Summary Review of Overexploitation and Decline Cycles in the Scottish Arctic Bowhead Whale Fishery, 1750-World War One

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Historically all major global whaling activities share a characteristic feature: "overexploitation-decline" cycles. The Scottish Arctic bowhead whaling industry was no exception in all essential details except one. It was conducted in extremely hazardous ice conditions in which more than half the participating vessels were lost. Despite this, 247 ships from 16 Scottish ports captured some 20,000 bowhead whales at East Greenland, Davis Strait, and Baffin Bay. In total this effort represented more than 160,000 man-trips, the requirement to crew at least 3400 vessel-voyages. Extent records of these voyages in Scottish sources (mostly newspapers) comprise a comprehensive statistical database enabling the analyzation of different aspects of this historically important maritime activity. This overview employs these data to examine the maelstrom of forces which inhibited owners from practicing sustainable management strategies, leading to near extinction of North Atlantic bowhead stocks and, inevitably, commercial collapse of the industry.

Historiquement, toutes les grandes activités liées à la chasse à la baleine à travers le monde avaient un même point commun, soit les cycles de surexploitation et de déclin. L'industrie écossaise de la chasse à la baleine boréale de l'Arctique n'a pas fait exception au niveau des détails essentiels, sauf sur un point : elle avait cours dans des conditions de glace extrêmement dangereuses dans lesquelles plus de la moitié des navires participants ont été perdus. Malgré cela, 247 navires

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en provenance de 16 ports écossais ont capturé environ 20 000 baleines boréales à l'est du Groenland, dans le détroit de Davis et dans la baie de Baffin. Cet effort était l'équivalent de plus de 160 000 voyages-hommes, soit les besoins en équipage d'au moins 3 400 voyages en navire. Les mentions existantes de ces voyages dans les sources écossaises (principalement des journaux) constituent une base de données statistiques complète qui permet d'analyser les différents aspects de cette activité maritime d'une grande importance historique. À partir de ces données, le présent aperçu évalue les forces qui ont empêché les propriétaires de mettre en pratique des stratégies de gestion durable, ce qui a donné lieu à la quasi-extinction des stocks de baleines boréales dans l'Atlantique Nord et, inévitablement, à l'effondrement commercial de l'industrie.

Introduction

Commercial whaling has been characterized by recurring cycles throughout its lengthy history, with each distinctive phase following a pattern of discovery, exploitation, overexpansion, fierce competition, and rapid stock depletion. New hunting grounds, species substitution, and the introduction of more efficient and effective technologies could briefly revitalize an industry, but diminishing profits, exhaustion, and decay inevitably led, in time, to its demise (Fig. 1). Scottish Arctic bowhead[1] whaling followed this sequence in all essential details,[2] but one, the disproportionately large number of vessels lost.

By the time the Scots committed fully to the Northern fishery in 1750, the industry was well past its prime. The East Greenland grounds had been scoured for more than 150 years and those at Davis Strait for at least half a century.[3]

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1 *Balaena mysticetus*, Greenland right, historically the most common reference of British and other European whalers but latterly replaced generally by bowhead, the preference of the early American industry.

2 This paper draws information from two graduate theses, twenty-one journal articles, and a summary book dating from 1973 to 2016. Chesley W. Sanger, "Technological and Spatial Adaptation in the Newfoundland Seal Fishery during the Nineteenth Century" (MA thesis, Memorial University of Newfoundland, 1973); "The Origins of the Scottish Northern Whale Fishery" (PhD diss., University of Dundee, 1985); *Scottish Arctic Whaling* (Edinburgh: John Donald, 2016). For a full list of journal articles, see https://mun.ca/geography/people/faculty/chesley-w-sanger.

3 For an overview, including original sources, of the origins of East Greenland and Davis Strait whaling, see Sanger, *Scottish Arctic Whaling*, 1-5.

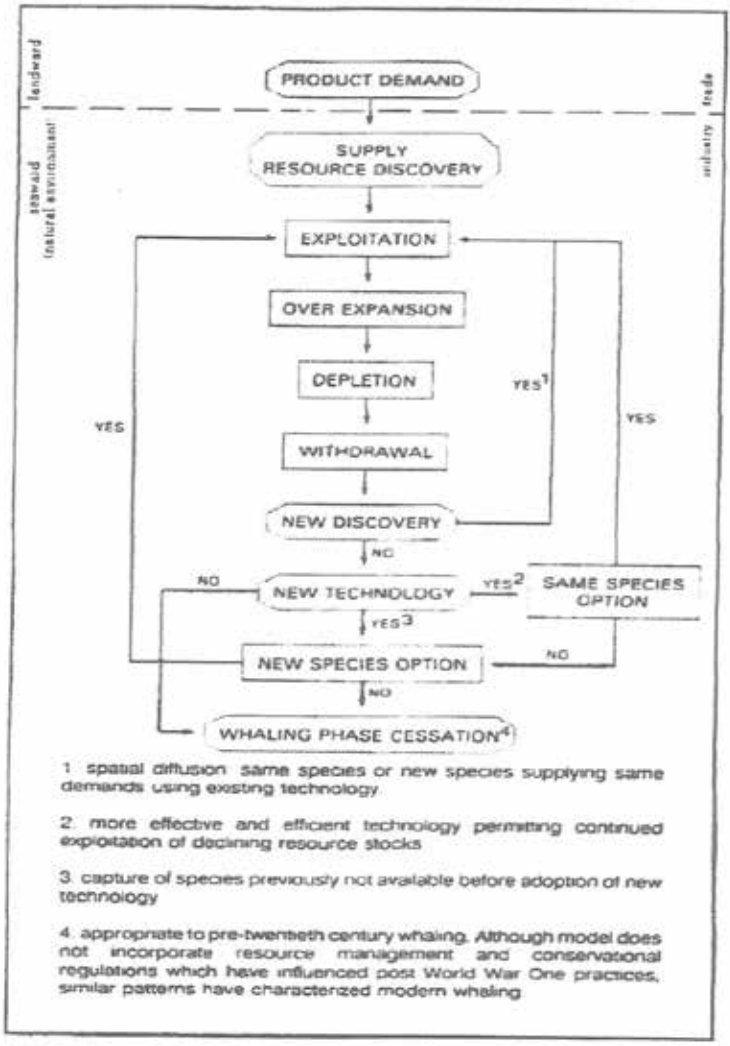

Figure 1. Whaling – pre-twentieth century historical patterns. (Courtesy of the author)

Participants were thus forced to adopt increasingly aggressive strategies in a remote and dangerous ice-filled environment.[4] These pressures, in conjunction with a host of other factors,[5] created almost unimaginably demanding and

[4] As a historical geography study, this essay places special emphasizes on the biological and physical environments as foundational components of an ecosystem focused on human activity – "man-land relationships" in other words.

[5] These forces included, most importantly, catches, stock depletion, changing oil and bone prices, government policies, geopolitical issues, warfare, and annual offshore deployment

hazardous hunting conditions, as the trade struggled to remain viable in the face of rapidly declining bowhead numbers. Of the two hundred and forty-seven whalers which sailed from Scottish ports between 1750 and World War One, for example, more than fifty percent failed to return.[6]

Besides the significance of these losses as an indicator of the effects of overexploitation, this paper examines the myriad of forces that not only prevented Scottish owners implementing sustainable management practices but also led to closure of the industry at the beginning of the twentieth century and the reduction of all North Atlantic bowhead stocks to near extinction levels.[7] The overview of the historical geographic "reconstruction"[8] that follows reveals the emergence of seven "depletion-renewal" phases: 1.) Greenland Sea whale fishery: 1750-c.1800; 2.) Davis Strait whaling: c.1800-WWI; 3.) Baffin Bay fisheries: 1817-WWI; 4.) East Greenland sealing: c.1840-c.1860; 5.) Steamers: 1857-WWI; 6.) Newfoundland seal fishery: 1876-1900; and 7.) Finale: c.1870-WWI.

Socio-Economic Setting

Time, place, resource, and nationality created a distinctive Scottish trade. The reduced status of the two North Atlantic bowhead populations (Fig. 2) in combination with difficult offshore conditions were important differentiating features. Also important were the Scots themselves. While they did not have the political and economic wherewithal during the seventeenth and eighteenth centuries to compete directly with the Americans, English, and other rivals in Southern whaling, the Arctic trade, in a relative sense, was essentially their only whaling option. As other nations ranged further and further afield globally in search of new bowhead, southern right, sperm, and eventually, with the development of "modern" whaling, all rorqual stocks, the Scots were content

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strategies.

6 For a list of the 127 vessels lost (including year; sail or steamer; home port; hunting ground; and catches), see "Vessels Lost," *Scottish Arctic Whaling (1750-WWI): A Digitalized Statistical Profile*, WhalingHistory.org. Similarly, "Voyages Data Viewer," *Scottish Arctic ...,* WhalingHistory.org, records digitally the 3641 vessel-voyages that occurred between 1750 and WWI.

7 Commercial whaling of bowheads has been prohibited under international conventions since the 1930s. See, for example. International Whaling Commission (IWC) https://iwc.int/about-whales/whale-species/bowhead-whale.

8 Following the model developed by "the dean of American historical geographers," Carl O. Sauer, and Canadians, Andrew Hill Clark and Cole Harris. See, for example, Sauer, *Northern Mists* (Berkley: University of California Press, 1968); Clark, *Acadia: The Geography of Early Nova Scotia* (Madison: University of Wisconsin Press, 1968); and Harris, *The Seigneurial System of Early Canada: A Geographical Study* (Montreal: MQUP, 1984).

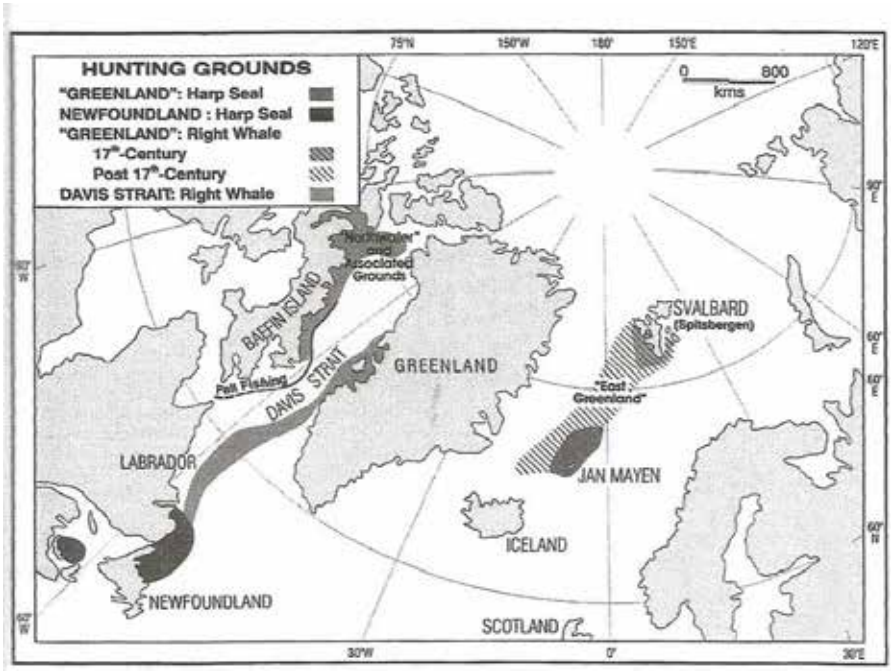

Figure 2. North Atlantic bowhead whales and harp seals stocks. (Courtesy of the author)

to carve out a niche which, although forced to rely on ancillary activities such as sealing, continued to maintain the pursuit of Greenland right whales at its core.[9]

[9] The origins of large-scale whaling are lost in antiquity. Spanish and French Basques, however, are generally credited with its development. There have also been numerous attempts to describe its global evolution, but they are, of necessity, as D.G. Burnett correctly points out, "uneven in their depth and coverage." *The Sounding of the Whale: Science and Cetaceans in the Twentieth Century* (Chicago: The University of Chicago Press, 2012), 9. He suggests, for example, that there are five distinctive episodes of commercial whaling. My Scottish studies identify seven traditional phases, ranging from the original Bay of Biscay operation to the American Western Arctic fishery. The replacement of old-fashioned, traditional technology and methods in the 1860s, however, enabled the industry for the first time to capture species previously immune to attack, thus heralding an eight and final phase – the "modern" era. Scottish Arctic whaling in this paper can thus be viewed as a relatively minor system nested within a generally agreed upon series of higher order cycles. For a fuller examination, including specifics re Norwegian, Svend Foyn's development of "modern" whaling, see Sanger, "The Origins of Scottish Northern Whaling," 42-182. The most comprehensive study of modern whaling is J.N. Tonnessen and A.O. Johnsen, *The History of Modern Whaling* (Los Angles: University of California Press, 1982).

Resource and Physical Environmental Underpinnings

The offshore temporal and spatial parameters – the marine setting – were determined by bowhead migrations northward onto their summer feeding ranges and fall return to their winter sanctuaries. These, in turn, were shaped largely by the annual growth and retreat of pack-ice (Fig. 3). All major Northern grounds, consequently, were ice-edge operations, earning the bowhead's sobriquet, "the ice whale."[10] The Scots proved to be especially skilled at recognizing these migration patterns and annual sea-ice wax and wane rhythms, with their shorter seasonal and daily variations. They were equally efficient at using equipment and developing techniques and strategies needed to harvest bowheads in a particularly harsh, ice-filled environment.[11]

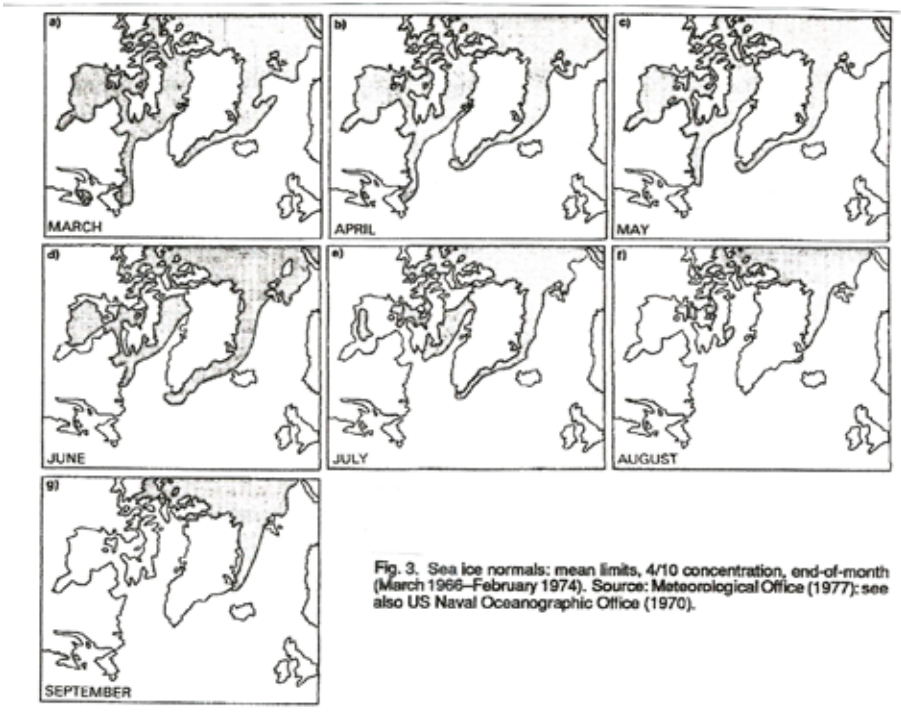

Fig. 3. Sea ice normals: mean limits, 4/10 concentration, end-of-month (March 1966–February 1974). Source: Meteorological Office (1977): see also US Naval Oceanographic Office (1970).

[10] C.M. Scammon, for example, observed that "everything tends to prove that the *Balaena mysticetus* is truly an 'ice whale,' for among the scattered floes, or about the borders of the ice-fields or barriers, is its home and feeding ground." *The Marine Mammals of the North-Western Coast of North America: Together with an Account of the American Whale-Fishery* (San Francisco, CA: John H. Carmany and Co., 1872), 58.

[11] Essentially a small, open-boat (oar - occasionally sail) and hand-thrown harpoon operation.

East Greenland

British logbooks and journals have been used to construct maps (Figs. 4 and 5) which show bowhead captures and sightings at East Greenland, Davis Strait, and Baffin Bay.[12] These maps clearly delineate the intersection of

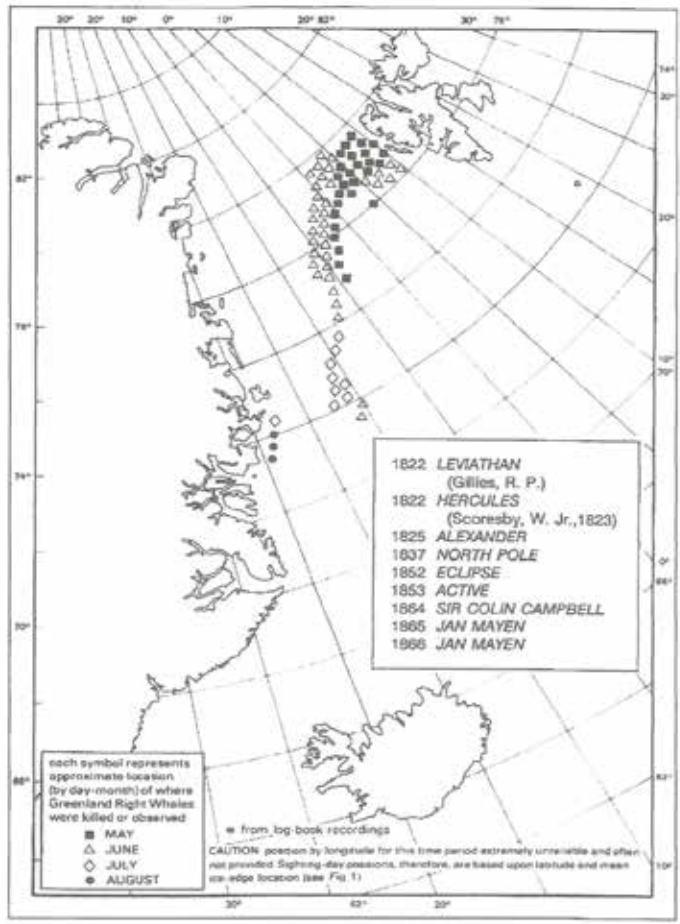

Fig.4. Whaling results, from log book recordings, of nine British sailing vessel voyages on the East Greenland hunting grounds, 1822–66.

[12] For a series of more detailed maps depicting bowhead sightings and kills for both sailing vessels and steamers, see Chesley W. Sanger, "The Greenland Right Whale – an Assessment of the Biological Basis of the Northern Whale Fishery during the 17th, 18th, and 19th Centuries," in *Agriculture, Resource Exploitation and Environmental Change*, ed. H. Wheatley (Aldershot: Ashgate, 1997); and "'On good fishing ground but too early for whales I think': The Impact of the Greenland Right Whale Migration Patterns on Hunting Strategies Employed in the Northern Whale Fishery during the 17th, 18th, and 19th Centuries," *The American Neptune* 51, no. 4 (1991).

seasonal migrations and annual pack-ice distributions.

The growth of rich feeding "blooms" at East Greenland each spring, coincident with retreating ice cover, improving weather, and longer daylight hours, marked the beginning of hunting. Defined by the eastern edge of the pack-ice to the west and north, and the western shores of Spitsbergen to the east (Figures 3a-g and 4), the Greenland Sea fishery was usually in full swing by the middle of May. Despite annual variations, the growth and retreat of the floes follow essentially the same pattern. The extension of open water to the west of Svalbard, called the "whale-fishers' bight," or "whale-fishing bay" by early whalers, is remarkably consistent from year to year. "The edge of the East Greenland ice-fields," as William Scoresby, Jr. pointed out, "presents an outline which, though subject to partial variations, is found … to be generally similar, and often strikingly uniform."[13] Similarly, Dr. Robert Grey, who made eight trips to East Greenland with his father, David Grey, arguably Scotland's most successful whaling captain, described the ice margin as consisting of a series of "points" and "bights" which, being unusually constant in position, "are well known to the whalers, several being designated by names."[14]

Greenland Sea whaling was usually classed as "open" or "closed," depending on difficulty accessing the hunting grounds before improved ice conditions enabled the bowheads to resume their northerly migration, the character, quantity, and eastern extent of the pack determining its usual late-spring timing. On 13 June 1791, for example, a surgeon's journal entry expressed the opinion that "no one entertains any hope of a fishing now."[15]

Davis Strait/Baffin Bay

As at East Greenland, hunting grounds were defined by resource migration and the annual flushing of winter-derived pack-ice from Baffin Bay (Fig. 3a-g). Currents, latitudinal temperature differentials, prevailing wind patterns, however, and bounded by two large land masses, Baffin Island and Greenland, in the west and east, produced a channeling effect which made it more difficult for the bowheads to gain entry to their summer feeding grounds in the Canadian Arctic Archipelago, thus giving rise to six temporal and spatially distinct Baffin Bay fisheries (Figs. 5 and 6).

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[13] *An Account of the Arctic Regions with a History and Description of the Northern Whale* Fishery (Edinburgh: Archibald Constable and Co., 1820), V. 2, 262. Scoresby made twenty trips to East Greenland as an apprentice, crewman, mate, and whaling master before becoming a cleric in 1823. His work made him, according to the *Dictionary of National Biography* "the foundation-stone of Arctic science."

[14] "Notes on a Voyage to the Greenland Sea in 1888," *The Zoologist* 13, 1889, 4.

[15] G. Kerr, *A Journal Kept on Board the CHRISTIAN of Abd. On a Voyage to the Northern Whale Fishery, 1791* (University Library, King's College, Aberdeen).

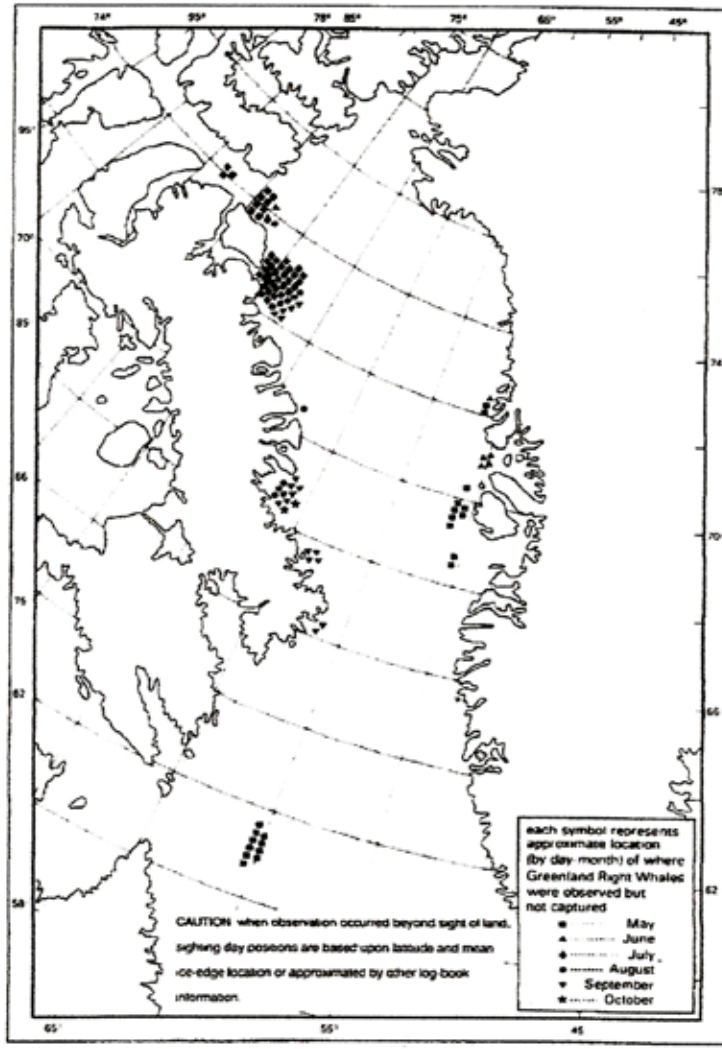

Figure 5: Whale Sightings: 10 Scottish Sailing Vessel Voyages on the Davis Strait - Baffin Bay Hunting Grounds (1830-1853)

Sources: **Logbooks; and Monthly Ice Charts, Meterological Office, Bracknell, Berkshire.**

The total quantity of ice to the west of Greenland also varied greatly within and between seasons. Baffin Bay was normally blockaded by late winter, with the pack usually reaching its maximum southern extension in early spring (Fig. 3a-g). Towards the end of March, it had generally begun to recede, retreating

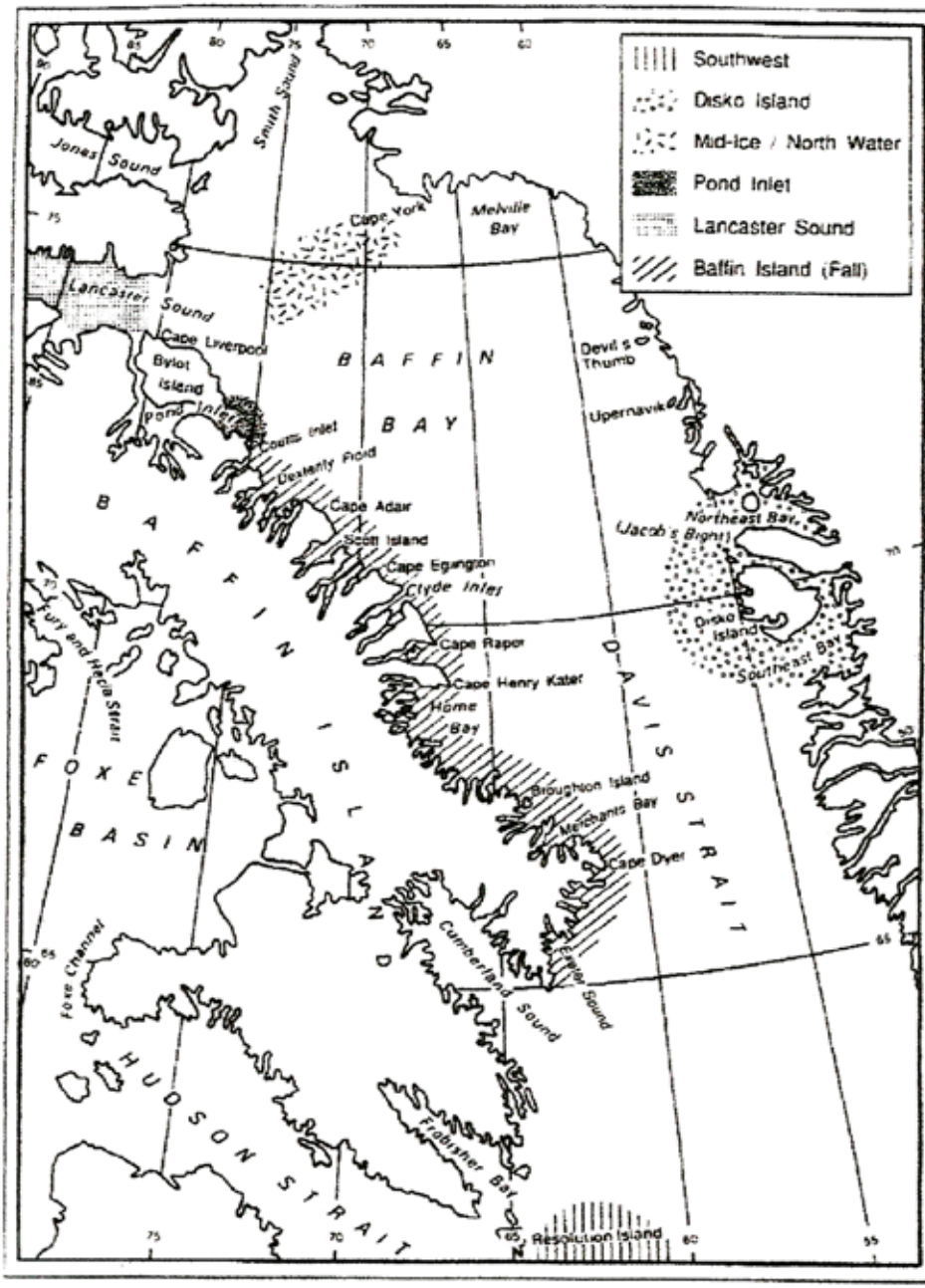

Fig. 6. Baffin Bay-Davis Strait whaling grounds.

northwest along the Labrador coast before canting northeast toward Greenland. By mid-summer the central floes were restricted to the western margins of Baffin Bay, the whole area being usually free of ice by early August.[16]

In terms of this paper, it is important to note that in the industry's temporal and spatial evolution from eighteenth century whaling at East Greenland to post-1818 operations at Baffin Bay, masters were compelled to scour increasingly hazardous ice-threatening environments and take greater risks due to severely reduced stocks on the "older" grounds, leading to increased losses. The amount, nature, location, and movement of pack-ice, in general, then, stamped a unique character on each year's fishery at East Greenland, Davis Strait, and Baffin Bay. Hunting strategies – successful or failures – were thus determined largely by a master's experience, and knowledge of the behavior of Greenland right whales and their complex and dynamic physical environment.

Seven-Cycle Depletion-Renewal Sequence

Annual deployment strategies were generally based on the previous season's results and owners/masters, though often risk takers, were reluctant to deviate from established practices until forced to do so by economic realities. The Scottish industry, consequently, was characterized by the seven phases identified earlier, with each separated by sometimes lengthy transitions rather than sharp boundaries (see Fig. 7).

Phase 1: Greenland Sea Whale Fishery, 1750-c.1800

The Scots endeavored to establish a presence on the northern grounds during the seventeenth century and first half of the eighteenth century,[17] but the transformation from a limited and tentative venture into a large-scale, ongoing seasonal operation was a slow process. The Seven Years' War, American War of Independence, and French Revolutionary War significantly influenced its early development. Participation ranged from sixteen vessels fitted out in 1755 to just three in 1779, before increasing to thirty-one in 1787 and 1788 (Fig. 7,

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[16] For additional information on drift patterns, composition, and the seasonal retreat and advance of the Baffin Bay and Davis Strait ice-pack, see, for example, B.B. Dey, "Seasonal and Annual Variations in Ice Cover in Baffin Bay and Northern Davis Strait," *Canadian Geographer* 24, no. 4 (1980); M.J. Dunbar, "Increasing Severity of Ice Conditions Baffin Bay and Davis Strait and its Effects on the Extreme Limits of Ice," in *Sea Ice: Proceedings of an International Conference*, ed. T. Karlsson (Reykjavik: The National Research Council of Iceland, 1972); and C.W.M. Swithinback, *Ice Atlas of Arctic Canada* (Ottawa: Canadian Defense Board, 1960).

[17] For a comprehensive investigation of Scotland's small-scale and episodic participation in Arctic whaling prior to 1750, see Chesley W. Sanger, "The Origins of British Whaling: Pre-1750 English and Scottish Involvement in the Northern Whale Fishery," *The Northern Mariner/Le Marin du Nord* 5, no. 3 (1995).

cycle 1). This variability was the result of often contravening forces such as warfare; peaceful interludes; bounty reductions; fluctuating oil and bone prices; growing Continental markets; expanding domestic demands in industrializing Britain; changing offshore competition ratios; the growth, elimination, and rebirth of New England sperm whaling; an increased emphasis on Davis Strait; and the imposition of protective tariffs.

Although Westminster's 1733 and 1740 whaling incentives failed to attract Scottish investment, they did encourage several small-scale English sponsored expeditions, principally merchants involved in the oil trade. It was natural, then, that when the "Great Bounty," passed in 1749, providing a bounty of forty shillings a ton for all whaling vessels fitted out in Britain, it finally induced local patrons to establish the broadly subscribed Edinburgh Whale-Fishing Company,[18] which purchased the London-owned *Trial*, specifically "designed for that trade."[19] According to information contained in the Bounty Payment Certificate, she was 333 tons, plantation built, equipped with six whale boats, and carried a crew of forty-five, besides the master and surgeon.[20] *Trial*'s maiden voyage serves as a useful paradigm of Scotland's first half century of involvement in Arctic whaling.

Except for a small number of exploratory voyages to Davis Strait by Firth of Clyde adventurers taking advantage of their west coast location, East Greenland was the preferred destination for investors concentrated in what would become Scotland's whaling core stretching north from Edinburgh to Peterhead. Northern whalers of necessity were "extremely stout,"[21] built to cope with hazardous ice conditions.[22] They were also larger mercantile ships mostly, modified seasonally to carry up to eight whale boats and the crews needed to man them and subsequently "cut in" and transport blubber home for rendering.[23]

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[18] Initially there were 254 shareholders drawn largely from Edinburgh and its environs. *Contract of Copartnery of the Edinburgh Whale-Fishing Company*, 1749.

[19] *Edinburgh Courant*, 15 January 1750.

[20] Bounty Payment Certificate E508/47/8/1. Bounty Payment records are housed in the National Archives of Scotland, Edinburgh.

[21] *Aberdeen Journal*, 15 April 1755.

[22] The arrival of the *St. Anne* at Aberdeen in 1755 with just one whale because "she happened early to be enclosed among Floats of ice in an unlucky Place," is typical of nineteenth century reports of unfavourable offshore hunting conditions. *Aberdeen Journal*, 29 July. Similarly, *Trial* captured just four walruses because she "had a tedious outward passage of forty Days, which might have been performed in fourteen, and when, there, being for some Time fixed within the Ice within nine Degrees of the North Pole*." Edinburgh Courant*, 24 September 1750.

[23] *Edinburgh*, for example, the smallest in the fleet in 1852 at 285 tons, carried a crew of forty-three men (E508/48/8/7), while the largest, *Argyle*, 444 tons, had eight whaleboats and a crew of fifty-five the previous year (E508/48/8/3).

Of particular significance, their size and design made them attractive to the military as supply freighters or troop transports, and as a source of experienced seamen for the navy, all foundational principles justifying public support of the trade.[24] Early Scottish returns also show that the bounties offered the possibility of earning rich profits should whales be captured, without incurring a loss if a voyage was unsuccessful,[25] a powerful incentive which encouraged caution on the whaling grounds.[26] This advantage diminished towards the end of the century, however, as domestic and foreign involvement increased, further reducing an already endangered bowhead stock. Long-term forces, consequently, were seasonally exaggerated by what constituted poor or good seasons,[27] a rhythm which characterized Arctic whaling.

These dynamics, then, in a century when commercial competition, as Schmoller explained, "even in times normally of peace, degenerated into a state of undeclared hostility,"[28] dictated Scotland's erratic participation levels leading up to the French Revolutionary and Napoleonic Wars (Fig. 7). Somewhat surprisingly, however, enemy action was responsible for only two losses,[29] and just thirteen of fifty-six ships failed to return between 1759 and 1801 because of physical environmental misfortunes – primarily reflecting an ongoing reluctance to put the bounty payment at risk. Such a low number is especially noteworthy in that there were more than 600 individual vessel-voyages over that period (Fig.7).

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[24] Even Adam Smith, for example, principal critic of the mercantile system, supported the whaling bounties because, in part, they contributed to a nation's "defense, by augmenting the number of its sailors and shipping. This, it may be alleged, may sometimes be done by means of such bounties at a much smaller expense, than by keeping up a great standing navy." *An Inquiry into the Nature and Causes of the Wealth of Nations* (New York: The Modern Library, 1965), 484. Originally published in 1776.

[25] The Edinburgh Whale-Fishing Company, for example, received £600s (40s. @ 330 tons) for the 1750 voyage of the *Trial* which returned with no blubber or whale bone. E508/47/8/1.

[26] "The Northern whale fishery," as a prominent Dundee economist explained, "illustrated the role of subsidies in the revival of the Scottish economy … Between 1750 and 1788 alone Scotland drew close on a quarter million pounds from the Treasury … a very substantial boost to the purchasing power of the maritime communities." S.G.E. Lythe, "The Dundee Whale Fishery," *Scottish Journal of Political Economy* 11 (1964), 158.

[27] Economic success or failure, defined usually by combinations of heavy or light ice, whale numbers, and difficult or easy hunting conditions.

[28] G. Schmoller, "Mercantilism as Unification," in *Mercantilism: System or Expediency?* ed. W.E. Minchinton (Lexington, MA: D.C. Heath and Company, 1989), 27.

[29] The *Royal Bounty* was captured on return voyage by the American frigate *Tartar* out of Boston. *Aberdeen Journal*, 11 August 1777; and despite the introduction of a vigorous convoy system the *Tay* of Dundee was taken close to home by a French privateer. *Edinburgh Advertiser,* 19 July 1799.

Figure 7. Scottish whaling vessels, losses, and depletion-renewal cycles (1750-WWI). (Courtesy of the author)

Phase 2: Davis Strait Whaling, c.1800-WWI

The French Revolutionary War proved to be a critical period. By the end of the eighteenth century, Scottish Arctic whaling had clearly entered a phase of maturity and consolation. The Scots had served their lengthy apprenticeship and were poised to outstrip their English rivals and radically alter the industry's character.

The first decade of the nineteenth century resurrected the usual pressures generated by both war and peace. Several new influences, however, were now brought to bear, the most important being acceptance, albeit reluctantly, that the Greenland Sea bowhead stock had finally been reduced to near uneconomic levels. After tentative participation in the 1750s, consequently, they were enticed back to Davis Strait. Nonetheless, the adoption of new strategies, as usual, was slowly achieved. Even during the boom years, 1784-1787 (Fig. 7), for example, there were signs that bowhead stocks could not sustain post-American War of Independence hunting levels.[30] Average catches and the size of individual bowheads continued to decline, though total kill numbers actually increased.

[30] The magnitude of the British effort, when combined with a revival in Dutch whaling, placed additional pressure on an already depleted resource. For a fuller discussion, see, for example, Chesley W. Sanger, "The Impact of the American Revolutionary War on Scottish Northern Whaling: The Dunbar Factor," *Northern Scotland* 20 (2000); and "Prologue to Scottish Domination of Northern Whaling: The Role of the French Revolutionary War," *International Journal of Maritime History* 20, no. 1 (2008).

In 1787, with the East Greenland trade under threat, the Montrose Whale-Fishing Company fitted out one of its three whalers, *Eliza Swan*, for Davis Strait, the first Scottish whaler to do so in more than thirty years. The "experiment" showed significant promise.[31] Nevertheless, the western grounds required longer and more dangerous late winter voyages, exposed ships, and crews, to greater physical risks from sea ice during the actual pursuit, and incurred more expensive fitting out, victualling, and salary costs, but by the end of the eighteenth century they represented an attractive alternative to Greenland Sea whaling.

Conservative as ever, however, it was not until the Peace of Amiens, signed 25 March 1802, that Scottish owners finally made a firm commitment to these significantly more demanding stations. The *Aberdeen Journal*, for instance, reported that bowheads at Davis Strait in 1801 were "in such plenty that a dozen sail might have loaded,"[32] and the following year, the *Edinburgh Courant* noted, following the return of *Raith* with twelve whales, it was "so full that the boats on deck are stowed with blubber, and the better part of her beer and water casks are also full."[33]

As can be seen in Figure 7, by the end of the decade, a confluence of factors, combined with a series of good years at both East Greenland and Davis Strait marked the beginning of a period of robust growth in Scottish Arctic whaling. These included: the ability to continue whaling during war; the collapse of Dutch whaling; entry into the Eastern Canadian timber trade during the off season following the effective closure of the Baltic[34]; end-of-season participation in the growing number of emigrants requiring transport to the United States and Canada[35]; continuation of the bounty for an additional five years from 1809[36]; and increased demand for whale oil and bone in both domestic and export markets.[37]

War with the United States accelerated the pace of growth when the New

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31 Its cargo (five large whales, averaging 41.4 casks of blubber) was larger than that obtained by any of the Scottish ships at East Greenland. E508/86/8/24.

32 22 June 1801

33 8 July 1802.

34 At the end of the 1809 season, for example, the Dundee whaler *Estridge* sailed in ballast for "St. Andrews, in North America." *Dundee Advertiser*, 22 September 1809.

35 Having returned to Dundee from Arctic whaling on 7 April 1810, for instance, the *Friendship* was advertised as sailing for Charleston, South Carolina. *Dundee Advertiser*, 17 August 1810.

36 In 1810, "Act 26 Geo. III cap. 41, with various emendations, etc. continued to 25 March 1815." Scoresby, *An Account*, V. 2 ,93.

37 See, for example, T. Ashton, "Workers' Living Standards: A Modern Revision," in *The Industrial Revolution in Britain,* ed. P. Taylor (Boston: D.C. Heath, 1967), 51; and A. Birnie, *An Economic History of the British Isles* (London: Methuen, 1969*)*, 183.

England "whaling trade shrank to zero."[38] The Scottish response was immediate. In just two years (1811-13), the fleet grew from twenty-two vessels to forty-five and in the next two years four more were added. The most important development, however, occurred at Peterhead. Rivalry between Dundee and Peterhead would dominate Northern whaling over the next sixty years.

The larger scale and scope of the industry unfortunately placed even greater stress on already severely diminished stocks. Most damage, not surprisingly, was inflicted at East Greenland. Masters operating on both grounds were thus frequently required to make longer, more costly, and dangerous voyages yielding fewer and smaller whales.[39] Renewed competition from foreigners at East Greenland following peace in 1815 brought additional pressure.[40]

Despite these new dynamics, losses during the early part of the Davis Strait cycle only mirrored those of the half-century Greenland Sea phase (2.4% vs 1.7% of vessel-voyages). Conflict did not have a major impact, with only *Simms*, out of Edinburgh, captured by a French privateer in 1806.[41] Neither did the growing importance of Davis Strait play a significant role with just one of the five whalers lost that year succumbing to negative environmental conditions on those grounds. Plainly, the potential loss of the bounty payment continued to encourage caution. Rapid expansion, increased competition, and further stock reductions, however, were about to change this pattern as owners and masters were increasingly driven to take greater risks.

Phase 3: Baffin Bay Fisheries, 1817–WWI

Characteristically, as the data shows, the commitment of many Scottish investors again faltered when confronted with similar circumstances (Fig. 7). Before participation rates could reach "normal" overexploitation-adjustment levels, however, the Davis Strait fishery expanded northward into Baffin Bay

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[38] J.T. Jenkins, *A History of the Whale Fisheries: From the Basque Fisheries of the Tenth Century to the Hunting of the Finner Whale at the Present Time* (London: Kennikat Press, 1971. First published 1921), 233. See, also, A. Starbuck, *History of the American Whale Fishery*: *From its Earliest Inception to the Year 1870* (Washington, DC: US Commission on Fish and Fisheries, 1978), 92-5.

[39] After more than 200 years of unregulated hunting, the average size of bowhead whales harvested along the East Greenland ice-edge remained substantially smaller than those taken at Davis Strait. The surgeon on *Resolution*, Whitby, for instance, noted in 1806 that "in the seas of Spitzbergen … whales now seldom reach 70 feet, being generally killed before they arrive at full growth." J. Laing, *A Voyage to Spitzbergen; Containing an Account of that Country; of the Zoology of the North; of the Shetland Isles; and of the Whale Fishery* (Edinburgh: Printed for the author, 1822), 90.

[40] The Dutch, for example, introduced a bounty incentive which was "extremely judicious and liberal." Scoresby, *An Account*, V. 2, 94.

[41] *Dundee Advertiser*, 15 July 1806.

beyond the traditional hunting grounds at Disko (Fig. 6) which to this point had signaled the end of the season. This initiated unprecedented fleet expansion and within two decades fundamentally altered the offshore character of the industry (Figs 2, 5 and 6). A complicated sequence of events enabled Scotland to gain dominance over their English rivals and set the stage for them to implement changes that permitted the trade to endure in a modified form for an additional fifty years beyond the end of "core" bowhead whaling in the late 1830s.

In the face of declining and uncertain profits, two Scottish masters, G. Muirhead, Edinburgh, and G. Valentine, Aberdeen, both poorly fished, were able to salvage paying voyages in 1817 by taking advantage of favorable environmental conditions to sail north along the west coast of Greenland and across Melville Bay after the fleet had cleared for home[42] (Figs. 3c-d and 6). This led to the opening of the Baffin Bay whaling stations, significantly expanding the catching window. In so doing, however, it also hastened the demise of the western stock. Not recognizing, or more likely, simply ignoring lessons that should have been learned on the older East Greenland and southern-most Davis Strait hunting grounds, owners embarked on yet another period of rapid expansion (Fig. 7). Scottish participation rapidly soared to sixty whalers in 1821, but their success was short-lived.

With the last refuge of the North Atlantic bowhead breached, annual catches soon began to decline at an even faster pace. The trade entered another phase of retreat and entrenchment as investors withdrew rather than continue to fit out larger, ice-strengthened ships for longer and more hazardous voyages that yielded poorer results. In 1841 and 1842 the industry reached its lowest level in thirty-seven years when just fifteen vessels participated.

The Baffin Bay fishery had an immediate and profound impact in terms of danger to both vessels and personnel (Fig. 7). Whereas formerly the industry had essentially been an ice-edge operation, timely entry to the new grounds required a northern passage along the west coast of Greenland each spring where the threat of opposing ice-faces colliding with ship-crushing force was always imminent. The 1819 season quickly demonstrated the dangers now regularly posed by "the dreaded Melville Bay."[43] Six Scottish and four English whalers were lost when "nipped" by ice.[44] Nevertheless, all but two men were rescued by nearby vessels navigating the same passage.[45] As Figure 7 reveals,

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[42] See, for example, *Aberdeen Journal*, 6 August 1817; and *Dundee Courier*, 12 September 1817.

[43] *Dundee Courier*, 24 September 1819. See also the 28 June 1831 entry of the journal kept by the medical officer of *Hercules,* University Library Kings College, Aberdeen.

[44] For full details, see Captain Deuchars' letter to the Dundee owners of the lost *Mary Anne. Dundee Advertiser*, 20 August 1819.

[45] In terms of crew security, the interaction of bowhead migrations and floe wax and wane

adverse environmental conditions continued to wreak havoc on the fleet, cumulating with the destruction of an additional twelve whalers in 1830.

Complex forces continued to shape the industry throughout the 1820s.[46] In the face of overexploitation, the overall trend, as can also be seen, was towards consolidation. After just half a decade, several masters, obliged to linger into the fall to salvage profitable voyages were opportunistically able to intercept the bowheads as they migrated southward along the east coast of Baffin Island onto their winter range, establishing the final well-defined operation – the Fall Fishery (Fig. 6). Although a relatively minor component of Baffin Bay whaling, it soon rivalled the Melville Bay spring struggle northward in dangers posed to ships, but for the first-time also seriously threatening crews with starvation, disease, scurvy, frostbite, and death.

In 1835, for example, many British masters, not able to make the Northwater before September, sailed southwest around the Mid-ice (Fig. 3) in an ill-advised attempt to prosecute the Fall Fishery. Having delayed their departure for home, eleven vessels, including *Middleton*, Aberdeen, and *Viewforth*, Kirkcaldy, became entrapped by the growing, southward drifting, central pack. Two were crushed. Stranded crews were distributed among the remaining ships, but owners, wishing to maximize profits, or more likely at this stage, limit losses, unfathomably had provided supplies for only "a regular" voyage. Fourteen of the eighty-four men on *Viewforth*, including those rescued from the wrecked *Middleton* on 15 November, died. The following season was an even greater disaster. More than a hundred whalers on the *Advice* and *Thomas*, Dundee, and *Dee* of Aberdeen perished under similar circumstances.[47]

The events of 1835 and 1836 were a clear manifestation of how severely bowhead numbers at Davis Strait had declined following the opening of the Baffin Bay stations and the pressures placed on masters who, without proper support from owners, felt driven to take even greater gambles. In response, the industry entered yet another phase of retrenchment (Fig. 7). Only thirty-four whalers cleared in 1837, dropping to twenty-four two years later, and in 1841 and 1842 reached their lowest level in thirty-seven years when just fifteen sailed. After almost two and a half centuries, the Arctic fishery could no longer be sustained by bowheads alone. In the face of the new reality, the Scots

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rhythms discussed earlier ensured that the hunt occurred under confined conditions which offered safety in numbers with nearby ships usually able to provide an ice-free passage home.

[46] For full details, see Chesley W. Sanger, "The Rise of Scotland to a Position of Dominance in British Northern Whaling, 1802-1840," *International Journal of Maritime History* XXIV, no. 1 (2012).

[47] The delayed return of the whalers for a second consecutive year received wide coverage in Scottish papers. See, for example, *Aberdeen Journal*, 10 May 1837; and *Dundee Advertiser*, 5 and 12 May, and 23 June 1837.

reluctantly adopted a significantly different strategy, one first forged by their European competitors – the pursuit of harp seals.[48] Peterhead entrepreneurs provided the lead. Hereafter, Scottish Northern whaling, or better, the hope of winning the "bowhead lottery" discussed earlier, would be subsidized by profits earned sealing.

Phase 4: East Greenland Sealing, c.1840-c.1860

The new fishery could be conducted by smaller ships[49] with less risk, given the nature of sealing.[50] Earlier and shorter voyages also reduced wage and fitting out costs and permitted employment in the Baltic and coastal trades upon their return. Equally important, masters could still capture the occasional bowhead. These factors had encouraged European reengagement following the Napoleonic War and attracted tentative participation by Peterhead investors prepared to take advantage of their northeast coast location.

After more than two decades of tentative involvement, Scots were finally prepared to build upon this experience to challenge their continental rivals. Unable to reach the northern reaches of Baffin Bay in 1841, for instance, the four whalers at Davis Strait returned poorly fished.[51] Meanwhile, the eleven Peterhead vessels at East Greenland captured more than 19,000 harps due to favorable ice and weather conditions, greater experience in locating and harvesting seals, and a growing commitment to the enterprise.[52] *Eclipse*, as a bonus, also "opportunistically" caught nineteen whales.[53] Somewhat paradoxically, combining sealing with whaling meant that bowhead stocks were further reduced. While whales could no longer support a viable industry, sealing profits permitted their continued pursuit.

As figures 7 and 8 indicate, by 1850 "whaling" companies, while concentrating more on sealing, still perceived this activity primarily as a chance to participate in the "bowhead lottery."[54] The comments of an Aberdeen observer in 1854 indicate the extent to which the trade had been transformed:

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48 At East Greenland (Jan Mayen) and Newfoundland (Fig. 2). A smaller White Sea stock was harvested primarily by Russian sealers.

49 In 1842, for example, two of Peterhead's larger vessels, *Joseph Green* and *Superior*, 306 and 353 tons respectively, were replaced by a single ship, *Jane*, at just 109 tons, reducing the average size of individual members of the sealing fleet to 240 tons, compared to 309 for Dundee's Baffin Bay whalers.

50 See, for example, Shannon Ryan, *The Ice Hunters: A History of Newfoundland Sealing to 1914* (St. John's, NL: Breakwater Press, 1994)

51 *Aberdeen Journal*, 3 November 1841; and *Dundee Advertiser*, 22 October 1841.

52 *Aberdeen Journal*, 7 and 21 July 1841.

53 Although nineteen "were young ones." Ibid. 21 July 1841.

54 See, for example, *Dundee Courier*, 12 August 1857.

"The whale fishery of this country has been gradually dwindling away, except at Peterhead alone, where it has of late years been vigorously and successfully prosecuted."[55] Other investors were finally prepared to accept the economic realities of Peterhead's sealing initiative.

Besides the transition to smaller ships, the data also show that Davis Strait whaling continued to be more treacherous than East Greenland sealing. While

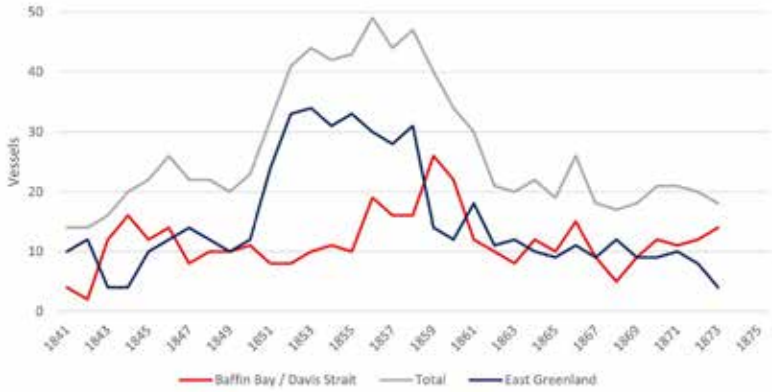

Figure 8. Scottish deployment strategies (1841-75) – Davis Strait and East Greenland. (Courtesy of the author)

only thirty-eight percent of the six hundred and forty vessel-voyages between 1841 and 1860, for example, operated there, compared to seventy-four percent (1817-1840), fully three quarters of the losses were due to the hazardous nature of Baffin Bay hunting. Reflecting the limited investment base of Peterhead and other smaller Scottish ports such as Banff and Fraserburgh enticed back into the trade, many of the new entrants purchased older, more "affordable" ships. The average number of years in the fleet when lost (1817-1840), for instance, increased from fifteen to twenty-two (1841-1860). The industry had clearly become a significantly more tentative undertaking.

Harp seal stocks at East Greenland, then, helped extend (and subsidize) Arctic whaling an additional twenty years. As the different phases demonstrate, however, unregulated, bumper seal catches could not continue in the face of rapidly expanding British and continental fleets. As figures 7 and 8 also show, with the East Greenland harp stock now also in decline, the Scottish

55 *Aberdeen Journal*, 22 February 1854.

Arctic trade again entered a period of crisis, manifested by vessel losses and withdrawals.

Phase 5: Steamers, 1857-WWI

The need to apply the "new technology" option (Fig. 1) indicates the fragile state of Scottish Arctic whaling/sealing by the late-1850s. With improvements in construction materials,[56] propulsion systems,[57] growing competition, and a declining resource, the pros and cons of introducing steamers were widely discussed throughout the 1850s.[58] In 1857, Peterhead and Hull entrepreneurs were the first to employ them in an attempt to revitalize the northern trade and, at the same time, gain an advantage. As it happened, the large quantities of pack ice associated with what, as noted earlier, was a closed season, severely restricted the maneuverability of the older sailing vessels.[59] The new steamers, *Innuit* and *Diana*, however, enjoyed moderate success, and other companies in both England and Scotland were quick to follow their lead.

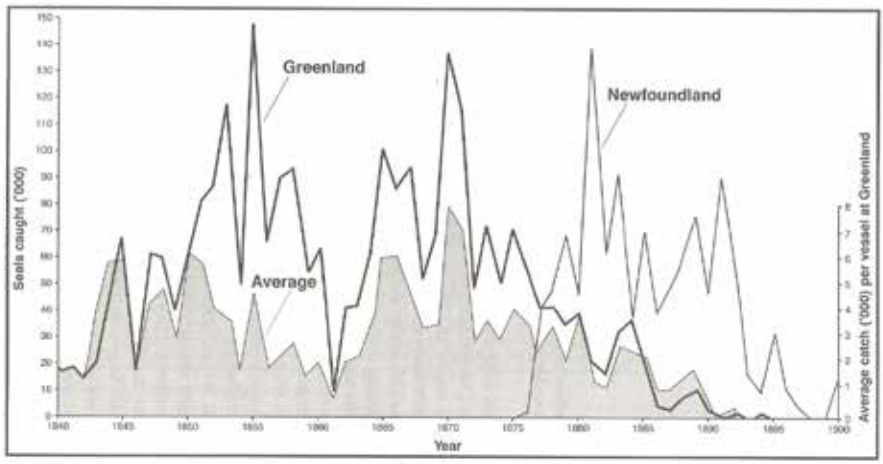

Figure 9. Scottish harp seal catches at East Greenland and Newfoundland. (Courtesy of the author)

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[56] The suitability of iron compared to wood, strengthened, for example, was new in shipbuilding and poorly understood.

[57] For a comprehensive overview of steamer propulsion systems and associated topics, see A.F. Molland, S.P. Turnock and D.A. Hudson, *Ship Resistance and Propulsion: Practical Estimates of Ship Propulsion Power*, (Cambridge: Cambridge University Press, 2011).

[58] See, for example, *Dundee Advertiser*, 30 October 1855; and *Peterhead Sentinel*, 6 February 1857.

[59] See, for, example, *Aberdeen Journal*, 9 September; *Dundee Advertiser*, 14 October; and *Peterhead Sentinel*, 9 October.

Substantially improved catches, at least initially, helped accelerate the pace of transition from sail to steam and once again altered the scope, scale, and character of Arctic whaling/sealing. 1859 was pivotal in determining the impact of the new technology. Conditions on the East Greenland sealing grounds were so harsh that both of Peterhead's steam-powered, iron whalers, *Innuit,* and the newly acquired *Empress of India*, were lost, while another, *Volunteer*, Newcastle, sank when crushed by ice. In fact, all the remaining English iron whalers sustained damage.[60]

The *Narwhal*, however, an older, wooden Dundee sailing ship converted to steam, brought home 2,841 seals, and helped rescue the crews of the two wrecked Peterhead steamers. More importantly, the vessel was then able to proceed to Davis Strait, demonstrating fully the superiority of steam propulsion in ice navigation and confirming the economic viability of "double voyages"[61] and, in the process, once again exerting additional pressures on both stocks.

Several factors[62] going forward made it inevitable that Dundee would quickly achieve not only British but global supremacy as the major supplier of Arctic whale and seal products. Principal among these was the presence of an innovative and enterprising shipbuilding company, Alexander Stephen and Sons, Ltd., committed to the design and construction of wooden "composite" steamers, rather than iron, which were "not suitable for the rough work of boring into the Greenland pack."[63]

The steamers, however, despite their early successes, had serious liabilities. They were more expensive to acquire, fit out, and operate, and financial losses were therefore considerably higher in a poor season than for sailing vessels operating under similar conditions. The venture, in other words, was still a lottery, but with both greater rewards and penalties. The trends developed prior to 1857 continued through the next decade and a half. Although the 438 vessel-voyages between 1860 and 1874, for example, were deployed equally on both grounds, seventy-nine percent of losses occurred at Davis

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[60] See, for example, B. Lubbock, *The Arctic Whalers* (Glasgow: Brown, Son, and Ferguson Ltd. Nautical Publishers, 1937), 373.

[61] The earlier start of the East Greenland seal fishery made it possible for steamers to deliver or arrange transport of pelts home for rendering and still take part in Baffin Bay whaling – "double voyages" which could not be made by sailing vessels.

[62] Besides superior shipbuilding capabilities, there was the provision of investment capital by textile manufacturers concentrated in Dundee who were at that time converting to jute processing, a procedure requiring substantial quantities of oil, and the existence of sagacious entrepreneurs, already experienced in whaling and sealing who were anxious to take advantage of the new opportunities.

[63] Lubbock, *The Arctic Whalers*, 372. For a comprehensive history of Alexander Stephen and Sons Ltd., see *A Shipbuilding History, 1750-1932* (London: printed for Alexander and Sons, Ltd., 1932).

Strait. Notwithstanding their many advantages, steamers proved to be just as vulnerable to the perils of making the northern passage across Melville Bay before the bowheads were able to "escape" onto their summer feeding ranges, especially when escalating costs, combined with increased competition for a rapidly declining resource, obliged masters to almost place crews and vessels routinely in peril.[64]

Nonetheless, as figures 8 and 9 reveal, the steamers were, in a sense, too efficient. Unable to agree on a resource management plan,[65] it quickly became apparent that the dwindling East Greenland harp seal stock could not sustain this level of harvesting.[66] By the early 1870s, uncertain sealing income again forced Dundee owners to consider alternative deployment strategies for their northern steamers.

Phase 6: Newfoundland Seal Fishery, 1876-1900

The renewed prosperity, then, was short-lived. An international agreement on a closed sealing season, finally reached towards the end of the 1876 fishery,[67] was ineffective and too late. By the middle of the 1870s, East Greenland ships were taking fewer harps and a larger proportion was returning clean. Reports received at Dundee during the 1875 season, meanwhile, indicated that the Newfoundland seal fishery had been extraordinarily successful. It was not surprising, therefore, that, despite two failed attempts fourteen years earlier,[68] a Dundee company, facing financial ruin, again decided to send a steamer to Newfoundland. Although *Arctic (1)* captured only 3,872 harps in 1876, its

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64 In 1862, for example, four Dundee steamers were lost while attempting the northern passage across Melville Bay after encountering particularly harsh ice conditions.

65 Following the return of *Arctic (1)* to Dundee in 1874, for example, a local newspaper commented: "It has been remarked that the seal packs seen this season were not nearly so extensive as those encountered in years gone bye. This has been attributed by some to the tremendous slaughter which has been carried on uninterruptedly and the old ideas of instituting a close season has again been suggested." *Dundee Advertiser*, 17 April 1874.

66 See, for example, *Dundee Advertiser*, 25 April 1871; 22 and 25 April 1872; and 16 April 1874.

67 Ibid., 12 December 1876.

68 In 1862, before the East Greenland/Davis Strait double-voyage strategy had been developed, two Dundee vessels were deployed at Newfoundland with the intention of then proceeding on to Baffin Bay. The local seal fishery, however, was one of the most disastrous in years due to heavy ice and strong onshore winds that compressed the pack. The Dundee Seal and Whale-Fishing Company's experiment was an unqualified failure and the owners decided to focus on the nearer East Greenland whelping patches discussed in the previous section. For full details see, Chesley W. Sanger, "The 19th Century Newfoundland Seal Fishery and the Influence of Scottish Whalemen," *Polar Record* 20, no. 308 (1980); and "Technological and Spatial Adaptation in the Newfoundland Seal Fishery During the Nineteenth Century."

Ship / Year	Camperdown (D.S.W.F. Co.)	Polynia (D.S.W.F. Co.)	Esquimaux (D.S.W.F. Co.)	Arctic (A.S. & Sons)	Aurora (A.S. & Sons)	Narwhal (D.S.W.F. Co.)	Resolute (D.S.W.F. Co.)	Xanthus	Thetis (A.S. & Sons)	Jan Mayen	Terra Nova (A.S. & Sons)	Eclipse		TOTAL CATCH
1862	0	0	—	—	—	—	—	—	—	—	—	—		0
1863	—	*	—	—	—	—	—	—	—	—	—	—		—
1864	—	—	—	—	—	—	—	—	—	—	—	—		—
1865	—	—	—	—	—	—	—	—	—	—	—	—		—
1866	—	—	—	—	—	—	—	—	—	—	—	—		—
1867	—	—	156	—	—	—	—	—	—	—	—	—		156
1868	—	—	—	—	—	—	—	—	—	—	—	—		—
1869	—	—	—	—	—	—	—	—	—	—	—	—		—
1870	—	—	—	—	—	—	—	—	—	—	—	—		—
1871	—	—	—	—	—	—	—	—	—	—	—	—		—
1872	—	—	—	—	—	—	—	—	—	—	—	—		—
1873	—	—	—	—	—	—	—	—	—	—	—	—		—
1874	—	—	—	—	—	—	—	—	—	—	—	—		—
1875	—	—	—	—	—	—	—	—	—	—	—	—		—
1876	—	—	—	3,872	—	—	—	—	—	—	—	—		3,872
1877	—	—	—	27,585	16,230	—	—	—	—	—	—	—		43,815
1878	—	—	3,576	33,678	11,439	738	—	—	—	—	—	—		49,431
1879	—	—	13,176	19,756	26,614	10,809	—	—	—	—	—	—		70,355
1880	—	—	6,425	17,011	9,578	13,769	497	532+	—	—	—	—		47,812
1881	—	—	25,439	3,040	24,875	31,557	40,979	—	14,095	—	—	—		139,985
1882	—	—	8,421	24,663	8,250	4,805	6,467	—	10,598	—	—	—		63,204
1883	—	—	17,739	8,235	12,821	11,291	20,124	—	22,144	—	—	—		92,354
1884	—	991	1,830	101	28,153	2,759	4,227	—	—	—	—	—		38,061
1885	—	159	83	375	12,458	—	39,307	—	—	100	18,534	—		71,015
1886	—	12,095	7,352	11,363	642	—	+ +	—	—	—	10,154	—		41,606
1887	—	7,398	5,174	6,578	5,324	—	—	—	—	—	25,684	—		51,158
1888	—	7,135	22,824	—	24,693	—	—	—	—	—	11,895	—		66,547
1889	—	19,350	20,036	—	11,168	—	—	—	—	—	25,734	—		76,286
1890	—	7,414	10,098	—	12,496	—	—	—	—	—	18,075	—		48,083
1891	—	16,505	20,563	—	16,723	—	—	—	—	—	35,239	—		89,030
1892	—	—	34,123	—	12,266	—	—	—	—	—	12,369	3,595		62,353
1893	—	—	1,754	—	7,719	—	—	—	—	—	7,458	—		16,931
1894	—	—	7,226	—	—	—	—	—	—	—	6,232	—		13,458
1895	—	—	—	—	—	—	—	—	—	—	33,886	—		33,886
1896	—	—	8,457	—	—	—	—	—	—	—	5,339	—		13,796
1897	—	—	1,903	—	—	—	—	—	—	—	3,501	—		5,404
1898	—	—	—	—	—	—	—	—	—	—	—	—		—
1899	—	—	—	—	—	—	—	—	—	—	—	—		—
1900	—	—	18,040	—	—	—	—	—	—	—	—	—		18,040
TOTALS														
Catch	0	71,047	235,396	156,275	241,447	75,728	111,601	532	46,837	100	214,100	3,595		1,156,639
Voyages	1	9	21	12	17	7	7	1	3	1	13	1		93
Averages	0.0	7,894.1	11,796.8	13,021.4	14,202.8	10,818.3	15,943.0	532.0	15,612.3	100.0	16,469.2	3,595.0		12,436.0

* Unable to reach Newfoundland sealing grounds.
+ + Lost on sealing voyage in Notre Dame Bay.
\+ Lost on subsequent whaling voyage to Baffin Bay.
D.S.W.F. Co. - Dundee Seal and Whale Fishing Company.
A.S. and Sons - Alexander Stephen and Sons.

Figure 10. Harp seal catches of Scottish vessels at Newfoundland, 1862-1900. (Courtesy of the author)

captain, William Adams, one of Scotland's most capable northern mariners, was still pleased with the effort and reported that he considered "Newfoundland a very good sealing ground and would be quite willing to go again."[69]

The resource base of the Newfoundland seal fishery, though now also in decline,[70] was still healthier than at East Greenland. The reappearance of the Scots, however, accelerated the pace at which local harp numbers were being reduced. Nevertheless, Adam's experience indicated that Arctic whaling/sealing could still be viable if Scottish owners were prepared to accept Newfoundland methods and employ local sealers. Two companies, acting on his advice, purchased waterfront properties in St. John's to construct boiling yards. These decisions, in effect, signaled that Dundee's sealing efforts would henceforth be focused on Newfoundland.

The reinvigorated industry was thus able to continue its ruthless depletion of the western North Atlantic bowhead stock. Reduced numbers and increased pressure on masters also made Baffin Bay whaling even more dangerous. While sixty percent of the 384 vessel-voyages were conducted at Davis Strait between 1875 and 1900, for instance, fully eighty-four percent of the nineteen losses occurred on those grounds, a seven percent increase over the previous two decades.

By 1882 the Scots were firmly ensconced at St. John's.[71] Throughout the remainder of the decade, however, the success rate began to decline and the Dundee presence there dwindled to just one or two vessels annually by the mid-1890s. The departure of *Esquimaux* following the 1900 season brought Scottish involvement in Newfoundland sealing, and consequently large-scale Arctic whaling/sealing, to a close. Altogether, twelve whalers (with only one loss, *Resolute*, 1886), made ninety-two sealing voyages over a twenty-five-year period, which yielded 1,156,483 harp seals (Fig. 10).

Phase 7: Finale, c.1876-WWI

The Scots also turned to other Arctic activities besides sealing, all essentially attempts to extend bowhead whaling. The most successful was

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69 *Dundee Advertiser*, 12 December 1876.

70 The brief appearance of the two Scottish steamers in 1862 clearly demonstrated their superior ice-navigation capabilities and set in motion a switch away from sail. While briefly revitalizing the local trade, however, they quickly, as at East Greenland, led to sharply declining catches. Sanger, "Technological and Spatial Adaptation in the Newfoundland Seal Fishery during the Nineteenth Century."

71 Their vessels, for example, were often commanded by experienced Newfoundland ice-masters and were manned by highly skilled local sealers. J. Fairweather, *With the Scottish Whalers: The Study of a Shipmaster's Fifty-Two Years at Sea* (Dundee: Printed for private circulation, 1928), 11.

the development of over-winter and land-station hunting at Cumberland Gulf (Fig. 6). The symbiotic relationship that evolved between Scottish whalers and indigenous populations in what is now northeastern Canada during the latter half of the 19th century was complicated and caused participation rates to fluctuate widely.[72]

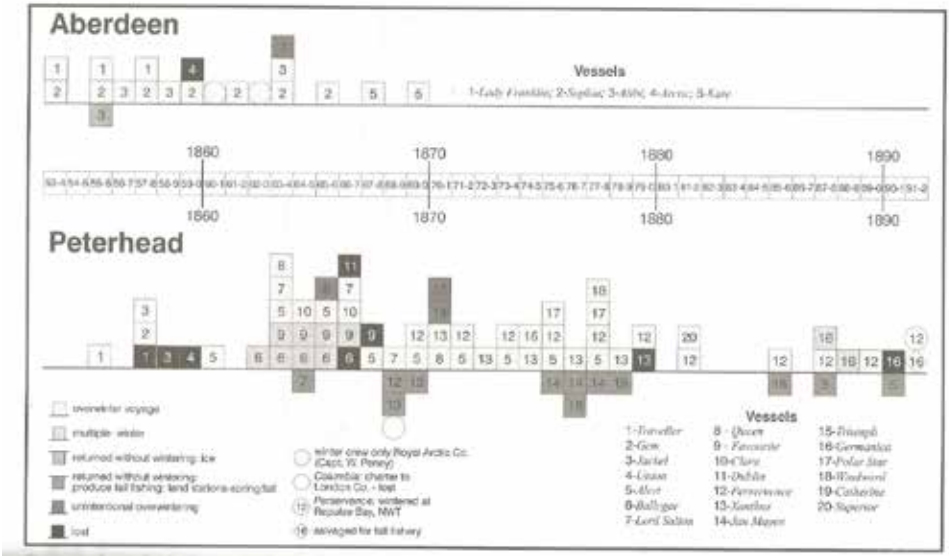

Figure 11. Scottish over-winter whaling at Cumberland Gulf, 1853-1892. (Courtesy of the author)

Aberdeen and Peterhead were the first to take on the less expensive option of land-based whaling, due in large part to their inability to mount a challenge to Dundee in the transition from sail to steam. Rather than newly constructed and well-quipped steamers, experienced personnel, and substantial shore structures, the new venture, originating with Captain William Penny, Aberdeen, in 1853, used older vessels, manned by small, over-wintering crews dependent on Inuit labour and expertise for whaling and, in many instances, survival. These temporary expeditions evolved into "permanent" stations managed by only one or two Scots before later focusing on bartering.

As can be seen in figure 11, twenty-four vessels from Aberdeen and Peterhead were fitted out for whaling at Cumberland Gulf between 1853 and 1890. Over that period there were at least sixty-eight over-winterings, with thirteen returning early, wishing not to risk profits earned during the autumn

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72 For a detailed account, see Chesley W. Sanger, "Scottish Over-Winter Whaling at Cumberland Gulf, Baffin Island: 1853-90," *International Journal of Maritime History* 19, no. 2 (2007).

fishery or due to an inability to reach their winter anchorages. In total, they brought back the produce of more than 346 bowheads.

Other Scottish investors, meanwhile, turned to a number of lesser activities in an attempt to maintain a presence in "Arctic whaling" – the pursuit of smaller marine mammals,[73] an unsuccessful excursion into Antarctic waters,[74] early "adventure-tourism" hunting,[75] and Indigenous bartering expeditions.[76] All of these initiatives, however, only served to slow rather than reverse the pace at which the Arctic trade declined during the last half of the nineteenth century. After more than a century and a half, World War I brought Scotland's participation in Northern whaling and sealing to a close.

Conclusion

Altogether, the blubber of almost 20,000 bowheads was brought home for processing, mostly in ports located on Scotland's east coast. Men from that region and latterly the Shetland and Orkney Islands made at least 160,000 man-trips, crewing more than 3,400 vessel-voyages. Between 1750 and World War I, the Arctic industry contributed to the growth of Scotland's whaling core and in the process heavily influenced the development of the country's economic, cultural, and historical fabric. Evidence indicates that this could only have been accomplished through extraordinary commitment and perseverance in the face of a hostile and dangerous offshore environment and escalating economic challenges.

The reconstruction and analysis presented in this paper indicate that Scottish Arctic bowhead whaling was a century and half downward spiral of depletion-recovery cycles, a seven-segment series which ended only when

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[73] Bottle-nosed whales, in particular. See, for example, *Peterhead Sentinel*, 21 March, and 28 November 1883.

[74] In 1892-3 the Scots were the first to fit out a whaling voyage to the Antarctic. Having elected to use traditional "bowhead" equipment and methods, however, rather than Foyn's new modern technology, the four-vessel expedition was unable to capture any of the numerous rorquals sighted. For full details, see, for example*, Dundee Advertiser*, 6 September 1892 and 31 May 1893; and *Dundee Courier*, 31 May 1893.

[75] See, for example, W.G. Burn-Murdock, *Modern Whaling and Bear Hunting* (London: Seeley, Service and Co. Lid., 1917); and *From Edinburgh to the Antarctic: An Artist's Notes and Sketches During the Dundee Antarctic Expedition of 1892-93* (London: Longmans, Green and Co., 1894); and Lubbock, *The Arctic Whalers*, 439-53.

[76] The ongoing quest to capture the few remaining bowheads was fueled primarily by high bone prices. In 1886, for example, baleen was quoted at £1,400 to £1,500 per ton (*Peterhead Sentinel*, 1 September) and the following year "a small parcel" was sold for £1,150 per ton (ibid, 19 June 1887). An indication of the growing importance of trade with local indigenous populations, manufacturer produce lists were modified in 1902 to include new categories: white whales (Beluga), walrus, seals, bears, and foxes.

the industry ran out of viable economic options. History also shows that similar patterns characterized virtually all global whale fisheries, leading the International Whaling Commission (IWC) in 1986 to impose a moratorium in an attempt, at least originally, to protect the industry.[77] Scottish Arctic whaling, however, appears to have been somewhat unique. Compared to English and continental rivals, for example, its broad-based investment structure and contribution to the industrialization of a restricted economy help explain its remarkable tenacity, best represented by the number of vessels lost and dangers crewmen faced on a regular basis. Of the two hundred and forty-seven whalers which cleared, one hundred and twenty-seven, more than fifty percent, failed to return. Not surprisingly, the data suggest that particularly treacherous and unforgiving hunting conditions were primary causal factors, with peaks in vessel losses reflecting periods of crisis as the industry was forced to transition from one phase to another.

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[77] Although oversimplified, the tumultuous history of the IWC can be summarized as having passed from preserving the whaling industry to the conservation of whale species.