017), doi:10.1038/sdata.2017.88. M. Sigl et al., 'Timing and Climate Forcing of Volcanic Eruptions for the Past 2,500 Years', *Nature* 523 (2015), 546. Markus Stoffel et al., 'Estimates of volcanic-induced cooling in the Northern Hemisphere over the past 1,500 years', *Nature Geoscience* 8 (2015), 786. Y. Zhong et al. 'Centennial-scale climate change from decadally-paced explosive volcanism: a coupled sea ice-ocean mechanism', *Climate Dynamics* 37 (2011), 2373. Matthew Toohey and Michael Sigl, 'Volcanic stratospheric sulfur injections and aerosol optical depth from 500 BCE to 1900 CE', *Earth System Science Data* 9:2 (2017), 809. Scientists debate the extent to which changes in solar radiation influence Earth's climate. Recent studies suggest a slight but real relationship. See, for example: Ilya G. Usoskin, 'A history of solar activity over millennia', *Living Reviews in Solar Physics* 14:1 (2017), 20. Rémi Thiéblemont et al., 'Solar forcing synchronizes decadal North Atlantic climate variability', *Nature Communications* 6 (2015), 1-8. Andrew P. Schurer, Simon F. B. Tett, and Gabriele C. Hegerl, 'Small influence of solar variability on climate over the past millennium', *Nature Geoscience* 7:2 (2014), 104-108. E. H. Lee at al., 'The Sunspot and Auroral Activity Cycle Derived from Korean Historical Records of the 11th-18th Century', *Solar Physics* 224:1-2 (2004), 375.

light both through qualitative scholarship pioneered by historians,[2] and quantitative studies co-authored by scientists and geographers.[3] Yet practically none of this work has focused on the Arctic,[4] even though its environments are especially sensitive to climate change, and even though Europeans braved the Little Ice Age to compete aggressively with one another and with peoples indigenous to the Arctic for access to northern resources. By investigating conflict in the seventeenth-century Arctic, this article finds that scholars have only begun to explore the full range of possible relationships between climatic trends and violence. It reveals that climatic variability not only provoked but also mitigated conflict; that conflict altered how directly or

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[2] See, for example: Geoffrey Parker, *Global Crisis: War, Climate Change and Catastrophe in the Seventeenth Century* (New Haven, 2013). Sam White, *The Climate of Rebellion in the Early Modern Ottoman Empire* (Cambridge:, 2011). Sam White, *A Cold Welcome: The Little Ice Age and America's Colonial Beginnings* (Cambridge, 2017). John Brooke, *Climate Change and the Course of Global History: A Rough Journey* (Cambridge, 2015). Timothy Brook, *The Troubled Empire: China in the Yuan and Ming Dynasties* (Cambridge, 2010). Kyle Harper, *The Fate of Rome: Climate, Disease, and the End of an Empire* (Princeton, 2017). Bruce Campbell, *The Great Transition: Climate, Disease, and Society in the Late-Medieval World* (Cambridge, 2016). Dagomar Degroot, *The Frigid Golden Age: Climate Change, the Little Ice Age, and the Dutch Republic, 1560-1720* (Cambridge, 2018).

[3] See, for example: Solomon M. Hsiang, Marshall Burke, and Edward Miguel, "Quantifying the influence of climate on human conflict', *Science* 341:6151 (2013), 1235367. Ying Bai and James Kai-sing Kung, 'Climate shocks and Sino-nomadic conflict', *Review of Economics and Statistics* 93:3 (2011), 970-981. Jun Yin, Yun Su, and Xiuqi Fang, 'Climate change and social vicissitudes in China over the past two millennia', *Quaternary Research* 86:2 (2016), 133-143. Colleen Devlin and Cullen S. Hendrix, 'Trends and triggers redux: Climate change, rainfall, and interstate conflict', *Political Geography* 43 (2014), 27-39. Qiang Chen, 'Climate Shocks, State Capacity and Peasant Uprisings in North China during 25–1911 ce.', *Economica* 82:326 (2015), 295-318. Ruixue Jia, 'Weather shocks, sweet potatoes and peasant revolts in historical China', The Economic Journal 124:575 (2014), 92-118. David Zhang, 'Climate Change and War Frequency in Eastern China over the Last Millennium', *Human Ecology* 35 (2007), 403-414. David Zhang and Harry Lee, 'Climate Change, Food Shortage and War: A Quantitative Case Study in China during 1500-1800', *Catrina* 5:1 (2010), 63-71. David Zhang et al., 'Climatic change, wars and dynastic cycles in China over the last millennium', *Climatic Chang*e 76 (2006), 459-477. David Zhang, 'Global climate change, war, and population decline in recent human history', *Proceedings of the National Academy of Sciences* 104:49 (2007), 19214-19219. David Zhang, 'The causality analysis of climate change and large-scale human crisis', *Proceedings of the National Academy of Sciences* 108:42 (2011), 17296-17301. Dian Zhang et al., 'Climate change, social unrest and dynastic transition in ancient China', *Chinese Science Bulletin* 50:2 (2005), 137-144. Zhibin Zhang, 'Periodic climate cooling enhanced natural disasters and wars in China during AD 10-1900', *Proceedings of the Royal Society* 277 (2010), 3745-3753. Richard S. J. Tol and Sebastian Wagner, 'Climate change and violent conflict in Europe over the last millennium', *Climatic Change* 99 (2010), 65-79. Dagomar Degroot, 'Climate Change and Conflict', in *The Palgrave Handbook of Climate History*, eds. Christian Pfister, Franz Mauelshagen, and Sam White (Basingstoke, 2018).

[4] The work that does exist has concentrated on the fate of the Norse settlements in Greenland. See, for example: Lisa K. Barlow et al., 'Interdisciplinary investigations of the end of the Norse Western Settlement in Greenland', *The Holocene* 7:4 (1997), 489-499. Kirsty A. Golding, 'Norse–Inuit interaction and landscape change in southern Greenland? A geochronological, pedological, and palynological investigation', *Geoarchaeology* 26:3 (2011), 315-345. Andrew J. Dugmore et al., 'Cultural adaptation, compounding vulnerabilities and conjunctures in Norse Greenland', *Proceedings of the National Academy of Sciences* 109:10 (2012), 3658-3663.

profoundly individuals and communities experienced climate change; and that climate change influenced not just the origins of conflict but also how conflict took place. Above all, it reveals that the decisions of sentient animals in turn affected the decisions humans could make while competing – and at times fighting – in a changing Arctic.

For much of the seventeenth century, Europeans valued few Arctic resources more highly than the bristle-like baleen "hairs" and thick blubber of the bowhead whale (*Balaena mysticetus*). Whalers sold hairs to dressmakers and boiled blubber into oil that could be used as fuel for lamps or as an ingredient in rope making, ship building, and soap manufacturing. This article combines multidisciplinary reconstructions of past climate changes with seventeenth-century ship logbooks, legal testimonies, and correspondence to reveal that climate change influenced violence in each of three distinct stages in the history of a "Greenland Fishery" that stretched between the island of Jan Mayen to the west and the Svalbard archipelago to the east (Figure 1). In the first, European whalers competed to establish temporary whaling stations in bays across Svalbard and eventually Jan Mayen. Most whalers focused on the western coast of Spitsbergen, the archipelago's largest and warmest island, where bays teemed with whales in late spring. Climatic cooling repeatedly caused sea ice to expand until it enclosed many of these bays, either sealing ships within or preventing them from entering. When that happened, Dutch and English whalers did not attack one another, either because they cooperated to exploit the harbors that could still be used, or because sea ice separated them from each other. When shifts in air surface temperatures or prevailing winds drew the ice away from Spitsbergen, by contrast, ships could move freely and competition repeatedly provoked conflict.

Fig. 1. The locations of Svalbard and Jan Mayen Island in the Arctic. Base map provided by the Norwegian Polar Institute, 2018.

In the second stage of the whaling industry, English and Dutch whalers set up permanent settlements on the coasts of western Svalbard and Jan Mayen. Until then, neither the island nor the archipelago had ever been settled by human beings. After pirates plundered the new whaling settlements, the English and Dutch drafted plans to colonize them year-round. Yet ambitious attempts to overwinter in Jan Mayen and Spitsbergen coincided with a particularly cold stretch of

the Grindelwald Fluctuation and therefore ended in disaster. The threat of violence had exposed whalers to the most dangerous weather of the period.

Average annual temperatures warmed soon after, until renewed cooling persistently brought thick summer sea ice to the northern bays of Spitsbergen, by then claimed by the Dutch. At the same time, bowhead whales started avoiding the bays of first Jan Mayen and then western Svalbard. In the third stage, Dutch, French, and German whalers therefore developed new techniques and technologies to pursue the whales at sea, far from the ice-infested coast, just as naval wars broke out between Europe's maritime powers. Conflict over whale commodities increasingly assumed the form of naval raids and privateering along the perimeter of the Arctic pack ice. At every stage of the Arctic whaling industry, therefore, climate change influenced conflict in different ways.

Today, political scientists debate whether warming in the Arctic will eventually lead to conflict between states over suddenly accessible resources.[5] Yet in the seventeenth century, climate change did not simply dictate whether conflict broke out between whalers from hostile countries, in rival companies. Short-lived, local environmental conditions that became more common or more extreme amid the gradual trends of climate change rather expanded or contracted the options available to sentient mammals in the Arctic, human and cetacean. In this volatile context, hostile whalers made decisions that reflected economic, political, cultural, and

[5] See, for example: Scott G. Borgerson, 'Arctic meltdown: the economic and security implications of global warming', *Foreign Affairs* (2008), 63-77. Kristian Åtland, 'Interstate relations in the Arctic: an emerging security dilemma?', *Comparative Strategy* 33:2 (2014), 145. D. Fairhall, *Cold Front: Conflict Ahead in Arctic Waters* (London, 2010). Gerhardt Hannes et al., 'Contested sovereignty in a changing Arctic', *Annals of the Association of American Geographers* 100:4 (2010), 992-1002. R. Howard, *The Arctic Gold Rush – The New Race for Tomorrow's Natural Resources* (London/New York, 2009). R. Huebert, *The Newly Emerging Arctic Security Environment* (Calgary, 2010). Oran R. Young, 'Whither the Arctic? Conflict or cooperation in the circumpolar north', *Polar Record* 45:1 (2009), 75. Heather N. Nicol and Lassi Heininen, 'Human security, the Arctic Council and climate change: competition or co-existence?', *Polar Record* 50:1 (2014), 80. Kathrin Keil, 'The Arctic: A new region of conflict? The case of oil and gas', *Cooperation and Conflict* 49:2 (2014), 180.

technological developments that in turn registered the influence of climate change. A constellation of pressures environmental and social therefore affected – but did not determine – not only when and where conflict took place, but also how it unfolded and what it meant for bowhead and human lives in the Arctic. This article suggests that climate change has a more complex connection to violence than previously imagined, and a richer relationship to human history than typically acknowledged.

Shifting Environments of Svalbard and its Surroundings

Svalbard lies roughly halfway between the northern coast of Norway and the Geographic North Pole. Its largest islands dominate a collection of smaller outcroppings, from Bjørnøya (or Bear Island) far to the south to Amsterdamøya (or Amsterdam Island) in the north (Figure 2). Above these islands, warm air welling up from the southwest usually collides with frigid air blowing from the northeast. Cold currents flow east and north of Svalbard, yet the warm West Spitsbergen Current runs north around the western coast of Spitsbergen, which is therefore the warmest and most biologically diverse part of the archipelago. The mingling of warm and cold water off western Spitsbergen churns up nutrients from the deep ocean, promoting the growth of phytoplankton and in turn krill, a kind of zooplankton consumed by bowhead whales.[6]

[6] Louwrens Hacquebord, 'The hunting of the Greenland right whale in Svalbard, its interaction with climate and its impact on the marine ecosystem', *Polar Research* 18:2 (1999), 377. J. M. Węsławski et al., 'Greenland whales and walruses in the Svalbard food web before and after exploitation', *Oceanologia* 42.1 (2000), 42. Frigga Kruse, 'Is Svalbard a pristine ecosystem? Reconstructing 420 years of human presence in an Arctic archipelago', *Polar Record* 52: 5 (2016), 523.


Amsterdamøya
Nordaustlandet
Kongsfjordrenna
Spitsbergen
Forland-sundet
Barentsøya
Isfjorden
Edgeøya
Bellsund
Hornsund
Hambergbukta
Bjørnøya

Fig. 2. Top: Svalbard, with major bays used by whalers. Middle: Amsterdamøya and Danskøya (Danes Island), locus of Dutch and Danish whaling in Svalbard. Bottom: Jan Mayen and the two major bays used by whalers: Engelskbukta and Titeltbukta. Base maps provided by the Norwegian Polar Institute, 2017.

Around 1600, up to 50,000 bowhead whales calved near Jan Mayen early each year and then made their way northeast along the edge of the retreating pack ice. They arrived at the coasts of Spitsbergen and Edgeøya by late April.[7] With mouths slightly agape, they "skim fed" through schools of krill, straining the little creatures through baleen hairs that could reach four meters long. By consuming tons of krill, bowheads maintained their enormous bodies, which can weigh over 100 tons, and accumulated layers of insulating blubber that can be more than 30 centimeters thick. Bowheads use the energy stored in blubber to sustain them over the winter, when they typically eat nothing at all. The extraordinary evolutionary adaptations that allow bowheads to thrive in their forbidding environment also made them lucrative targets for early modern whalers. Because they lingered near the edge of the summer pack ice to avoid roving killer whale pods, they could be dangerous for whalers to approach. Yet they were – and remain – slow, gentle creatures that even whalers armed with pre-industrial technology could eventually kill. Moreover, roughly one day after bowheads die, gases generated by decomposition lift their carcasses above water, where whalers easily stripped them of valuable commodities.[8]

Bowhead whales were more than unthinking stores of lucrative biomass, however. Warm-blooded mammals, such as whales, tend to have big brains relative to the size of their bodies. Not only do they need a good deal of brainpower to manage the systems that maintain their internal temperatures, but warm-bloodedness also aids in the development of complex brains. Large whales, in fact, have the biggest brains in the animal kingdom, and there is

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[7] Whalers reported that bowheads spent the winter near Iceland, but scientists have found that the few bowheads left in the Svalbard stock currently overwinter in water at high latitudes near Spitsbergen, which is usually kept open by the warm West Spitsbergen Current. Christian Lydersen et al., 'Lost highway not forgotten: satellite tracking of a bowhead whale (*Balaena mysticetus*) from the critically endangered Spitsbergen stock', *Arctic* (2012), 84.

[8] Bowheads are "not courageous," Frederick Martens, a Dutch whaler, wrote in 1671, and "never try to hurt anyone on purpose." Frederick Martens, 'Voyage into Spitzbergen and Greenland: Part the First', In Adam White, *A collection of documents on Spitzbergen and Greenland* (London, 1855), 8. L. Hacquebord, F. Steenhuisen, and H. Waterbolk, 'English and Dutch whaling trade and whaling stations in Spitsbergen (Svalbard) before 1660', *International Journal of Maritime History* 15 (2003), 132.

emerging evidence that the absolute size of a brain – rather than its size relative to an animal's body – scales proportionately to cognitive ability. It seems absurd to suggest that whales are smarter than humans – no whale, to our knowledge, has ever written about human intelligence – but researchers are beginning to uncover previously unimagined complexity in whale behavior.[9]

By now, researchers have carefully studied the behaviors of bottlenose dolphins and humpback, killer, and sperm whales, yet they have devoted far less attention to other species, including bowhead whales. Bowheads can be especially resistant to study, since they overwinter in the inaccessible Arctic. Yet cutting-edge research now suggests that bowhead behavior may be as complex as any in the animal kingdom. During every winter breeding season, for example, male bowhead whales appeal to females by learning entirely new songs that vary between each of five distinct bowhead populations (or "stocks"). Bowheads in the Greenland Fishery may have sung two or three different winter songs, each roughly a minute long. Whales composed their songs using short units that they combined in phrases and ultimately distinct themes. It may always be difficult to study all forms of whale communication, since whales call to one another over hundreds, even thousands of kilometers. Yet most behavioral ecologists now accept that bowhead stocks have their own, evolving "cultures," according to a broad multidisciplinary definition of culture that sees it as "behavior patterns shared by members of a community that rely on socially learned and transmitted information."[10]

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[9] Part of the reason for whale intelligence may lie in the nature of the ocean environment. Since the open ocean offers little refuge from predators, baleen whales congregate to protect their young. Being in close proximity promoted the development of social behavior and, in time, intelligence. Hal Whitehead and Luke Edward Rendell, *The Cultural Lives of Whales and Dolphins* (Chicago, 2014), 56, 59, 63, 65.

[10] Culture, brain size, and intelligence have a close and mutually constitutive relationship. Peter Richerson and Robert Boyd have come up with another useful definition of culture: "Information capable of affecting individuals' behavior that they acquire from other members of their species through teaching, imitation, and other forms of social transmission." Here, information refers to "any kind of mental state, conscious or not, that is acquired or modified by social learning and affects behavior." Whitehead and Rendell, *The Cultural Lives of Whales and Dolphins*, 11, 85. The debate over the existence of animal culture has a long history, and the literature is now vast on cetaceans and especially apes. For a landmark publication, see: Andrew Whiten et al., 'Cultures in chimpanzees', *Nature*

In the seventeenth century, European whalers and whales in the Svalbard stock came to know each other intimately.[11] From the start, whalers noticed that individual bowheads cleverly exploited sea ice to elude pursuit by whalers. Later, whalers pursuing bowheads in the Arctic wrote that whales had learned to back away from whaling ships, sink abruptly with the apparent intent to swamp whaling boats (called "shallops"), and even remove harpoons by rubbing them against thick ice. It is, perhaps, tempting to assume that whalers had anthropomorphized their prey, despite their apparent willingness to slaughter them with impunity.[12] Yet as we will see, whalers accurately observed and ruthlessly exploited other, decidedly alien behaviors in bowhead whales. Their accounts ultimately confirm that the whales were not passive players in the tragedy of their destruction, but rather active, self-conscious agents that often resisted whalers as best they could.[13]

399:6737 (1999), 682. An important paper that suggests cultural elements in bowhead skim feeding is: B. Würsig et al., 'Behavior of bowhead whales, *Balaena mysticetus*, summering in the Beaufort Sea: a description', *Fishery Bulletin* 83:3 (1985), 357-377.

[11] Hartson Bodfish, a whaler, wrote in 1936 that the judgement of a bowhead whaler, "must be pitted against the natural wariness of the whale, and he must possess accurate knowledge of the whale's habits and characteristics." Hartson Bodfish and Joseph Allen, *Chasing the bowhead, as told by Captain Hartson H. Bodfish and recorded for him by Joseph C. Allen* (Cambridge, 1936), 90.

[12] Ryan Tucker Jones insightfully writes that, in the historiography of whaling, "The temptation to anthropomorphize the whales' actions, and particularly to note their awareness of being hunted, has been recurrent. Yet, these suggestions are never seriously pursued, and instead are meant largely in jest." Ryan Tucker Jones, 'A Whale of a Difference: Southern Right Whale Culture and the Tasman World's Living Terrain of Encounter', *Environment and History* (forthcoming), 7. It may be impossible to avoid some anthropomorphic assumptions when observing animal behavior, although today scientists work hard to overcome those biases. In any case, most behavioral ecologists now accept that the challenging aspects of anthropomorphism pale in comparison to the bigger problem of simply ignoring or explaining away animal behavior that appears to reflect learning and intelligence, as though such behavior is uniquely the province of human beings. Moreover, many non-western ways of knowing – including those adopted by peoples indigenous to the Arctic – embrace, rather than discourage, anthropomorphism. See, for example: Zoe Todd, 'An Indigenous feminist's take on the ontological turn:'ontology'is just another word for colonialism', *Journal of historical sociology* 29:1 (2016), 4-22.

[13] Martens, "Voyage into Spitzbergen and Greenland," 8. Cornelis Gijsbertsz Zorgdrager, *Bloeijende opkomst der aloude en hedendaagsche Groenlandsche visschery* (The Hague, 1727). Allen, *Chasing the bowhead,* 98. Whitehead and Rendell, *The Cultural Lives of Whales and Dolphins*, 71. Since the 1980s, the animal turn in the humanities has led to far more work than can here be summarized in full. Studies on whales include: Ryan Tucker Jones, 'Running into whales: The history of the North Pacific from below the waves', *The American Historical Review* 118:2 (2013), 349-377. Studies that explore animals as agents and instruments in the Arctic include: Peder Roberts and Dolly Jørgensen, 'Animals as instruments of Norwegian imperial authority in the interwar Arctic', *Journal for the History of Environment and Society* 1:1 (2016), 65-87. Dolly Jørgensen and Sverker Sørlin, eds., *Northscapes: History, Technology, and the Making of Northern Environments* (Vancouver, 2013). Tuomas Räsänen and Taina Syrjämaa,

When sea ice melted in the spring and bowheads appeared off Jan Mayen, whalers left the ports of western Europe to meet them. These whalers, typically young men, faced harrowing dangers in the Arctic environment. The exhumed skeletons of whalers buried at Amsterdamøya and the tiny nearby island of Ytre Norskøya reveal that many whalers suffered from scurvy, a disease brought on by vitamin C deficiency. Moreover, logbooks, letters, and skeletal remains suggest that whalers routinely died after falling from ice-covered masts; being crushed or drowned by various kinds of ice at sea or on land; or being hurled into frigid water by a dying whale.[14]

Until around 1700, whaling captains recruited their crews in small coastal villages, often on the basis of family ties or shared social circles. Whalers' financial security usually depended on "making their voyage" – catching enough whales to fill their ship with barrels of oil – in the summer. It was hard to find winter employment as a sailor that would allow them to depart with the whaling fleet in the spring.[15]

Whales and whalers struggled to survive in environments that changed dramatically over the course of the seventeenth century. The Grindelwald Fluctuation reached the Arctic in the

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eds., *Shared Lives of Humans and Animals: Animal Agency in the Global North* (Abingdon, 2017). Dolly Jørgensen and Virginia Langum (eds.), *Visions of North in Premodern Europe* (Turnhout, 2018). Recent, seminal books on animal humanities include: Lorraine Daston and Gregg Mitman, eds., *Thinking with animals: New perspectives on anthropomorphism* (New York, 2005). Margo DeMello, *Animals and society: an introduction to human-animal studies* (New York, 2012). Recent think pieces include: Linda Nash, 'The Agency of Nature or the Nature of Agency?,' *Environmental History* 10:1 (2005), 67-69. Joshua Specht, 'Animal history after its triumph: unexpected animals, evolutionary approaches, and the animal lens', *History Compass* 14:7 (2016), 326-336. Jennifer Adams Martin, 'When sharks (don't) attack: Wild animal agency in historical narratives', *Environmental History* 16:3 (2011), 451-455. Anna Lisa Taylor, 'Where are the wild things? Animals in western medieval European History', *History Compass* 16:3 (2018), e12443.

[14] "Swimming is . . . requisite for a Whale-killer to be expert in," English whaler Thomas Edge reflected in 1622, "for it may be a meanes to save his life." Thomas Edge, 'The Description of the severall sorts of Whales', in *Purchas His Pilgrimes Vol. 13* (Glasgow, 1904), 27.

[15] Joost C. A. Schokkenbroek et al., *Trying Out: An Anatomy of Dutch Whaling and Sealing in the Nineteenth Century, 1815-1885* (Amsterdam, 2008), 34. George J. R. Maat, 'Osteology of Human Remains from Amsterdamoya and Ytre Norskoya', in *Smeerenburg Seminar: Report from a symposium presenting results from research into seventeenth century whaling in Spitsbergen*. Norsk Polarinstitutt Rapportserie 38 (1987), 45.

1580s, roughly two decades after it started cooling northern Eurasia. It would endure in the far north until the late 1630s, around a decade longer than it lasted in Europe. A short, warmer period followed but gave way by the 1670s to the renewed cooling of the Maunder Minimum, which would continue in the Arctic, as elsewhere, until well into the eighteenth century (Figure 3). In both the Grindelwald Fluctuation and Maunder Minimum, cooling in the Arctic was more pronounced in the spring, autumn, and winter than it was in the summer. Yet across much of the northern hemisphere, unusual weather volatility from year to year and decade to decade also distinguished both cold periods from the slightly warmer climatic regimes that preceded and followed them.[16]

[16] Nicholas P. McKay and Darrell S. Kaufman, 'An extended Arctic proxy temperature database for the past 2,000 years', *Scientific Data* 1 (2014), 140026. E. Crespin et al., 'The 15th century Arctic warming in coupled model simulations with data assimilation', *Climate of the Past* (2009):,394. E. Crespin et al., 'Arctic climate over the past millennium: Annual and seasonal responses to external forcings', *The Holocene* 23 (2013), 327. J. Overpeck et al., 'Arctic Environmental Change of the Last Four Centuries', *Science* 278:1251 (1997), 1253.

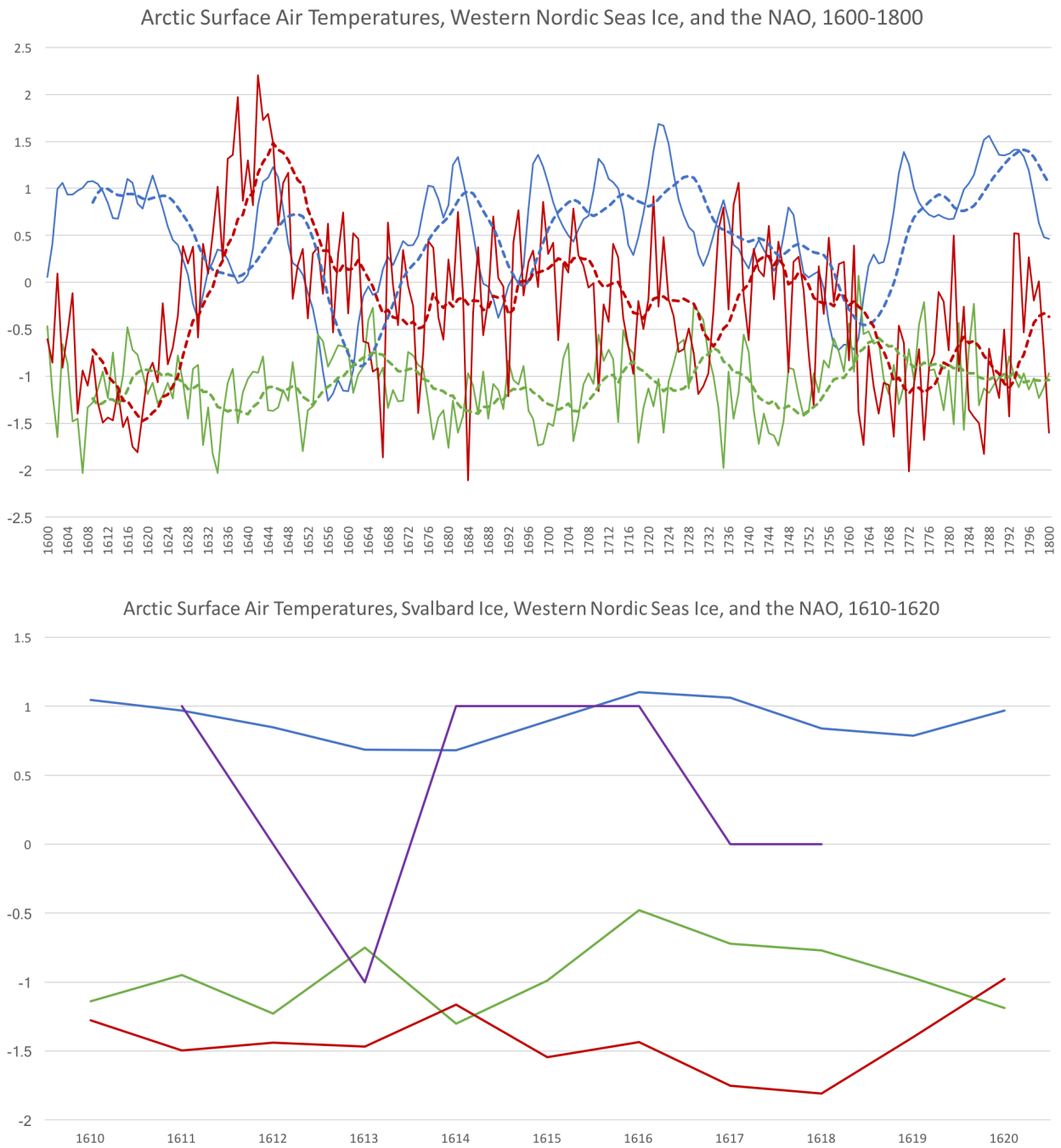

Fig. 3. Top: A multi-proxy reconstruction of average annual Arctic temperatures (green); sea ice (blue) in the Western Nordic Seas; and the state of the NAO (red), all from 1600 to 1800. Ten-year moving averages show decadal trends. Bottom: the same reconstructions from 1610-1620, with a qualitative measure (purple) of sea ice observations around Svalbard, derived from whalers' logbooks, letters, and testimonies, reconstructed on a simple ordinal scale (-1 for minimal sea ice, 1 for abundant ice). Developed using primary sources cited in the article, and data in: M. Macias Fauria et al., "Unprecedented low twentieth century winter sea ice extent in the Western Nordic Seas since AD 1200." *Climate Dynamics* 34:6 (2010): 781-795. McKay and Kaufman, "An extended Arctic proxy temperature database for the past 2,000 years," 140026. Pablo Ortega et al., "A model-tested North Atlantic Oscillation reconstruction for the past millennium." *Nature* 523:7558 (2015): 72.

Arctic temperature reconstructions rely on a mix of model simulations, documentary evidence, and especially natural "proxy" sources – such as ice cores or marine sediments – that register annual or seasonal weather and therefore long-term climate trends. Together, these sources reveal, first, that weather around Svalbard and Jan Mayen has long been highly variable, oscillating between extremes as atmospheric and oceanic currents interact to provoke new patterns of regional sea ice. Depending on their direction, powerful winds could not only break up sea ice but also bring it surging into the bays of Svalbard and Jan Mayen in even warm years, or temporarily draw it out to sea in colder years. Bitterly cold winters in even the chilliest phases of the Grindelwald Fluctuation routinely gave way to mild but short-lived weather brought in by depressions moving north from the southwest.[17]

Second, reconstructions reveal that decadal trends in average annual temperature around Svalbard and Jan Mayen approximately mirrored those of the broader Arctic in the seventeenth century. Diverse proxy sources, not to mention reports written by whalers themselves, suggest that decadal trends in the extent of regional sea ice also fluctuated roughly in step with shifting Arctic temperatures, which meant that sea ice expanded during both the Grindelwald Fluctuation and Maunder Minimum (Figure 3). Moreover, storms capable of breaking up sea ice probably grew less common in the Grindelwald Fluctuation and Maunder Minimum owing to changes in the North Atlantic Oscillation (NAO), a climatic mode that consists of a low-pressure zone near Iceland and a high-pressure zone near the Azores. When atmospheric pressure around Iceland is very low, and very high around the Azores, the NAO enters a positive setting that funnels winds from the west – "westerly" winds – across northern Europe and the Arctic. These westerlies transport storm systems and in turn precipitation to Svalbard. When the difference in

[17] Elisabeth Isaksson et al., 'Two ice-core δ18O records from Svalbard illustrating climate and sea-ice variability over the last 400 years', *The Holocene* 15:4 (2005), 501.

atmospheric pressure falls between the Icelandic low and Azores high, by contrast, the NAO reaches a negative phase that causes the usual band of westerly winds to meander, and permits the intrusion of persistent winds from other directions. Storms would then have been less common around Svalbard. Early in the seventeenth century, the NAO lingered in a negative state, before shifting into a strongly positive state in the late 1620s, as the Grindelwald Fluctuation across much of the Northern Hemisphere – but not the Arctic – came to a close. The NAO returned to its negative setting after the first two decades of the Maunder Minimum.[18]

Ultimately, reconstructions reveal that climatic trends influenced average annual temperatures and in turn the quantity of sea ice in and around whaling grounds. Yet they also demonstrate that these trends did not always dictate daily or even monthly conditions near whaling stations and ships. For whalers, the environment of the Greenland Fishery was a fickle antagonist.

Rise of the Greenland Fishery in a Cool but Variable Climate

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[18] W. Van der Knaap, 'Human influence on natural Arctic vegetation in the 17th century and climate change since A.D. 1600 in northwest Spitsbergen: a paleobotanical study', *Arctic, Antarctic and Alpine Research* 17:4 (1985), 384. Waldemar Walczowski and Jan Piechura, 'Influence of the West Spitsbergen Current on the local climate', *International journal of climatology* 31:7 (2011), 1091. Patrycja Jernas et al., 'Palaeoenvironmental changes of the last two millennia on the western and northern Svalbard shelf', *Boreas* 42:1 (2013), 245. Hilary Birks, 'Holocene vegetational history and climatic change in west Spitsbergen – plant macrofossils from Skardtjørna, an Arctic lake', *The Holocene* 1:3 (1991), 216. William J. D'Andrea et al., 'Mild Little Ice Age and unprecedented recent warmth in an 1800 year lake sediment record from Svalbard', *Geology* 10.1130 (2012), 1007. Robert F. Spielhagen et al., 'Enhanced modern heat transfer to the Arctic by warm Atlantic water', *Science* 331:6016 (2011), 452. Dmitry Divine, 'Thousand years of winter surface air temperature variations in Svalbard and northern Norway reconstructed from ice-core data', *Polar Research* 30:1 (2011), 7379. Torgeir O. Røthe et al., 'Arctic Holocene glacier fluctuations reconstructed from lake sediments at Mitrahalvøya, Spitsbergen', *Quaternary Science Reviews* 109 (2015), 111.Cabedo-Sanz, Patricia, and Simon T. Belt, 'Seasonal sea ice variability in eastern Fram Strait over the last 2000 years', Arktos 2:1 (2016), 8. Fauria et al., 'Unprecedented low twentieth century winter sea ice extent in the Western Nordic Seas since AD 1200,' 782. Rueda et al., 'Coupling of air and sea surface temperatures in the eastern Fram Strait during the last 2000 years', *The Holocene* 23:5 (2013), 695. Christophe Kinnard et al., 'Reconstructed changes in Arctic sea ice over the past 1,450 years', *Nature* 479:7374 (2011), 511. R. R. Dickson et al., 'The Arctic ocean response to the North Atlantic oscillation', *Journal of Climate* 13:15 (2000), 2673. Ortega et al., 'A model-tested North Atlantic Oscillation reconstruction for the past millennium', 72.

In the sixteenth century, adventurers from France, England, and eventually the newly established Dutch Republic started exploring the Arctic in order to usurp Hanseatic trade with northern communities and find routes to Asia that would be quicker and therefore more lucrative than those dominated by Iberian sailors. Unfortunately for them, their expeditions gathered pace just as the Grindelwald Fluctuation started cooling the far north. In 1596, sea ice forced an expedition piloted by Dutch navigator Willem Barents to change course until it encountered first Bjørnøya and shortly thereafter Spitsbergen. The thick but passable ice likely registered both the general cooling of the Grindelwald Fluctuation and the relative mildness of its summers. If so, the regional manifestations of climate change helped Barents discover an environment that would soon incite intense competition among European whalers.[19]

England's Muscovy Company, which controlled English trade with the White Sea, soon sponsored further expeditions that uncovered the rich marine resources around Svalbard.[20] In the summer of 1611, the Company therefore commissioned Jonas Poole, an experienced walrus hunter, to lead its first whaling expedition to Spitsbergen. The Arctic that year was even colder than the Grindelwald Fluctuation average, however, and when the expedition's two whaling

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[19] Gerrit de Veer, *Reizen van Willem Barents, Jacob van Heemskerck, Jan Cornelisz. Rijp en Anderen Naar het Noorden (1594-1597), Eerste Deel* ('S-Gravenhade, 1917), 51. Dagomar Degroot, 'Testing the Limits of Climate History: The Quest for a Northeast Passage During the Little Ice Age, 1594-1597', *Journal of Interdisciplinary History* XLV:4 (Spring 2015), 475. John F. Richards, *The World Hunt: An Environmental History of the Commodification of Animals* (Berkeley, 2014), 142. Louwrens Hacquebord, *De Noordse Compagnie (1614-1642): Opkomst, Bloei en Ondergang* (Zutphen, 2014), 11.

[20] Jonas Poole, 'Divers Voyages to Cherie Iland, in the yeeres 1604. 1605. 1606. 1608. 1609', in *Purchas His Pilgrimes Vol. 13*, 265. H. Hudson and J. Playse, 'Divers voyages and northerne discoveries of that worthy irrecoverable discoverer, Master Henry Hudson,' in *Henry Hudson the Navigator: The Original Documents in which his Career is Recorded* (London, 1860), 2. Hacquebord, Steenhuisen, and Waterbolk, 'English and Dutch whaling trade and whaling stations in Spitsbergen (Svalbard) before 1660', 117. Dagomar Degroot, 'Exploring the North in a Changing Climate: The Little Ice Age and the Journals of Henry Hudson, 1607-1611', *Journal of Northern Studies* 9:1 (2015), 78. Węsławski et al., 'Greenland whales and walruses in the Svalbard food web before and after exploitation', 42. William Martin Conway, *No Man's Land: A History of Spitsbergen From Its Discovery in 1596 to the Beginning of the Scientific Exploration of the County* (Cambridge, 1906), 33.

ships[21] approached Kongsfjordrenna (Figure 2) in May, Poole "found almost all the sounds full of Ice." The ice forced his ships from the coast and kept his whalers from pursuing bowheads, "although they saw divers." Weeks later, abundant sea ice forced a crew under Thomas Edge to beach one of the expedition's ships near Krossfjorden. When Poole and his crew loaded its supplies aboard their ship, they suddenly slid leeward and the ship abruptly sank. Rival walrus-hunters from Hull reluctantly rescued the survivors and returned them to England, emptyhanded. Amid extensive sea ice in 1611, English whalers generally suffered but for the most part helped one another.[22]

Although Poole and his crew spotted many bowheads near sea ice, they could not hunt far from the coast. After killing bowheads and stripping (or "flensing") the carcasses of their blubber, whalers of the early seventeenth century needed to haul the blubber to temporary furnaces (or "try pots") on the shore. There, they boiled the blubber into oil, poured the oil into barrels, and finally loaded the barrels aboard their ships. These techniques forced whalers to hunt in bays, and it was fortunate for them that many bowheads gathered there. Yet so did sea ice, given cold temperatures or persistent winds from the west or north.[23]

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[21] The expedition originally consisted of four ships. Sailors aboard one ship made for Novaya Zemlya far to the East, while others aboard a second ship searched for a Northern Passage to Asia. Only two ships were left to "kill the Whale" off Spitsbergen. Jonas Poole, 'A briefe Declaration of this my Voyage of discovery to Greenland', in *Purchas His Pilgrimes Vol. 14* (Glasgow, 1906), 38.

[22] Poole claimed that Thomas Marmaduke, captain of the Hull interlopers, at first "told us plainly, wee should not come aboard his ship, and caused Pikes and Launces to bee brought to keep us out." But Edge prevailed on Marmaduke to let the survivors aboard. Poole, 'A briefe Declaration of this my Voyage of discovery to Greenland', 38. Thomas Edge, 'Greenland first discovered by Sir Hugh Willoughbie', in *Purchas His Pilgrimes Vol. 13,* 12. Conway, *No Man's Land,* 47. William Martin Conway, *Early Dutch and English Voyages to Spitsbergen in the Seventeenth Century* (London, 1902), 3. Richards, *The World Hunt,* 130. J. M. Węsławski, et al., 'Greenland whales and walruses in the Svalbard food web before and after exploitation', *Oceanologia* 42:1 (2000): 38. Fauria et al., 'Unprecedented low twentieth century winter sea ice extent in the Western Nordic Seas since AD 1200', 782. McKay and Kaufman, 'An extended Arctic proxy temperature database for the past 2,000 years', 140026. Hacquebord, *De Noordse Compagnie,* 13.

[23] Louwrens Hacquebord and Dag Avango, 'Settlements in an Arctic resource frontier region', *Arctic Anthropology* 46:1-2 (2009), 26. Avango and Hacquebord, 'Industrial extraction of Arctic natural resources since the sixteenth century', 18. L. Hacquebord, F. Steenhuisen, and H. Waterbolk, 'English and Dutch whaling trade and whaling stations in Spitsbergen (Svalbard) before 1660', *International Journal of Maritime History* 15 (2003), 118.

The Muscovy Company dispatched a second expedition to Spitsbergen in 1612, a cold year in the far north. Sea ice lay thick across the Western Nordic Seas (the sea region roughly between Greenland and Spitsbergen), but seems to have been sparse in the vicinity of Spitsbergen for at least some of the summer.[24] Soon after Muscovy Company whalers arrived off the island, they encountered foreign competition for the first time. In Bellsund, they chased away a Dutch ship captained by Willem Corneliszoon van Muyden, and in Forland-sundet they confronted two English interlopers (Figure 2). Open water allowed whalers to confront one another in bays across the entire west coast of Spitsbergen. Nevertheless, Muscovy Company whalers met with modest success, killing 17 whales and rendering them into 180 barrels of oil.[25]

The Muscovy Company responded to rival whalers by winning a charter from King James I that granted it exclusive rights to whaling around Svalbard. The Company accordingly dispatched seven ships to Spitsbergen in the summer of 1613, a fleet that included the warship *Tiger.* Temperatures across the Arctic were warmer than they had been in previous years, and whalers reported open seas. Extensive sea ice would have forced crews to change course on their way to Spitsbergen, but the way was clear.[26]

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[24] In May, Poole reported that "the Sounds" were full of ice, and that ice covered the ships they had wrecked in the previous year. Yet in June he spotted ice retreating from the coast in an easterly wind, and there was apparently not enough ice to prevent Marmaduke from exploring far to the north. In July, however, storms and sea ice again threatened the expedition. Overall, 1612 seems to have been a year of average sea ice around Svalbard, in the context of the Grindelwald Fluctuation. Jonas Poole, 'A Relation written by Jonas Poole of a Voyage to Greenland', in *Purchas His Pilgrimes Vol. 14,* 44.

[25] They boiled blubber into oil "with much difficultie," Edge wrote, "as not being experimented in the businesse." Poole, 'A Relation written by Jonas Poole of a Voyage to Greenland', 47. Edge, 'Greenland first discovered by Sir Hugh Willoughbie', 15. Thomas Edge, 'A briefe narration of the discoverie of the northerne seas.' Notes from Martin Conway, Collection of Notes and Printed Items on the History of Spitzbergen & its Exploration. Reference code: SSC/23. Archives of the Royal Geographical Society, London. Hacquebord, Steenhuisen, and Waterbolk, 'English and Dutch whaling trade and whaling stations in Spitsbergen (Svalbard) before 1660', 119. Schokkenbroek et al., *Trying Out,* 27. William Martin Conway, *Early Dutch and English Voyages to Spitsbergen in the Seventeenth Century* (London, 1902), 4. Hacquebord, *De Noordse Compagnie*, 15.

[26] Master William Baffin, who served in the Muscovy Company fleet and kept a journal, only once reported extensive sea ice in 1613: on 18 June at the entrance of Grønfjorden off Isfjorden. Even then, the whalers thought they could find a way through. William Baffin, 'A Journal of the Voyage made to Greenland with five English Ships and a Pinnasse', in *Purchas His Pilgrimes Vol. 14,* 53. Conway, *No Man's Land,* 53. Fauria et al., 'Unprecedented

Despite their charter, Muscovy Company whalers confronted a wave of new and old rivals at Spitsbergen. Dutch cities collectively dispatched three whaling ships and two walrus-hunting sloops to the island. Like the English, the Dutch depended on temporary coastal installations to boil blubber. This time, Van Muyden carried a charter from Maurice of Nassau, *stadtholder* of all Dutch provinces except Friesland, that permitted Dutch whaling around Spitsbergen. Joining the Dutch were sailors in eight or more Basque ships, and English interlopers aboard at least one vessel.[27]

In early or perhaps mid-June, Benjamin Joseph and his crew in the *Tiger* encountered two Amsterdam vessels, piloted by Van Muyden, around Forland-sundet (Figure 2). After Joseph ordered the ships from Spitsbergen, Van Muyden instead sailed to Bellsund, where his crew started whaling. On 10 July, Joseph aboard the *Tiger* spotted them but decided against attacking until two additional Muscovy Company ships joined him on the 11th. Outgunned, the Dutch reluctantly surrendered their spoils and sailed home empty-handed.[28]

Other Dutch crews endured similar encounters with the *Tiger*, and only one completed a successful journey. Muscovy Company whalers, by contrast, returned with huge stores of oil and baleen hair.[29] After the whaling season, the Republic's governing body, the States-General, sent envoys to England to demand reparations, yet the Muscovy Company refused to make them.[30]

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low twentieth century winter sea ice extent in the Western Nordic Seas since AD 1200', 782. McKay and Kaufman, 'An extended Arctic proxy temperature database for the past 2,000 years', 140026.

[27] Conway, *No Man's Land,* 53. Hacquebord, *De Noordse Compagnie,* 16.

[28] Hessel Gerritszoon van Assum, 'History of the Country called Spitsbergen', in Conway, *Early Dutch and English Voyages to Spitsbergen in the Seventeenth Century*, 29. Conway, *No Man's Land,* 60. Richards, *The World Hunt,* 130.

[29] Though Edge wrote that Company sailors "neglected their owne voyage" by chasing after "Interlopers." Edge, 'Greenland first discovered by Sir Hugh Willoughbie', 16.

[30] Baffin, 'A Journal of the Voyage made to Greenland with five English Ships and a Pinnasse', 56. Conway, *No Man's Land,* 64. Schokkenbroek et al., *Trying Out*, 27.

The absence of sea ice in an unusually warm year, relative to prevailing conditions in the Grindelwald Fluctuation, promoted hostilities in 1613. Spitsbergen's bays were all open, and sailors aboard the *Tiger* could not enforce the Muscovy Company's claims to every bay at the same time. When Joseph demanded that crews from rival nations and companies leave Svalbard, they could simply travel out of sight to the next ice-free bay. After Joseph found them a second time, however, he was more inclined to attack than negotiate.

1614-1616: Cooling and Cooperation from Jan Mayen to Spitsbergen

After the summer of 1613, Dutch entrepreneurs asked the States-General for permission to form a stockholding company that would open offices in key maritime cities and unite Dutch whalers in the face of English aggression. In 1614, the States-General granted their request and offered a renewable monopoly to the new "Northern Company" for whaling in coastal waters between the Russian island of Novaya Zemlya and the Davis Strait in what is now northern Canada (Figure 1). The Company's whaling ambitions focused on the Greenland Fishery, and Dutch whalers had to join in order to establish coastal stations in the region.[31]

In the summer of 1614, the chambers of the Northern Company dispatched fourteen whaling ships and three heavily armed warships to Spitsbergen. Outnumbered for the first time, the Muscovy Company sent eleven ships and two smaller pinnaces.[32] Upon arriving, both fleets found the northern bays of Spitsbergen choked with ice. Average annual temperatures cooled

[31] Robert Fotherby, 'A Voyage of Discoverie to Greenland', in *Purchas His Pilgrimes Vol. 14,* 61. Conway, *No Man's Land,* 65. Schokkenbroek et al., *Trying Out*, 27. Hacquebord and Avango, 'Settlements in an Arctic resource frontier region', 26. Hacquebord, *De Noordse Compagnie,* 18.

[32] The voyage north was precarious. Sailors aboard two of these ships lost their way in a storm, while sea ice entirely enclosed the rest of the fleet for several days. Fotherby, 'A Voyage of Discoverie to Greenland', 62.

sharply across Europe and the Arctic in 1614, a cold year even in the context of the Grindelwald Fluctuation. Whalers and soldiers aboard two large fleets now vied for resources that they could only access in a few ice-free bays. Rather than fight, leaders of the Muscovy and Northern Company fleets grudgingly agreed to settle in different bays and cooperate to drive away Basque or English interlopers. By shrinking the space in which whalers could pursue their prey and restricting access to shore facilities, chilly conditions typical of the Grindelwald Fluctuation forced whalers to make a quick choice between cooperation and all-out conflict. In an already threatening environment, Dutch and English whalers chose the safer option, working together to earn the largest profits they could.[33]

Meanwhile, the Northern Company dispatched an expedition to find new land that its whalers could use without fear of English interference. When the expedition could make no headway north of Spitsbergen, its sailors followed the edge of the pack ice west until they spotted Jan Mayen. Their sighting awakened the Northern Company to the existence of an island not far from Spitsbergen that also offered rich possibilities for whaling. Prompted in part by thick sea ice that in effect joined Spitsbergen to Jan Mayen, the sighting would shape the subsequent course of hostilities in the Greenland Fishery.[34]

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[33] Those profits may not have been high: with so many ships in just a few bays, each whaling crew did not catch many whales. Edge, 'Greenland first discovered by Sir Hugh Willoughbie', 17. Though the summer was cold overall, late August was very warm. Fotherby, 'A Voyage of Discoverie to Greenland', 79. 'Instructie voor Hillebrant Gerbrantsz. Quast', Register der Instructiën van de Staten-Generaal, 1611-1623, in Samuel Muller, *Geschiedenis der Noordsche Compagnie* (Utrecht, 1874), 372. Conway, *No Man's Land,* 69. Richards, *The World Hunt,* 131. Fauria et al., 'Unprecedented low twentieth century winter sea ice extent in the Western Nordic Seas since AD 1200', 782. McKay and Kaufman, 'An extended Arctic proxy temperature database for the past 2,000 years', 140026. Hacquebord, Steenhuisen, and Waterbolk, 'English and Dutch whaling trade and whaling stations in Spitsbergen (Svalbard) before 1660', 120.

[34] Fotherby, 'A Voyage of Discoverie to Greenland', 65. Conway, *No Man's Land,* 79. Joris Carolus, 'Stierman Caertschryver tot Enkhuizen', in William Martin Conway, *A Collection of Tracings and Charts of Spitsbergen: Representing the Advancement of Discovery there from 1596* (London, 1901). Hacquebord, *De Noordse Compagnie,* 21.

In 1615, the Northern Company's ships again outnumbered those of the Muscovy Company off Spitsbergen, though some sailed for Jan Mayen. Ships in both fleets struggled to reach the Arctic. While 1615 was milder in the Arctic than 1614 had been, it was colder than 1613, and on average icier in the Western Nordic Seas than it had been since 1611. For two weeks, sea ice trapped a Muscovy Company fleet off Spitsbergen. A Dutch whaling logbook reported that thick sea ice forced a crew to change course on 7 June, well before they reached Spitsbergen. On the 10th and 17th they collided with sea ice, badly damaging their ship's hull, anchor, and rudder. They finally left the ice behind on the 23rd, but it would take nearly a month to repair the ship, and they would not kill their first whale until July 5th. Sea ice typical of the Grindelwald Fluctuation had in effect shortened the length of time available for them to compete with English whalers off Spitsbergen.[35]

The Muscovy Company had occupied Bellsund in 1614, but in 1615 Dutch whalers built what they hoped would be a permanent warehouse there to store equipment and supplies. Despite that provocation, the English and Dutch did not come to blows. By shortening the coastal whaling season and restricting access to the bays of western Spitsbergen, extensive sea ice seems to have convinced whalers to set their differences aside and focus on whaling.[36]

Nevertheless, in the following year the merchants of the Northern Company decided to avoid competition with the Muscovy Company by dispatching most of their whalers and escorts to Jan Mayen. If they could not kill enough whales there, crews aboard four ships would follow

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[35] 'Journaal van een Groenlandvaarder, 1615', 0120 Oud archief stad Enkhuizen 1353-1815 (1872), Westfries Archief, Hoorn. Conway, *No Man's Land,* 83. Robert Fotherby, 'A true report of a Voyage Anno 1615', in *Purchas His Pilgrimes Vol. 14,* 83. Edge, 'Greenland first discovered by Sir Hugh Willoughbie', 17.

[36] Conway, *No Man's Land,* 84. 'Remonstrance of States General touching Greenland, 1615', State Papers Holland. SP 84/93, National Archives, Richmond. 'States General to James I. - answer concerning Greenland, and another copy, 1615', SP 84/71/41, National Archives, Richmond. Conway, *Early Dutch and English Voyages to Spitsbergen in the Seventeenth Century*, 39. Hacquebord, Steenhuisen, and Waterbolk, 'English and Dutch whaling trade and whaling stations in Spitsbergen (Svalbard) before 1660', 120.

the bowhead migration to Spitsbergen, and one would occupy the warehouse in Bellsund. If the English resisted, the crew would send for a Dutch warship, whose marines would seize the warehouse by force.[37]

Average temperatures across the Arctic were warmer in 1616 than they had been since the start of the century, yet strangely sea ice in the Western Nordic Seas was also more extensive than it had been since then. The contrast between warm temperatures on a very large scale, and heavy sea ice – likely caused by cool sea surface or air surface temperatures – on a smaller, regional scale delayed Dutch attempts to reach Jan Mayen by several weeks. Yet when the whalers finally arrived off its icy coast in June, they immediately killed whales in large numbers. Then, on the 15th, 16th, and 24th, whalers aboard Muscovy Company ships appeared off Jan Mayen. Dutch officers quickly granted them permission to pursue whales. The coast of Jan Mayen had fewer accessible bays than Spitsbergen, especially in years of extensive sea ice, and the island's small size probably meant that whales congregated densely off its coast. Whalers had to hunt in even closer proximity to each other – and to sea ice – than they did around Spitsbergen, but if they avoided conflict most could quickly make their voyage. Once again, in cramped, icy conditions the Dutch and English decided to hunt alongside each other rather than come to violence.[38]

Yet not every Dutch crew made their voyage in 1616. In late summer, four Northern Company ships sailed for Spitsbergen. One arrived in Bellsund, where its crew found that the English had repositioned their warehouse and appropriated its supplies. They had no warship to

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[37] Conway, *No Man's Land,* 92. 'Concept-Instructie voor Jan Jacobsz. Schrobop als commandeur-generaal van het konvooi ter verdediging der walvischvaarders in 1616', and 'Instructie waer naer Capiteyn Jan Jacobsz. Schrobop', in Muller (ed.)., *Geschiedenis der Noordsche Compagnie*, 373-377.

[38] 'Journaal van een tocht naar Groenland en Spitsbergen met het schip "de Hoop" en schipper Heertgen Jansen van Enkhuizen, 1616', 0120 Oud archief stad Enkhuizen 1353-1815 (1872), Westfries Archief, Hoorn. Fauria et al., 'Unprecedented low twentieth century winter sea ice extent in the Western Nordic Seas since AD 1200', 782. McKay and Kaufman, 'An extended Arctic proxy temperature database for the past 2,000 years', 140026.

call on, however, since the Dutch fleet had already set sail for the Republic. Had sea ice been less extensive in 1616, the whaling season would have started earlier, a Northern Company ship would have arrived in Bellsund with time to spare, and violence may well have erupted between the Dutch and English off Spitsbergen.[39]

1617-1618: Retreating Sea Ice and Rising Violence off Spitsbergen

In the following year, most of the Dutch whaling fleet again made for Jan Mayen. Yet midway through May, captain Cornelius de Cooke and a crew aboard a ship from the Dutch province of Zeeland arrived off Spitsbergen, where a large Muscovy Company fleet soon found them. Both English and Dutch sailors had made an unusually early landfall. It was only slightly less icy across the Western Nordic Seas than it had been in 1616, but sea ice seems to have been sparse around Svalbard. The NAO also entered a much more strongly negative position than it had reached since the beginning of the Grindelwald Fluctuation. With the usual flow of westerly winds disrupted, easterlies may have pushed sea ice away from the western coast of Spitsbergen.[40]

Although Thomas Edge aboard the Muscovy Company flagship warned the Dutch to leave Spitsbergen, they soon entered Hornsund and there joined crews aboard two more Zeeland ships. On 1 June, whalers aboard a Muscovy Company vessel arrived in the bay and argued with

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[39] Conway, *No Man's Land,* 92. Conway, *Early Dutch and English Voyages to Spitsbergen in the Seventeenth Century*, 40. Hacquebord, Steenhuisen, and Waterbolk, 'English and Dutch whaling trade and whaling stations in Spitsbergen (Svalbard) before 1660', 120. Edge, 'Greenland first discovered by Sir Hugh Willoughbie', 18.
[40] Conway, *No Man's Land,* 102. Conway, *Early Dutch and English Voyages to Spitsbergen in the Seventeenth Century*, 40. Ortega et al., 'A model-tested North Atlantic Oscillation reconstruction for the past millennium', 72. Fauria et al., 'Unprecedented low twentieth century winter sea ice extent in the Western Nordic Seas since AD 1200', 782. McKay and Kaufman, 'An extended Arctic proxy temperature database for the past 2,000 years', 140026. Hacquebord, *De Noordse Compagnie,* 19.

the Dutch. The problem lay in the strange behavior and perhaps culture of the bowheads. Whalers reported that bowheads travelled in pods of no more than four animals, within larger groups that could number in the hundreds. A bowhead pod would scatter when whalers attacked one of its whales, but the larger group would carry on as though nothing had happened. Whalers found that they could carefully exploit bowhead behavior in ice-free bays by attacking only whale pods that seemed about to leave the bay. The rest of the whales would then carry on feeding. If, however, competing whalers killed bowheads in different parts of the same bay, many pods would scatter, and many whales would escape the bay. Distinct bowhead behaviors therefore encouraged disputes between whalers hunting in the same bay.[41]

The Muscovy Company whalers soon sent a message to Edge, who dispatched a warship under the command of William Heley. Yet for weeks, persistent winds – likely from the southeast – slowed the ship and kept it from reaching Hornsund. At last, in late July word reached De Cooke that Heley and his marines would soon arrive. By then, the Dutch had fully loaded two ships with all the oil they could handle, and De Cooke led them out of Hornsund. Yet the crew of the third ship could not load their barrels on time. They had no choice but to surrender their spoils when Heley and his marines arrived in Hornsund.[42]

In 1617, ice-free seas again allowed English crews to chase their Dutch rivals around Spitsbergen, while letting the Dutch temporarily escape to new harbors. Since most of the

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[41] Conway, *No Man's Land,* 196. In March 2018 e-mail correspondence, marine biologist Mads Peter Heide-Jørgensen (Greenland Institute of Natural Resources) confirmed that these are likely behaviors of the bowhead whale.

[42] Heley also chased away an interloping English ship ("bad weather" kept him from capturing it) and would have attacked two Danish ships, had they not departed before he could reach them. 'Twee getuigenissen van deelnemers aan de reis ter walvischvangst van 1617', in Muller (ed.)., *Geschiedenis der Noordsche Compagnie*, 404-406. Zorgdrager, *Bloeijende opkomst der aloude en hedendaagsche Groenlandsche visschery*. Edge, 'Greenland first discovered by Sir Hugh Willoughbie', 19. William Heley, 'Divers other Voyages to Greenland, with Letters of those which were their employed', in *Purchas His Pilgrimes Vol. 14,* 92. Conway, *No Man's Land,* 101. Conway, *Early Dutch and English Voyages to Spitsbergen in the Seventeenth Century*, 40. Hacquebord, *De Noordse Compagnie,* 22.

Northern Company fleet had traveled to Jan Mayen, the Dutch again found themselves outnumbered at Spitsbergen, and English sailors exploited this advantage. Persistent southeasterly winds, likely enabled by the state of the NAO, only worsened the disparity in numbers and perhaps encouraged hostilities between the English and Dutch. By delaying the *Dragon,* the winds allowed crews aboard two Dutch ships to escape. Three Dutch vessels would have outnumbered Heley, however, and perhaps kept him from ordering an attack.

When the summer whaling season came to a close in 1617, the States-General again demanded compensation from the Muscovy Company, but again to no avail. In the following spring, the directors of the Northern Company therefore dispatched no fewer than twenty-three ships to Svalbard and nineteen to Jan Mayen. The Muscovy Company sent just thirteen ships and two pinnaces to Svalbard, which meant that its employees found themselves outnumbered in nearly every bay. Only at Bellsund did the Muscovy Company have the advantage. There, whalers aboard three or four English ships shared the bay with one or two Northern Company vessels.[43]

Sea ice in the Western Nordic Seas was less extensive in 1618 than it had been in the previous year. The NAO reached an even more negative state, and perhaps easterly winds pushed ice away from some of Spitsbergen's shores. Yet temperatures across the broader Arctic were colder than they had been since 1615, and whalers reported plenty of sea ice along the northwestern coast of Spitsbergen. Once again, the Grindelwald Fluctuation unfolded in different ways on different geographic scales. At Smeerenburgfjorden, sea ice kept Muscovy Company whalers from going out to sea for nearly three weeks. Dutch whalers may have stolen one of their slaughtered whales, but sea ice had surrounded the Dutch and kept the English from reaching

[43] Conway, *No Man's Land,* 107.

them. In effect, the ice had frozen whaling operations at Smeerenburgfjorden and halted hostilities that might have erupted there.[44]

Very different circumstances prevailed in Spitsbergen's southern bays. Edge struck first by evicting Dutch whalers from Bellsund. When these whalers arrived in Hornsund, they encouraged Northern Company officers stationed there to avenge the losses of 1617. Many Dutch whalers now sailed for Forland-sundet, where they knew Heley led a Muscovy Company crew. Heley and his sailors had killed plenty of whales, but thick sea ice kept them from hauling blubber to the coast. The ice may have delayed the entry of Dutch whalers into Forland-sundet, but by late July at least six Northern Company ships had made it in. At last, on 19 August, crews aboard five Dutch vessels opened fire, killing one Muscovy Company sailor, injuring many others, and badly damaging Heley's ship. The Dutch seized its cargo and delivered it to the four offices of the Northern Company.[45]

Off Spitsbergen, the hostilities of 1618 unfolded in a cold year with moderate sea ice, which left some bays open and others closed or partly closed for different lengths of time. Whalers' responses to sea ice from bay to bay clearly reveal how environments shaped by weather and prevailing climatic conditions influenced violence in the Arctic. Where the ice was thick and widespread, whalers dependent on shore facilities either could not catch bowheads or

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[44] James Beversham, 'A Letter of James Beversham to Master Heley', in *Purchas His Pilgrimes Vol. 14,* 96. Conway, *No Man's Land,* 107. Ortega et al., 'A model-tested North Atlantic Oscillation reconstruction for the past millennium', 72. Fauria et al., 'Unprecedented low twentieth century winter sea ice extent in the Western Nordic Seas since AD 1200', 782. McKay and Kaufman, 'An extended Arctic proxy temperature database for the past 2,000 years', 140026.

[45] Robert Salmon, 'A Letter of Master Robert Salmon to Master Sherwin', in *Purchas His Pilgrimes Vol. 14,* 94. Edge, 'Greenland first discovered by Sir Hugh Willoughbie', 23. Thomas Edge, 'At Bellsund", and John Johnson, William Dridle, and William Henderson, 'At Hornsund', in Conway, *Early Dutch and English Voyages to Spitsbergen,* 65. 'Deposition concerning the Greenland fisheries, 1619', State Papers Holland, SP 84/93, National Archives, Richmond. 'Mem. of what happened in Greenland, 1618', State Papers Holland, SP 84/85, National Archives, Richmond. 'Note on Dutch attacks on the English in Greenland, 1618', and 'Representations of the Muscovy Co. against the Dutch, 1618', SP 84/87, National Archives, Richmond. Conway, *No Man's Land,* 120.

could not boil blubber, and they could not approach rival whalers. Where there was no sea ice, whalers could travel freely. Once again, open water allowed Dutch whalers to linger off Spitsbergen even after English sailors forced them to leave one of its bays. This time, their numbers allowed them to exploit open water to organize a counterattack, although their target – Heley – whaled in a bay just north of Spitsbergen's ice-free southern coast. The Dutch could only begin to harass his crew once sea ice had retreated from that bay. Had it been colder and icier, hostilities might not have erupted at all.

In the first decade of whaling around Svalbard and Jan Mayen, sea ice in cold weather usually discouraged conflict between whalers from rival companies and countries. Sometimes it literally separated whalers in different companies from one another; other times it dramatically reduced the amount of space in which whalers could hunt, and thereby encouraged them to work together. By contrast, when winds or warm temperatures led to open seas around the coast of western Spitsbergen, hostilities repeatedly erupted between whalers and escorts. Paradoxically, open seas often provoked conflict by allowing whalers to escape the threat of violence. When officers aboard escorting warships found them in another harbor, they were less likely to let them go with a warning.

Colonizing the Arctic in a Cooling Climate

After Heley and his crew returned home emptyhanded, it was the Muscovy Company's turn to demand restitution. The States-General pressed for an agreement between England and the Dutch Republic that would regulate the Greenland Fishery and divide the bays of western Spitsbergen between the Muscovy and Northern Companies. In July 1619, James I instead

maintained his claim to Spitsbergen – although he promised not to enforce it for three years – and demanded that the Northern Company pay damages to the Muscovy Company. Since the Dutch fleet outnumbered the neglected English fleet, however, James had no way of enforcing his ruling. In practice, from 1619 the Northern and Muscovy Companies accepted their claims to different parts of Svalbard. The Northern Company confined itself to Amsterdamøya, where its employees built a permanent camp called Smeerenburg ("blubber town"). The Muscovy Company constructed permanent stations at Isfjorden, Bellsund, and Hornsund. The second stage of the Greenland Fishery had begun.[46]

Fig. 4. A Dutch representation of Smeerenburg in its prime, based on another painting that showed Danish whaling infrastructure on nearby Danskøya. Cornelis de Man, Traankokerijen bij het dorp Smerenburg (1639), Rijksmuseum Amsterdam.

Although the Muscovy Company had seemingly triumphed by claiming Spitsbergen, it soon grew obvious that the new arrangement favored the Northern Company. Since the edge of the summer pack ice lingered near Amsterdamøya, more whales gathered there than entered

[46] Conway, *No Man's Land,* 120. Hacquebord, *De Noordse Compagnie,* 23.

Spitsbergen's southern bays. The shallow beach at Smeerenburg, meanwhile, allowed the Dutch to flense whales on the shore (Figure 4). They no longer had to wait for decomposing bowheads to surface, and they no longer had to row blubber to land. Workers quickly constructed innovative furnaces at Smeerenburg that allowed them to boil more and better-quality oil than the whalers of the Muscovy Company could. As Smeerenburg expanded, carpenters replaced tents with wooden cottages and finally brick buildings that included a blacksmith shop, a chapel, and a bakery. Ultimately, more than a thousand sailors stayed at the settlement every summer. The Company's encampments on Jan Mayen never reached that size, yet for a while they processed so much whale oil that sailors used a special ship to ferry excess oil back and forth from the island to the Republic. Overall, by constructing Smeerenburg and fully occupying Jan Mayen, Dutch whalers greatly increased the efficiency with which they flensed whales and cooked blubber.[47]

While the Muscovy Company largely accepted the new arrangement, tensions were slow to ease. James again pressed his claims in 1622, English sailors briefly kept Dutch crews from whaling in 1624, and in 1625 the Muscovy Company so insisted on payment for the outrages of 1618 that it briefly provoked talk of war between England and the Dutch Republic. James, however, ultimately prioritized a new alliance with the Dutch Republic against Habsburg Spain over the Muscovy Company's demands for compensation. Therefore, violence no longer broke out between the Northern and Muscovy Companies. Shifting environmental conditions off Spitsbergen could only provoke hostilities in the right political circumstances.[48]

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[47] Hacquebord, Steenhuisen, Waterbolk, 'English and Dutch whaling trade and whaling stations in Spitsbergen (Svalbard) before 1660', 132. Avango, Hacquebord, and Wråkberg, 'Industrial extraction of Arctic natural resources since the sixteenth century', 19. Avango et al., 'Between markets and geo-politics', 31. Richards, *The World Hunt,* 132. Hacquebord, *De Noordse Compagnie,* 23. G. Jackson, *The British Whaling Trade*, 2nd Ed. (St. John's, 2015), 47.

[48] Nathaniel Fanne, 'Laus Deo in Faire-Haven', in *Purchas His Pilgrimes Vol. 14,* 103. Conway, *No Man's Land,* 140.

Yet for both companies, the new system of permanent camps had one glaring weakness. Just before and after the summer whaling season, enterprising interlopers could theoretically find their way to the camps and seize the valuable equipment and commodities that the Northern and Muscovy Companies had stored there, as long as sea ice did not block their way to the coast. Both companies defended their encampments with forts and cannons, but of course these were useless if deserted. Already in 1617, Heley hoped to intercept Dutch vessels not only to keep them from interfering with Muscovy Company whalers, but also to prevent them from seizing the "good store" of oil and blubber that Company whalers had left behind on the coast. After that summer, the Company's directors planned to permanently colonize the bays of western Spitsbergen so they could be defended year-round. In November 1617, John Meyrick, England's ambassador to Russia, even secured a license from a Russian delegation to hire "subjects" of the Tsar "called Lappes, a people lyveinge in a very cold climate and a barraine soyle." The Laplanders would teach English whalers how to survive the Arctic winter. When this scheme came to nothing, the directors of the Muscovy Company offered rich rewards for any whalers who agreed to attempt an overwintering on Spitsbergen. Nobody volunteered.[49]

In 1619, entrepreneurs founded new companies in Denmark and France that imperiled the fragile peace at Svalbard. The Northern Company permitted the nascent Copenhagen Company to whale from Danskøya (Danes Island), just south of Amsterdamøya (Figure 2), but only if Danish whalers used Danish ships. When the Copenhagen Company dispatched two Basque ships in 1623, both Northern and Muscovy Company officers turned them away. Meanwhile, the

[49] Company whalers may have gained a keen appreciation for the dangers of frigid Arctic weather after shallops and whaling ships foundered amid extensive sea ice in the cold years of 1619 and 1622. Edward Pelham, *Gods Power and Providence* (London, 1631), 9. Letter from John Chamberlain, Letter from Gerard Herbert, SP 14: Secretaries of State: State Papers Domestic, James I, 1603-1640. Heley, 'Divers other Voyages to Greenland', 92. John Chambers, 'A Letter of John Chambers to W. Heley', in *Purchas His Pilgrimes Vol. 14,* 98. Edge, 'Greenland first discovered by Sir Hugh Willoughbie', 25. Conway, *No Man's Land,* 104, 126.

Muscovy Company took legal action to keep interloping whalers from sailing to Spitsbergen. After years of harassment, whalers from Hull and York finally managed to send nine ships to Spitsbergen in 1626, a year of relatively mild temperatures across the Arctic and around Svalbard, with minimal sea ice in the Western Nordic Seas. The interlopers outraced the Muscovy Company fleet to Spitsbergen and entered Bellsund, where open water allowed them to reach the whaling station on the coast. They sacked the station and damaged all the equipment stored there, then made for a nearby island. Soon after, sailors in a Muscovy Company fleet arrived in the bay and confronted the interlopers. Legal wrangling between the Muscovy Company and its English rivals would drag on for years. All the while, the threat of another raid lingered.[50]

The directors of the Muscovy Company therefore resurrected the idea of colonizing Spitsbergen's bays. To recruit an overwintering crew, they offered pardons to condemned criminals, but still none agreed to stay.[51] Then, at the end of the 1630 whaling season, sea ice and northeasterly winds prevented whalers aboard a shallop from rowing back to their ship, which then set sail and left them marooned at Bellsund. The year was quite cold across the Arctic, even in the context of the Grindelwald Fluctuation, and sea ice might have been fairly abundant around the coast of Spitsbergen. The crew managed to survive winter by constructing a hut within the warehouse the Muscovy Company had earlier seized from the Northern Company, and by killing enough polar bears and gulls to hold off scurvy.[52]

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[50] Fanne, 'Laus Deo in Faire-Haven', 104. Conway, *No Man's Land,* 143.

[51] According to Pelham, the Company did eventually find some willing volunteers. Yet when its whaling fleet prepared to depart Spitsbergen in late summer, these prisoners, "taking a view of the desolatenesse of the place . . . conceived such a horrour and inward feare in their hearts" that they preferred to face their sentence in England rather than attempt an overwintering. Pelham, *Gods Power and Providence,* 10.

[52] Pelham, *Gods Power and Providence,* 32. Ortega et al., 'A model-tested North Atlantic Oscillation reconstruction for the past millennium', 72. Fauria et al., 'Unprecedented low twentieth century winter sea ice extent in the Western Nordic Seas since AD 1200', 782. McKay and Kaufman, 'An extended Arctic proxy temperature database for the past 2,000 years', 140026.

The accidental success of the deserted crew did not inspire the directors of the Muscovy Company to recruit new volunteers. However, in the following year, Basque sailors banned from Hollandse Bay waited for the Northern Company fleet to leave Jan Mayen and then sacked the Northern Company's settlement on that island. Although 1631 was, on average, very cold across the Arctic, ice cores suggest that the summer was warm around Svalbard. In any case, sea ice was in short supply in the Western Nordic Seas, and the Basque whalers likely found it easy to reach the coast. In response, the directors of the Northern Company resolved to send two groups of seven volunteers to both Jan Mayen and Amsterdamøya. By overwintering, they would defend the Company's infrastructure from costly raids and gather potentially valuable information about the polar environment. Since the marooned English crew had published a popular account of their overwintering at Bellsund, the Company had little trouble attracting volunteers. In August 1633, two teams prepared to overwinter at Jan Mayen and Smeerenburg.[53]

Yet the threat of Basque piracy would expose these volunteers to the worst extremes of a cooling climate. Warm years at Svalbard and ice-free years across the Western Nordic Seas had permitted raids that depended on easy access to the shores of Jan Mayen and Amsterdamøya. However, across the Arctic temperatures outside of summer in particular gradually cooled during the early 1630s, and sea ice grew more extensive around Svalbard. Worse, a shift to a strongly positive NAO brought persistent westerly winds, and with them frequent storms and abundant sea ice, to the western coasts of both Spitsbergen and Jan Mayen.[54]

After 20 September, overwintering whalers at Jan Mayen considered themselves safe from Basque raiders and therefore removed gunpowder from their cannons. Yet before long,

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[53] Conway, *No Man's Land,* 169.
[54] Ortega et al., 'A model-tested North Atlantic Oscillation reconstruction for the past millennium', 72. Fauria et al., 'Unprecedented low twentieth century winter sea ice extent in the Western Nordic Seas since AD 1200', 782. McKay and Kaufman, 'An extended Arctic proxy temperature database for the past 2,000 years', 140026.

bitterly cold, snowy weather hindered their attempts to hunt reindeer and polar bears, depriving them of the fresh meat they needed to resist scurvy. In April, whales appeared off the coast but remained tantalizingly out of reach beyond sea ice, and by early May the last volunteers had died. The Northern Company fleet would not arrive until 4 June. In a warmer year, it might have reached Jan Mayen in time to save the overwintering crew.[55]

The team at Smeerenburg fared much better. Like their colleagues on Jan Mayen, they prepared to confront Basque pirates in September. Yet their plans for resisting Basque raids, as in much else, showed more foresight than those of the Jan Mayen whalers. On 2 September, commander Jacob Segersz. van der Brugge wrote in his journal that his crew would respond to Basques appearing on the horizon by lighting fires in every building, making as much noise as they could, waving flags, and firing cannons, all to complete the illusion that the Northern Company had left Smeerenburg fully inhabited. With luck, the Basques would turn away.[56]

The whalers at Smeerenburg also rowed to Spitsbergen in search of "scurvy-grass:" shrubs rich in vitamin C and therefore good medicine against scurvy. Despite frigid, snowy weather and thick sea ice, they eventually found an abundant supply, which in turn gave them the strength and energy they needed to hunt. For months, they braved relentless blizzards to kill more than enough walruses, reindeer, polar bears, and gulls to preserve their health. Time and again, storms and thick sea ice nearly killed sailors as they chased their prey or climbed prospects that could afford a good view of ice or whales at sea. Stormy winds repeatedly threatened to blow down their shelter, and ice crept through the door to the edge of a fire they kept burning. Van der Brugge bitterly complained that the Northern Company had not done

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[55] *Twee Journalen, Het Eerste gehouden by de Seven Matroosen op her Eyland Mauritius/in Groenlandt/In den Jare 1633 en 1634. in haer Overwinteren/doch sijnal t'samen gestorven: En her tweede gehouden by de Seven Matroosen, die op Spitsbergen Zijn Overwintert....* (Amsterdam, 1635), 17.
[56] Conway, *No Man's Land,* 173.

enough to insulate their cottage against the cold. Fortunately, warm, southwesterly depressions occasionally provided a reprieve from even the chilliest winter weather. The crew not only survived through May but in fact sent a gift of scurvy grass and reindeer to the captain of the first whaling ship that pulled into Hollandse Bay that spring.[57]

The different fates of overwintering sailors at Jan Mayen and Smeerenburg reveal that local environmental conditions, shaped in part by broad climatic trends, did not simply determine the course of human affairs. Unfortunately, the directors of the Northern Company drew a rather different conclusion. They decided that Van der Brugge and his crew owed their survival to the air of Svalbard, which they wrongly judged to be healthier than that of Jan Mayen. In the following winter, the Company therefore left a crew at Smeerenburg but not Jan Mayen. Temperatures were cold across the Arctic, but not as cold as they had been, and sea ice may have been slightly less abundant across the Western Nordic Seas. Nevertheless, the whalers at Smeerenburg could not find scurvy-grass, and all died before the onset of winter. After their demise, whaling companies no longer attempted to colonize the Arctic. Amid the cold, icy, stormy weather of the late Grindelwald Fluctuation, even the risk of piracy could not justify expensive and often suicidal attempts at overwintering in Svalbard.[58]

The Maunder Minimum and the Rise of Privateering at Sea

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[57] Jacob Segersz van der Brugge, *Journael, of dagh-register, gehouden by seven matroosen*…. (Amsterdam, 1665), 45.

[58] Especially after Spanish sailors sacked St. Jean de Luz, hotbed of Basque whaling, in 1636. *Twee Journalen*, 23. Conway, *Early Dutch and English Voyages to Spitsbergen in the Seventeenth Century*, 172. Conway, *No Man's Land,* 183.

After 1634, the Grindelwald Fluctuation gradually faded across the Arctic. Average annual temperatures rose unsteadily, fell to another low in 1651, and then climbed steadily, reaching a high in 1665. Summer temperatures around Svalbard, meanwhile, stayed warm until at least 1645. Sea ice in the Western Nordic Sea declined sharply after 1621, but started rising modestly in the 1630s and actually peaked in 1645 before falling dramatically and reaching lows in 1656 and 1661. The NAO, meanwhile, gradually reached stronger positive values in the 1630s, peaked from 1642 to 1644, and then descended into alternating weakly negative and weakly positive states. Finally, the Maunder Minimum reached the Arctic in the 1660s. Average annual temperatures fell across the region, summers around Svalbard remained cool, sea ice expanded dramatically over the Svalbard marine ecosystem, and the NAO plunged into a deeply negative phase.[59]

Spurred partly by these trends, bowhead whale behavior changed profoundly across the Greenland Fishery. Because bowheads suffer from heat stress in warm water, many whales followed the edge of the pack as it retreated from Spitsbergen and Jan Mayen, which meant that there were often fewer to hunt near the Northern Company's coastal settlements. Yet even before the Grindelwald Fluctuation ended in the far north, whalers reported that bowheads were learning to avoid those settlements. Already in 1619, whalers reported that rising activity in Hollandse Bay discouraged some bowheads from feeding there, and by the 1630s they noticed

[59] Ortega et al., 'A model-tested North Atlantic Oscillation reconstruction for the past millennium', 72. Fauria et al., 'Unprecedented low twentieth century winter sea ice extent in the Western Nordic Seas since AD 1200', 782. McKay and Kaufman, 'An extended Arctic proxy temperature database for the past 2,000 years', 140026. A. Tarussov, 'The Arctic from Svalbard to Severnaya Zemblya: Climatic reconstruction from ice cores', *Climate since AD 1500* (1992): 506. Louwrens Hacquebord, 'The hunting of the Greenland right whale in Svalbard, its interaction with climate and its impact on the marine ecosystem', *Polar Research* 18:2 (1999): 378. Torgny Vinje, 'Barents Sea ice edge variation over the past 400 years', in *Extended abstracts, Workshop on Sea-Ice Charts of the Arctic*. WMO/TD 949 (1999): 5.

that the whales had started to avoid their usual breeding grounds off Jan Mayen.[60] In the 1640s, new whaling companies based in France and Hamburg joined Dutch and Danish whalers on the northwestern tip of Svalbard, so that as many as 100 whaling ships gathered there in some summers. Yet by then, many surviving whales had stopped coming to the region. Even when summer sea ice returned in force with the coming of the Maunder Minimum, the whales did not. By staying at sea, bowheads had very quickly changed a culture that long hinged on annual migrations between islands, along routes passed down the generations from mothers to calves. Whalers even observed that many bowheads had become skittish and difficult to approach even at sea, while others learned to escape pursuit by swimming under the porous edge of the pack ice and surfacing behind it in unreachable pockets of water.[61]

Yet as bowheads adapted to climate change and the growth of the whaling industry, Dutch whalers responded. Beginning in the early 1620s, the Dutch took to sea in ships with hardened, greased hulls that could better withstand sea ice. By the 1630s, they also learned to flense whales far from the coast by dragging carcasses on or beside pack ice, and many had adopted a Basque method of boiling blubber at sea. Independent Dutch whalers used these methods to pursue whales in the open sea, circumventing the Northern Company's monopoly on coastal whaling. Meanwhile, a slight increase in the extent of sea ice across the Western Nordic Seas, combined with more frequent westerly winds associated with a persistently positive NAO, likely kept whalers from reaching the Jan Mayen coast just as whales started avoiding it. The

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[60] In 1619, 11 Northern Company ships gathered in Hollandse Bay. On 11 July, Maerten Remmertsz, skipper of a Dutch whaling ship, compared the bay to the port of Amsterdam, then perhaps the busiest in Europe. 'Journaal van een tocht naar Groenland en Spitsbergen door schipper Maerten Remmertsz, 1619', 0120 Oud archief stad Enkhuizen 1353-1815 (1872), Westfries Archief, Hoorn.

[61] Since bowhead whales can live for well over a century, these behavioral changes must have been learned. In March 2018 e-mail correspondence, Mads Peter Heide-Jørgensen considered these to be likely behavioral changes for bowhead whales. Conway, *No Man's Land,* 125, 138, 168. Zorgdrager, *Bloeijende opkomst der aloude en hedendaagsche Groenlandsche visschery.* Martens, 'Voyage into Spitzbergen and Greenland: Part the First', 12.

Northern Company's whalers quickly abandoned Jan Mayen altogether. Then, from 1642, many Dutch whalers began to skip the step of rendering blubber into whale oil. Instead, they transported blubber directly to efficient try-works in the Republic.[62]

English whaling companies did not adopt these innovations. Even in the coldest stretches of the Maunder Minimum, the climate of Svalbard never cooled to such an extent that sea ice consistently blocked the bays of Isfjorden, Bellsund, and Hornsund for the entire whaling season. English whaling in these bays therefore continued but remained relatively modest in scale, partly because the directors of the Muscovy Company feared chasing away the whales. As a result, both whales and English whalers across southern Spitsbergen retained their original cultures: bowheads continued to enter the bays, and English whalers of the seventeenth century never developed the technologies and techniques that allowed the Dutch to hunt in the open ocean. From 1655, the English whaling industry steadily declined.[63]

At the same time, the Dutch whaling industry grew explosively. Owing in part to the demise of coastal whaling, the States-General did not renew the Northern Company's monopoly in 1642. Small partnerships now dispatched ever more whaling ships to the Greenland Fishery. When regional warming, the changing state of the NAO, and shifting bowhead culture drew whales far from Svalbard, independent whalers used their new techniques and technologies to pursue them. Increasingly, they used Smeerenburg only to store equipment, load water and ballast, repair damaged ships, and assemble in convoys before returning to the Republic. When the Maunder Minimum set in and sea ice kept whalers from reaching Smeerenburg for much of

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[62] Conway, *No Man's Land,* 191. Dag Avango et al., 'Between markets and geo-politics', 31. Ortega et al., 'A model-tested North Atlantic Oscillation reconstruction for the past millennium', 72. Fauria et al., 'Unprecedented low twentieth century winter sea ice extent in the Western Nordic Seas since AD 1200', 782. McKay and Kaufman, 'An extended Arctic proxy temperature database for the past 2,000 years', 140026.
[63] Conway, *No Man's Land,* 201.

the whaling season, the settlement fell into disrepair. The seesaw of warming and cooling had helped transform the behavior of both whales and whalers across the Arctic.[64]

Most Dutch whaling crews attempted to congregate at summer's end because travelling in convoy provided a measure of safety from privateering and piracy on the open sea. Already in 1624, a crew aboard a Dutch whaling ship unwisely left Smeerenburg on their own – possibly to exploit whale oil prices that would have been high before the Northern Company convoy reached port – only to be captured by Dunkirk privateers. One year later, the directors of the Muscovy Company unsuccessfully called on the English fleet to seize Dutch whalers and thereby compensate them for their losses in 1618. In 1638, a dispute between the Danish and Dutch governments over the rising numbers of Dutch whalers at Smeerenburg led crews aboard Danish warships to briefly hold two Dutch whaling ships. Yet it was only with the rise of open sea whaling that privateering far from the coast became the main way in which violence between humans affected the Arctic whaling industry.[65]

Hostilities of this kind tied Arctic whaling into naval wars that raged with special fury in European waters but also involved sailors and ships in the far-flung outskirts of rising commercial empires. For example, during each of three seventeenth-century Anglo-Dutch Wars (1652-54, 1664-67, and 1672-74), the States-General temporarily outlawed whaling voyages to the Arctic, the construction of whaling ships, the manufacture of whaling equipment, and participation in international whaling ventures. The Republic's admiralties needed sailors who would have served aboard whaling ships, and shipwrights who would have constructed whaling vessels. Whaling ships also made tempting, potentially lucrative targets, especially when they

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[64] Conway, *No Man's Land,* 129. Louwrens and Avango, 'Settlements in an Arctic resource frontier region', 30. Schokkenbroek et al., *Trying Out*, 29.
[65] Conway, *No Man's Land,* 168.

sailed alone or at the edge of large convoys. Indeed, as the First Anglo-Dutch War came to a close in 1654 and a Dutch whaling fleet finally set sail for the Arctic, a squadron of English warships seized two straggling whalers that traveled just beyond the reach of their escorts.[66]

Because most whalers obeyed the States-General, the pace of Arctic whaling in the late seventeenth century registered the ways in which climate change influenced the course and ultimately the length of naval wars in and around the North Sea. In the First Anglo-Dutch War, the NAO largely stayed in its positive phase. Persistent westerly winds gave the tactical advantage of the "weather gage" to English fleets, which allowed their sailors to choose how and when to attack. That, in turn, helped them deploy ships of revolutionary size and armament in newly refined "line of battle" tactics that proved decisive in most battles with Dutch fleets. After just two years, the First Anglo-Dutch War ended with an English victory. Had the NAO not lingered in its positive phase during the first decade of the Maunder Minimum, the war might have dragged on for another year, and Dutch whalers would not have set sail in April 1654.[67]

In the Second Anglo-Dutch War, by contrast, the NAO responded to the deepening Maunder Minimum by entering a strongly negative state. Dutch admiralties had adopted English tactics and ship designs, which meant that English and Dutch fleets were well matched at sea. Yet persistent easterly winds often gave a tactical edge to Dutch fleets. The weather gage helped them win decisive victories in 1666 and 1667, shortening both the war and the pause in whaling. In the third war, the NAO remained in a weekly negative state. France and England allied against the Dutch Republic and would have won a quick victory at sea, were it not for prevailing easterly

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[66] 'Placaet. Proclamation forbidding voyages to Greenland with other restrictions on whaling and fishing', (The Hague, 1666), SP 119/276, National Archives, Richmond. 'Placcaet. Forbidding navigation and whaling in and around Greenland in 1673', (The Hague, 1673), SP 119/326, National Archives, Richmond. 'Placcaet...imposing restrictions on navigation and whaling', (The Hague, 1676), SP 119/356, National Archives, Richmond. Conway, *No Man's Land,* 215.

[67] Degroot, *The Frigid Golden Age,* 211.

winds. The weather gage helped Dutch sailors prolong the war at sea, which in turn lengthened disruptions to Dutch whaling. By altering when and how whalers could set sail for the Arctic, the manifestations of climatic trends far from the Arctic shaped the possibilities for violence in the far north.[68]

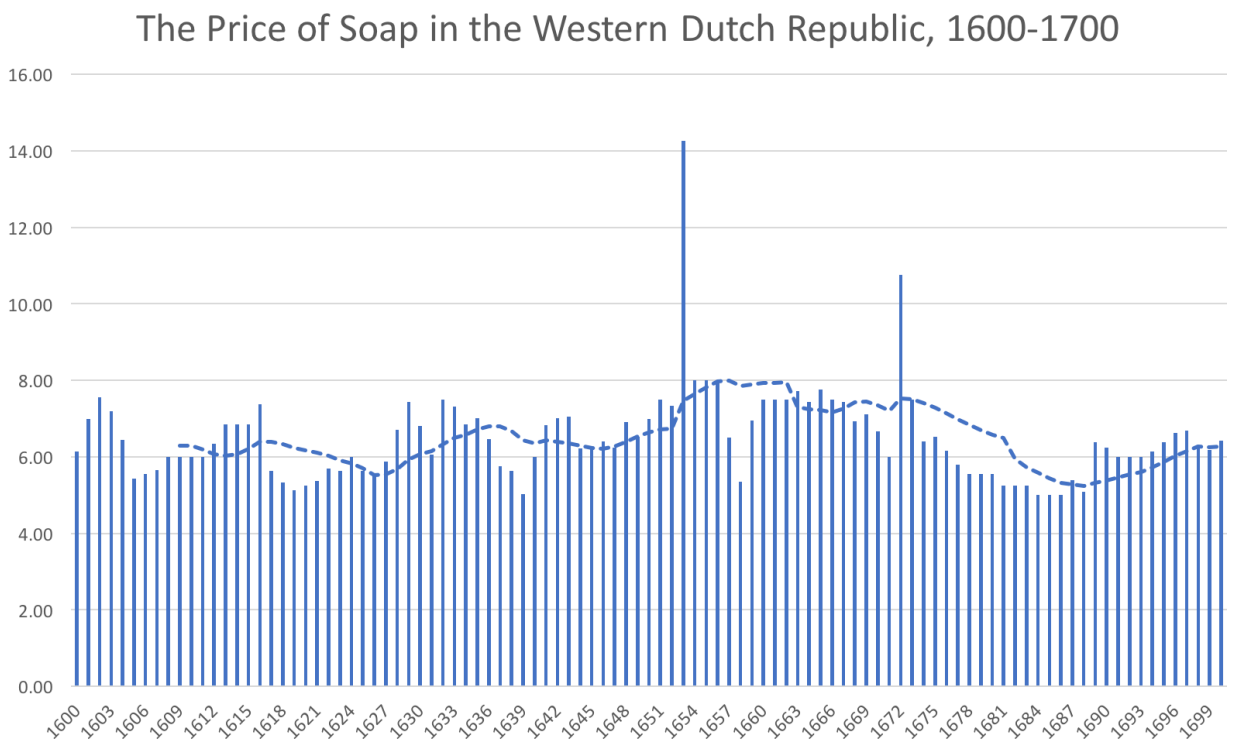

Fig. 5. Prices for soap in the western provinces of the Dutch Republic during the seventeenth century. Soap-makers typically used whale oil in the production process. Soap prices therefore climbed during each of the Anglo-Dutch naval wars (1652-54, 1664-67, and 1672-74), and during the War of the Grand Alliance (1689-97). The dashed line shows the ten-year moving average. "The prices of the most important consumer goods, and indices of wages and the cost of living in the western part of the Netherlands, 1450-1800." Available at: www.iisg.nl/hpw/data.php#netherlands

Some Dutch whalers could not resist the temptation of exploiting wartime increases in the price of commodities manufactured using whale oil and baleen hair (Figure 5). Yet those who defied the States-General did so at their peril. In June 1674, sailors aboard three French frigates

[68] Degroot, *The Frigid Golden Age,* 219. See also: Dagomar Degroot, '"Never such weather known in these seas:" Climatic Fluctuations and the Anglo-Dutch Wars of the Seventeenth Century, 1652–1674', *Environment and History* 20:2 (May 2014), 239-273.

braved the "very cold" climate of Spitsbergen and the "terrible" ice that seemed to surround it to seize ten Dutch ships whose crews who had violated Dutch prohibitions on whaling. The continuing trickle of French whalers to Arctic hunting grounds also provided opportunities for Dutch privateers. In 1670, for example, Dutch privateers seized a lone French whaling ship bound for the Greenland Fishery.[69]

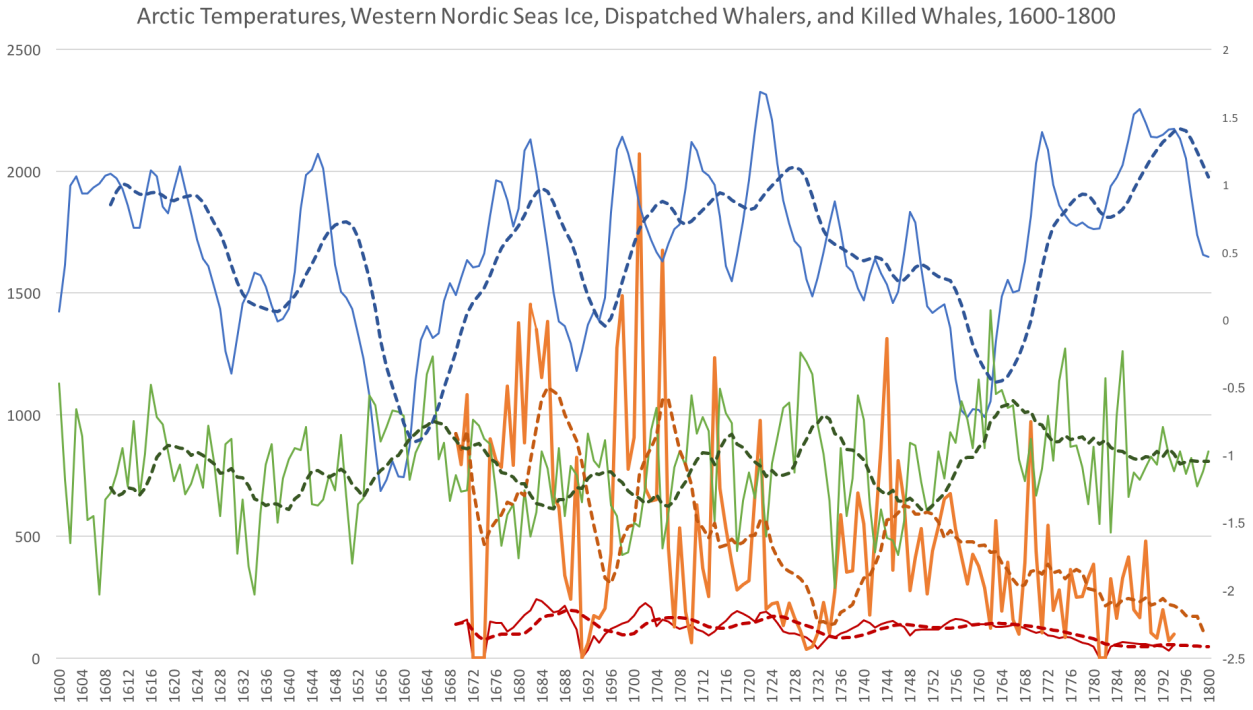

Fig. 6. Environmental and human trends in the Dutch Arctic whaling industry. Green and blue lines, respectively, show average annual Arctic temperatures and sea ice in the Western Nordic Seas. Orange and red lines, respectively, depict the number of bowhead whales killed in the Greenland Fishery and the number of whalers dispatched from the Dutch Republic. These annual statistics are together available only from 1669. Thick dashed lines represent ten-year moving averages. The suspension of whaling during the Third Anglo-Dutch War and (briefly) the War of the Grand Alliance (1688-97) is clearly visible. So are particularly striking relationships between all four trends: in the 1680s and the first decade of 1700s, when sea ice expanded, average Arctic temperatures fell, and whaling surged; and in the early 1690s and 1730s, when sea ice retreated, average Arctic temperatures rose, and whaling declined. Fauria et al., "Unprecedented low twentieth century winter sea ice extent in the Western Nordic Seas since AD 1200." 781-795. McKay and Kaufman, "An extended Arctic proxy temperature database for the past 2,000 years," 140026. Gerret van Sante, Alphabetische Naamlyst van alle de Groenlandsche en Straat-Davissche Commandeurs (etc). (Haarlem, 1770).

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[69] Jean Doublet, 'Journal du corsaire Jean Doublet de Honfleur, lieutenant de frégate sous Louis XIV', (Paris, 1887), 58. Philippe Henrat, 'French Naval Operations in Spitsbergen During Louis XIV's Reign', *Arctic* 37:4 (1984), 545. Conway, *No Man's Land,* 208.

By the 1670s, sea ice had expanded and thickened to such an extent in the cooling climate that whales may have found it difficult to hide in pockets of open water. At least in early summer, many therefore crowded along the edge of the pack ice, where they were relatively easy to hunt. On decadal timescales, average annual Arctic temperatures, sea ice in the Western Nordic Seas, the number of Dutch whalers dispatched to the Greenland Fishery, and the number of bowhead whales they killed, all fluctuated apace (Figure 6). Yet trends across longer timescales all moved in one direction: ever more whalers travelled to the Greenland Fishery as sea ice thickened and the Arctic climate cooled in the Maunder Minimum, and they killed ever more whales. As whaling fleets expanded, they became tempting targets not only for privateers and pirates, but also for entire squadrons of state-owned warships. In 1694, amid the War of the Grand Alliance (1689-97), no fewer than four French frigates pursued the Dutch whaling fleet near Svalbard. By leading the French into a labyrinth of thick sea ice, the Dutch whaling fleet divided the squadron and then ambushed the frigates that remained in pursuit. While the French seized 26 whaling vessels, most of the fleet escaped. Climatic cooling not only encouraged open sea hostilities by creating more lucrative opportunities for whalers in the Arctic, but also influenced how those hostilities unfolded.[70]

Conclusion: A Fatal Synergy Reconsidered?

In the first stage of the Greenland Fishery, climatic variability at times provoked, and at other times mitigated, conflict between whalers. The overall chilliness of the Grindelwald

[70] Conway, *No Man's Land,* 224. Van Sante, *Alphabetische Naamlyst van alle de Groenlandsche en Straat-Davissche Commandeurs.* Ernest-Théodore Hamy, 'Une croisière française à la côte nord du Spitzberg en 1693', (Paris, 1901), available at: http://gallica.bnf.fr/ark:/12148/bpt6k104325s/f10.image.

Fluctuation, however, generally promoted cooperation over conflict. Then, in the second stage, conflict and especially the threat of conflict increased the vulnerability of whalers to the most dangerous local environmental manifestations of the cooling associated with the Grindelwald Fluctuation. Finally, in the third stage, the environmental consequences of renewed cooling during the Maunder Minimum, both across the Arctic and in the distant waters off Europe, not only promoted a new kind of violence in the far north but also shaped how conflict for northern resources actually played out.

The history of the Greenland Fishery opens entirely new perspectives on relationships between climate change and conflict across the pre-modern world. Scholars who consider these connections typically focus on broad and at speculative links between climatic trends, dearth, and violence on the grandest scales in time and space. They too often view people as hapless victims in the face of environmental forces that overwhelmed rudimentary agro-economies. Few indeed have imagined that animals both domestic and wild were anything more than cogs in the organic machines of managed ecosystems: cogs that simply broke down as climates changed.

The huge scale on which scholars of climate and conflict typically work inevitably obscures the agency of both people and animals. It can thereby lead historians to miss the connective tissue that bound together climatic and human histories on the small temporal and geographic scales on which people and animals actually perceived and interacted with environmental forces. By focusing on discrete, local connections between the short-term environmental manifestations of climatic trends and the day-to-day activities of individuals and small communities, this article has revealed that the climatic fluctuations of the Little Ice Age influenced at least some kinds of conflict in more diverse ways than scholars have imagined.

Climate history that works across small scales can open new perspectives on the often-surprising ways in which global climatic trends manifested in local environments, and on the adaptive, ingenious responses of both animals and people with culture. Unlike most scholars of past climate change, historians have the ability to craft richly textured narratives of the little causal connections by which climatic trends influenced human affairs. These narratives can shed new light on what we can expect in the warming world of the twenty-first century.

Such histories can now be written owing to the recent explosion in the availability and precision of non-textual sources, exhumed by archaeologists and paleo-scientists from natural archives that include glacial ice, marine sediments, refuse heaps, and tree trunks. Working with scholars in other disciplines can today allow historians to explore questions about places, peoples, and topics that texts alone cannot answer. In some respects, historians face an unprecedented challenge in the history of their profession, as scholars in other disciplines have greatest expertise in the sources that now provoke many of the most interesting questions about the human past. Yet as this article has shown, evidence from natural archives is often most effective when used alongside surviving texts. Historians can use texts to verify, expand, and refine environmental reconstructions developed using natural archives, and then use sources from those archives to re-interpret texts that once seemed perplexing or limited. There are entirely new histories to be written, ones with great relevance for our understanding of the present and future, but historians will rarely be able to write them alone.

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