A catch history for Atlantic walruses (*Odobenus rosmarus rosmarus*) in the eastern Canadian Arctic

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ABSTRACT

Knowledge of changes in abundance of Atlantic walruses (*Odobenus rosmarus rosmarus*) in Canada is important for assessing their current population status. This catch history collates available data and assesses their value for modelling historical populations to inform population recovery and management. Pre-historical (archaeological), historical (e.g., Hudson's Bay Company journals) and modern catch records are reviewed over time by data source (whaler, land-based commercial, subsistence etc.) and biological population or management stock.

Direct counts of walruses landed as well as estimates based on hunt products (e.g., hides, ivory) or descriptors (e.g., Peterhead boatloads) support a minimum landed catch of over 41,300 walruses in the eastern Canadian Arctic between 1820 and 2010, using the subsample of information examined. Little is known of Inuit catches prior to 1928, despite the importance of walruses to many Inuit groups for subsistence. Commercial hunting from the late 1500s to late 1700s extirpated the Atlantic walrus from southern Quebec and the Atlantic Provinces, but there was no commercial hunt for the species in the Canadian Arctic until ca. 1885. As the availability of bowhead whale (*Balaena mysticetus*) declined, whalers increasingly turned to hunting other species, including walruses. Modest numbers (max. 278/year) were taken from the High Arctic population in the mid-1880s and large catches (up to 1400/year) were often taken from the Central Arctic population from 1899–1911, while the Foxe Basin stock (Central Arctic population) and Low Arctic population were largely ignored by commercial hunters. Land-based traders (ca. 1895–1928) continued the commercial hunt until regulatory changes in 1928 reserved walruses for Aboriginal use. Since 1950, reported walrus catches have been declining despite a steady increase in the Inuit population. Effort data are needed to assess whether lower catches stem from declining hunter effort or decreased walrus abundance. The recent take of walruses by sport hunting has been small (n=141, 1995–2010), sporadic and local.

These landed catch estimates indicate the minimum numbers of walruses removed. They have not been extrapolated to the whole whaling fleet or interpolated to fill gaps in various records, nor do they account for under-reporting or animals that were killed and lost. Unreported and lost animals may represent a significant fraction of the total removals and must be considered in any modelling exercise. The sources, quality and completeness of the catch data vary widely over time and space and between the different hunt types. This variability confounds interpretation and contributes to the uncertainty that needs to be incorporated into any modelling. The data on Inuit subsistence catches before ca. 1928 are particularly fragmentary and uncertain.

INTRODUCTION

Atlantic walruses (*Odobenus rosmarus rosmarus*) are widely distributed in the eastern Canadian Arctic (Fig. 1; Born et al. 1995, COSEWIC 2006) and have been hunted for subsistence, commerce, and sport. Walruses were once common south to the Gulf of St Lawrence and Sable Island but were extirpated from southeastern Canada by the late 1700s through intensive commercial hunting (Reeves 1978, Born et al. 1995), although individuals are still seen there occasionally (COSEWIC 2006). Their gregarious nature makes them vulnerable to large local takes and, coupled with a narrow trophic niche and restricted seasonal distribution, makes them vulnerable to environmental changes (Born et al. 1995, COSEWIC 2006). Commercial hunting of walruses was banned in Canada in 1928, but they are still taken for subsistence and in a limited sport hunt. The Atlantic walrus has been assessed as "Special Concern" in Canada, partly in recognition of an historical decline in numbers (COSEWIC 2006).

Lack of a comprehensive catch history for Atlantic walruses in Canadian waters makes it hard to assess the status of current populations and to put population changes in context. An increasing population trend may not, for example, provide evidence of significant recovery if the population is still a small fraction of its former size. One approach to establishing this context is to gather data on catches over time and use this information to estimate the sizes of the original populations required to have supported the levels of removal. These historical catch data are

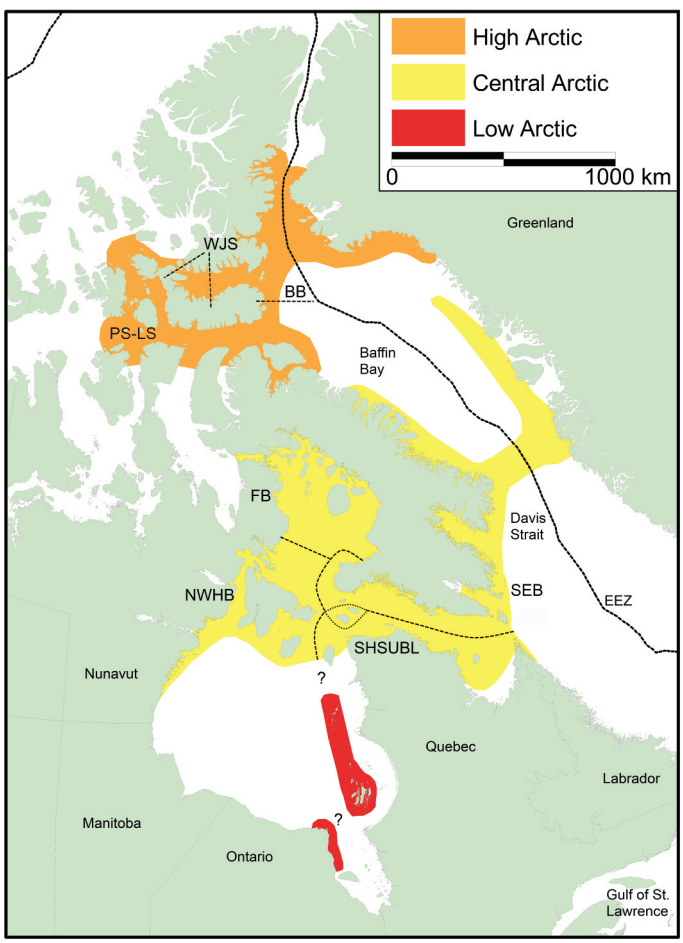
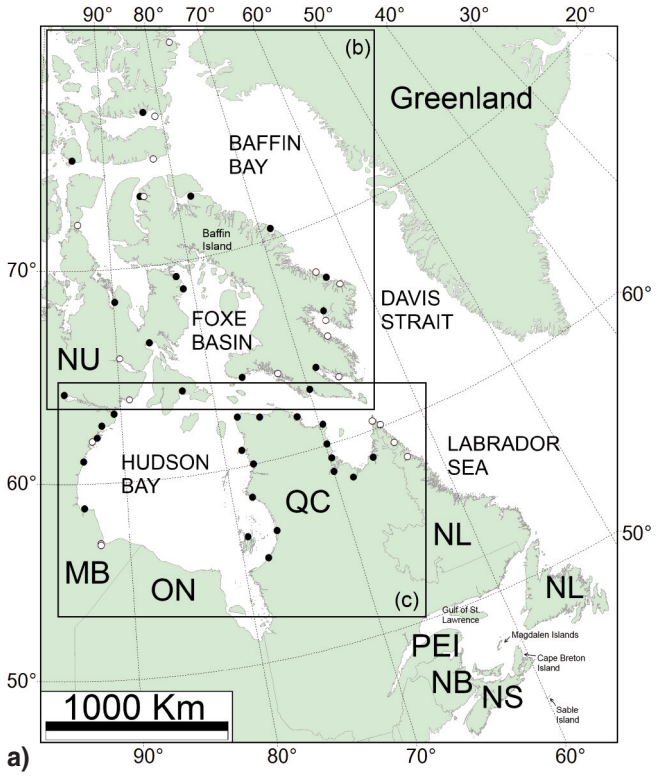


Fig. 1. *Approximate distributions of the Atlantic walrus populations that use Canadian waters, updated from COSEWIC (2006) with information from Stewart REA (2008), LGL Limited and North/South Consultants Inc. (2011), Andersen et al. (2014), Dietz et al. (2014). Elliot et al. (2013); Heide-Jørgensen et al. (2013, 2014), Shafer et al. (2014); and Stewart REA et al. (2013, 2014a-c). Walrus management stocks within these populations include: BB=Baffin Bay, FB=Foxe Basin, NWHB=North and West Hudson Bay, PS-LS=Penny Strait–Lancaster Sound, SEB=South and East Baffin, and SHSUBL=South Hudson Strait–Ungava Bay–Labrador, and WJS=West Jones Sound. Question marks (?) indicate uncertainty with respect to distributions and/or movements.*



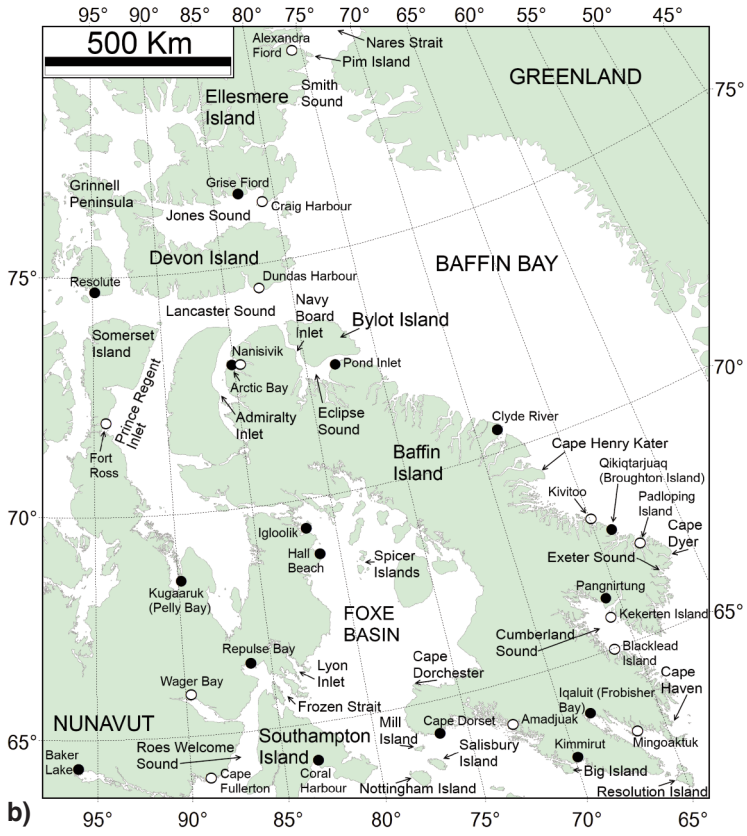
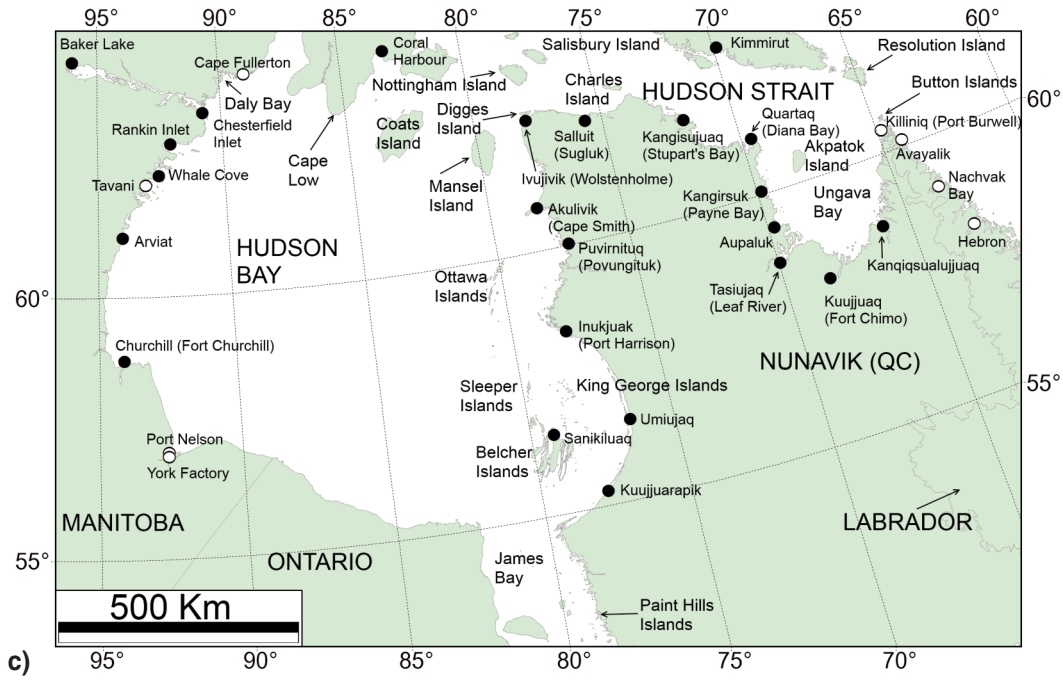


Fig. 2a–c. *Key place names used in text shown on an overview of eastern Canada (2a) with inset maps expanded for the regions north (2b) and south (2c) of Hudson Strait. Black dots denote communities and white dots with black borders denote whaling stations or trading posts. Historical names no longer in use are shown within brackets.*



needed to model population trajectories, gauge population status, set recovery targets, and inform management for sustainable subsistence and sport hunting.

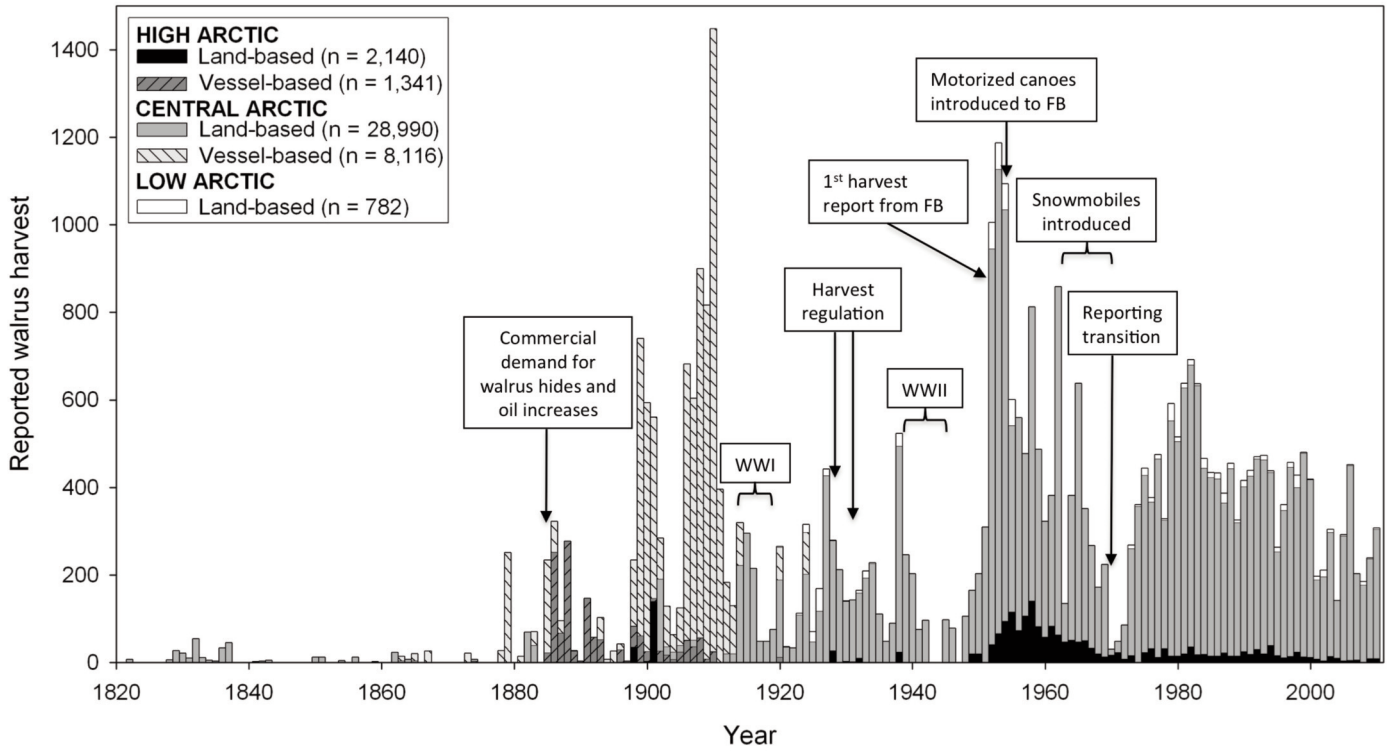
This paper is the first attempt at a comprehensive catch history for the Atlantic walrus in Canada. It considers the full distributional range of the species in Canadian waters, but concentrates on the eastern Canadian Arctic (Fig. 2a–c). We summarize and interpret data from pre-historical (archaeological), historical, and modern catch records first in a timeline considering the factors driving the various types of hunts, and then by biological population and management stock. Aspects of the data record pertinent to future population modelling are discussed.

PART 1: TEMPORAL OVERVIEW OF WALRUS HUNTING

Walrus hunting in Canada spans many centuries concomitant with changes in human occupancy and culture. Although necessarily brief and oversimplified, for historical context we provide a timeline (Fig. 3) before presenting our methods of data collection and interpretation.

Prehistorical Aboriginal Subsistence

Paleoeskimos, the first known human occupants of the eastern Canadian Arctic, migrated east from Alaska (possibly Asia) during a relatively warm period ca. 2500–2000 BC. The two major periods are Pre-Dorset (ca. 2200–500 BC) and Dorset (ca. 500 BC until ca. 1000–1500 AD; Maxwell 1985, Helmer 1994, Dyke and Savelle 2009). Paleoeskimo sites are distributed throughout the Canadian High Arctic; in Hudson Bay, Hudson Strait, and Foxe Basin; along the Labrador coast south to Newfoundland; and in Greenland (Maxwell 1985). Paleoeskimo cultures possessed sea mammal harpoons but not the sophisticated whaling technology of the later Neoeskimo (Thule) culture (Savelle 1994). The Dorset culture had a form of kayak (Maxwell 1985) but there is little evidence for the use of dogs (Darwent 2002, Morey and Aaris-Sørensen 2002). Many Dorset sites are located near extensive areas of fast ice and polynyas (Schledermann 1980), and site artifacts often include tools such as ice chisels and scoops. This and the lack of toggling har-



COMMERCIAL	Limited demand or directed hunting; limited trade with Inuit, mostly for ivory	Opportunistic hunts	Targeted hunts for walruses	Lower hide prices	Purely commercial hunts prohibited after 1928 but trade for products permitted until 1931	
SUBSISTENCE	Whalers and explorers hunted walruses for subsistence, often with Inuit help; few data on Inuit subsistence catches or requirements	Inuit involvement in commercial and subsistence hunts by whalers, traders, and others. Few data on Inuit subsistence catches.			Hunted by Inuit for subsistence. Substantial trade in walrus products prior to regulation in 1931. Inter-settlement trade continues; handicrafts sold. Declining catches probable since ca. early 1950s; increasing human populations.	
SPORT	Sporadic sport harvests, mostly from the High Arctic by whalers,				Sport hunting prohibited	Regulated sport hunting
REPORTING	Vessel logbooks → HBC Journals → RCMP (Nunavut) → DFO; HBC Journals → DFO (Nunavik) → Makivik					

Fig. 3. *Timelines of key events related to catches reported by vessel-based (commercial whalers), and land-based (others) hunters from Atlantic walrus populations in the eastern Canadian Arctic, 1820–2010. FB=Foxe Basin, WW=World War. Solid blue lines and their labels indicate the primary sources of catch reports during a particular period; dashed blue lines indicate less consistent sources.*

poons and float equipment suggest that sea ice hunting techniques (seal holes and floe edge) were more important than open-water hunting (Mary-Rousselière 1976, Maxwell 1985).

The early Dorset period is characterized by the appearance of more heavily constructed harpoon heads (Murray 1996, 1999) and a significant increase in the proportion of walrus remains in faunal assemblages (Darwent 2002). At Dorset sites in Newfoundland, harp seal (*Pagophilus groenlandicus*) remains dominate the assemblages (> 90%; Harp 1951, 1976, Renouf and Murray 1999, Hodgetts et al. 2003). Walruses do not appear to have been hunted there (Maxwell 1985), although they were represented in artwork and spiritual items (Harp 1970).

Maxwell (1985) suggested that the presence of walruses and bearded seals (*Erignathus barbatus*) was important to Dorset cultural development throughout the core area of northern Baffin Island, Foxe Basin, Southampton Island and northwestern Hudson Bay, and Hudson Strait (Fig. 2 a–c). Significant amounts of walrus bones were found at the Avayalik site in northern Labrador where walruses may have been hunted in winter, presumably at the floe edge (Cox and Spiess 1980). Early to middle Dorset sites with significant amounts of walrus remains include locations on the coasts of northern Foxe Basin, Ungava Bay, Southampton Island, Hudson Strait and northern Labrador (Taylor 1968, Cox and Spiess 1980, Murray 1996, Monchot et al. 2013). Walruses likely represented a significant source of food and oil and provided material for tools, artwork and religious items (Maxwell 1985, Monchot et al. 2013).

Neoeskimo or Thule (Mathiassen 1927) migrants from Alaska, ancestors of modern Inuit, spread eastward during the Medieval Warm Period and arrived in the central and eastern Arctic ca. 1200 AD (Savelle and McCartney 1990, Park 2000, Friesen 2004). Remnants of the Dorset culture persisted in northern Quebec and Labrador until about 1500 AD. The degree of overlap between migrating Neoeskimo groups and terminal Paleoeskimo cultures is a matter of debate (Friesen 2004, Coltrain 2009).

Bowhead whales (*Balaena mysticetus*) were a key component of the early Thule economy and the warming trend led to a decrease in summer ice cover and a range expansion for both whales and whalers (McGhee 1969–1970, 1972, 1975, McCartney 1977, Savelle 2010). The Thule people used boats (*umiaks*) and dog teams that enabled them to exploit a greater variety of food items than their predecessors and likely facilitated their successful colonization of the central and eastern Canadian Arctic (Coltrain et al. 2004). The larger boats facilitated cooperative hunting and harpoons with toggle heads and inflated skin bladders enabled early Thule hunters to focus on bowheads. McCartney (1977) distinguished between 'classic' and 'modified' Thule, with classic Thule referring to the early culture carried into the Canadian Arctic, with a focus on bowhead whales. Modified Thule (McCartney 1977) refers to adaptations after ca. 1500–1600 AD, following climatic cooling brought about by the Little Ice Age, when whaling declined and the economy became more diversified (Schledermann 1979, Coltrain et al. 2004).

Historical Inuit Subsistence

The "Historical Inuit Subsistence" period was defined for the purposes of this discussion as starting with the availability of written records (i.e., a shift from archaeological to ethnographic sources, written documentation from explorers, whaling logbooks, etc.) and ending with the introduction of walrus protection regulations in 1928 (Canada 1928: P.C. 1036). The Thule culture began the transition to today's Inuit culture ca. 1600 AD, about the time of European contact. There is significant spatial variation in the timing and intensity of European contact, which adds difficulty to using this to define the period and affects the availability of written materials. Inuit on Baffin Island met European explorers starting in the 1600s (in addition to possible prior Norse contact; Fitzhugh 1985). With few exceptions, mostly in the south, written records of this contact were rare and sporadic until at least 1820, when whalers began the heavy exploitation

of bowhead whales in Lancaster Sound and Baffin Bay (Ross 1974, 1979a). While there was increasing contact between whalers and Inuit along the east coast of Baffin Island, it did not extend southwest into Cumberland Sound until ca. 1840 (Ross 1983). Based on Moravian diaries from the late 1700s, walruses were important to Inuit in Labrador as far south as 57°26′N, in the vicinity of Nain, where the animals appeared at the ice edge in February and March (Taylor 1984).

Between 1810 and 1860, prior to whaling contact, Inuit along the south coast of Hudson Strait (east of Salluit) and west coast of Hudson Bay (south of Cape Fullerton) had occasional access to trading posts (Ross 1975). There were nearly annual encounters between Inuit and Hudson's Bay Company (HBC) vessels along the south coast of Baffin Island in the Kimmirut (Lake Harbour) area. Contact in the Cape Dorset, Repulse Bay and Igloolik areas was limited to infrequent meetings with explorers. The *Sadlirmiut* of Southampton did not come into contact with whites until the whaling period and diseases they contracted from the whalers led to their extinction by the early 1900s (Ross 1975). In northern Foxe Basin contact was limited until the 1930s, when the Roman Catholic Church established a mission in the region in 1931 (Crowe 1969) and the HBC established a post at Igloolik in 1938 (HBC Archives [hereafter HBCA, listed in Supplement 1] Igloolik Post History).

Fig. 4. *Historical progression of walrus hunting methods from earliest proceeding clockwise from upper left to most recent: upper left) Inuit catching walruses near Igloolik in the 1820s (Parry 1824:172); upper right) explorers beset by walruses during an unsuccessful hunting expedition in Smith Sound in July 1861 (Hayes 1867:pl. 7); lower right) Inuit retrieving a walrus shot at the ice edge near Igloolik in 1952–1953 using a walrus hide line (Source: © Library and Archives Canada/ PA-129868, credit: R. Harrington /Richard Harrington fonds); and lower left) a hunt in open water south of Ellesmere Island using high-powered rifles in 1977 (credit: R.E.A. Stewart).*

Walruses were an important source of food and materials for Inuit during this period, although catch levels are difficult to establish because the record is meagre, especially before the mid-1800s (Fig. 4). The catch record is stronger thereafter although Inuit subsistence catches are often difficult to distinguish from those of other concurrent hunters, including commercial whalers, land-based traders, missionaries, Royal Canadian Mounted Police (RCMP), and representatives of other government agencies. Many of these groups employed Inuit to hunt walruses on their behalf or offered them goods in trade for walrus products. Sometimes the Inuit kept portions of these walruses for their own use or used products from others' hunts. The HBC and other agencies occasionally conducted walrus hunts in the fall to supply Inuit camps with meat for the winter and prevent starvation of both the people and their dog teams. These hunts were not entirely altruistic as they enabled Inuit trapping for trade fur during the winter.

Subsistence catches in the mid-1800s are difficult to estimate but were likely modest due to the technology available and risk involved in securing these large animals. They varied geographically and temporally in response to availability of the animals and other factors such as opportunities for trapping, population mobility, hunting costs, and the availability of wage employment. Northern Foxe Basin may be an exception. There, the lack of alternatives to walrus hunting may have kept this practice relatively constant over time, making it reasonable to extrapolate take levels in the mid-1900s to estimate earlier levels after considering the annual requirements of human and dog populations.

Commercial hunting by ship-based whalers

The Dutch initiated whaling for bowhead whales in Davis Strait prior to 1719 but most whaling took place along the Greenland side of Davis Strait and Baffin Bay until ca. 1820 when it shifted to western Davis Strait and western Baffin Bay, including Lancaster Sound and its adjacent inlets (Lubbock 1968, Ross 1979b). Collectively these efforts were often referred to as the "Davis Strait whale fishery." In 1817 and 1819 whalers and explorers found large numbers of bowheads in western Baffin Bay (Lubbock 1968) and in Lancaster Sound (Parry 1821) which soon diverted British whalers from the intensely competitive hunting in eastern Baffin Bay. English and Scottish sailing vessels crossed the North Atlantic in March or April and followed the retreating ice edge north off the west coast of Greenland until they could cross to the ice edge at Lancaster Sound or Pond Inlet, typically between late June and early August (see also Ross and MacIver 1982, Reeves et al. 1983). They chased whales in the sounds and inlets until fall then went south along the east Baffin coast, ahead of the forming ice and crossed the Atlantic. In the 1820s sometimes over 90 British vessels were involved in the Davis Strait fishery (Lubbock 1968).

The wooden sailing vessels used by the whalers were poorly equipped to deal with ice. They were relatively small, difficult to manoeuvre, and vulnerable to crushing. In some years, heavy moving pack ice inflicted catastrophic losses on the fleet, e.g. 14 vessels in 1819 (Parry 1821) and 19 in 1830 (Lubbock 1968). They were also poorly equipped to overwinter at high latitudes and few did so voluntarily. Contact with the Inuit was limited mostly to trading during lulls in the short open-water hunt.

When bowheads were abundant the whalers concentrated their effort on those animals, which provided large quantities of fine oil more reliably and with less effort than walruses or other Arctic marine mammals. Reduced whale numbers and heavy ice conditions that led to some poor bowhead catches in the mid 1830s and early 1840s signalled the beginning of the decline of the whale fishery in Lancaster Sound (Lubbock 1968). As catches dwindled the whalers stayed later in the fall along the east coast of Baffin Island searching for migrating bowheads (Barron 1895, Sanger 1994). To make ends meet, they had to find richer whaling grounds, improve hunting efficiency, and/or diversify their activities.

The search for better whaling grounds led to the discovery and development of whale fisheries in Cumberland Sound in 1840 (Ross 1983) and in northwestern Hudson Bay in 1860 (Ross 1975). Few ships intentionally overwintered in the eastern Canadian Arctic until 1853, when the Scottish whaling captain William Penny wintered in Cumberland Sound to get a head start on the spring whaling (Lubbock 1968, Sanger 2007). The success of this approach led to the development of whaling stations on Kekerten Island (1857) and Blacklead Island (1860) that operated until the 1920s (www.historicplaces.ca). In northwestern Hudson Bay, overwintering was the norm for American whalers from 1860 onward (Stackpole 1969, Ross 1975, 1984).

Steam whalers began entering the Arctic whaling fleet in 1859 and participated in the fishery until the early 1900s (Lubbock 1968, Sanger 1988). Steam power greatly improved whalers' ability to manoeuvre and enabled them to reach the North Water (polynya) about a month earlier in the spring (Sanger 1994). The strengthened wooden full or barque-rigged screw steamers built in Dundee were much more robust in ice than the iron steamers constructed in Hull and Peterhead (Sanderson 1958, Lubbock 1968, Sanger 1988). These advantages enabled the Scottish whaling fleet to continue whaling until the early 1900s. The last of the English fleet sailed about 1870 and by 1879 almost all of the Arctic whalers were steam-powered (Lubbock 1968).

Prior to ca. 1870, vessel logs provide evidence of walrus products obtained in trade from Inuit by explorers, whalers, and traders but little evidence of significant commercial hunting effort (Fig. 3; Barron 1895, Ross 1975, D.B. Stewart unpublished data). The whaling crews that hunted walruses occasionally (Barron 1895) were not necessarily well equipped for the task. At that time, whale lances would not penetrate the thick walrus hide and lead bullets flattened against the thick skull. Consequently, the whalers avoided harpooning walruses when they were actively looking for whales lest they "cripple" their harpoons (Barron 1895 p.193).

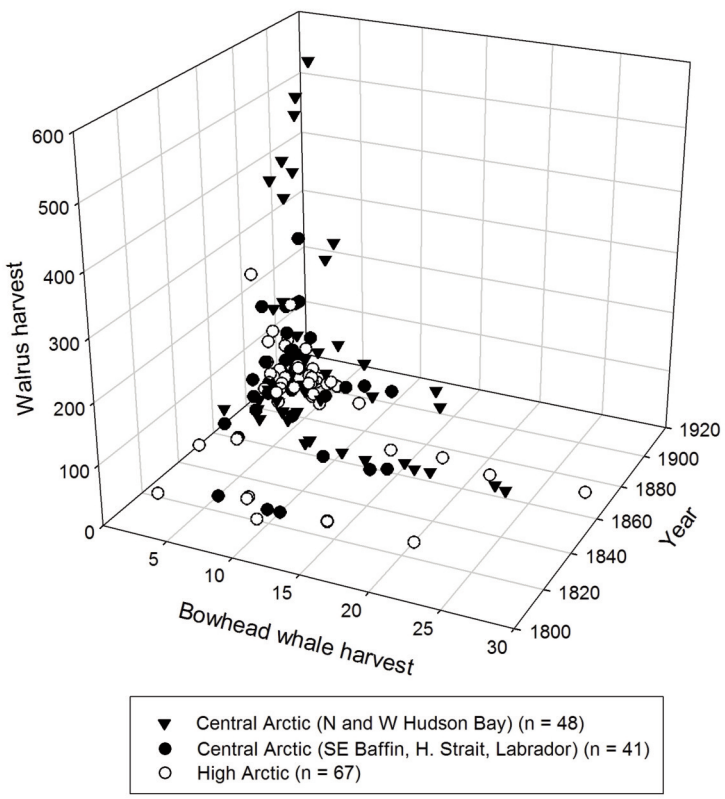


Fig. 5. *Three-dimensional plot showing how walrus and bowhead catches by individual whaling vessels operating in the eastern Canadian Arctic changed relative to one another between 1800 and 1920.*

In the 1870s and early 1880s the interest in obtaining walrus products began to increase (Southwell 1884, Watson 2003). The numbers taken by the whalers or traders were modest but large quantities of ivory were sometimes acquired in trade from the Inuit (Ferguson 1938). Compilers of British whale catches, such as Southwell, Ingram, and Lubbock, seldom mentioned walruses until 1885, but subsequently included walruses in their annual summaries as commercial interest in obtaining walrus products increased sharply (*Chieftain 1885, Esquimaux 1885, Maud 1885*) [Note: italicized citations are to ships' logs listed in Supplement 2]. By the turn of the century walrus catches were contributing significantly to the economics of the waning commercial whale fishery in the eastern Canadian Arctic (Fig. 5). Walruses were seldom mentioned in compilations (e.g., Starbuck 1878; Stackpole 1969) of American whalers' catches, although by 1884 products from species other than bowheads had become significant (Gordon 1885).

Some vessels and companies concentrated more than others on walrus hunting or on trading for walrus products. This was particularly apparent in the returns of whalers with shore stations on

Fig. 6. *Various craft have been used to hunt walruses in the eastern Canadian Arctic and have had their catches described as a "boatload" (proceeding clockwise from upper left): upper left) an umiak at Wakeham Bay in 1903 (Low 1906:facing 64) was made of hide (possibly walrus) and used for transport but in the past umiaks were also used to hunt walruses (Bruemmer 1992); upper right) the Scottish steam whaler* Active *leaving Dundee for Baffin Island took many walruses between 1898 and 1913 (HBC Archives photo 1987/363-W-46/26); lower right) the New Bedford whaling schooner* Era, *wintering at Cape Fullerton in the spring 1904 with a whaleboat in the foreground, also caught walruses (Low 1906:facing 250); lower left) the Peterhead boat* Seal *and a whaleboat carrying a kayak at Fort Ross in July 1949 (credit L.A. Learmouth, HBC Archives photo 1987/363-E-396/26); and middle left) a modern canoe with an outboard motor at Cape Dorset (credit: D.B. Stewart).*

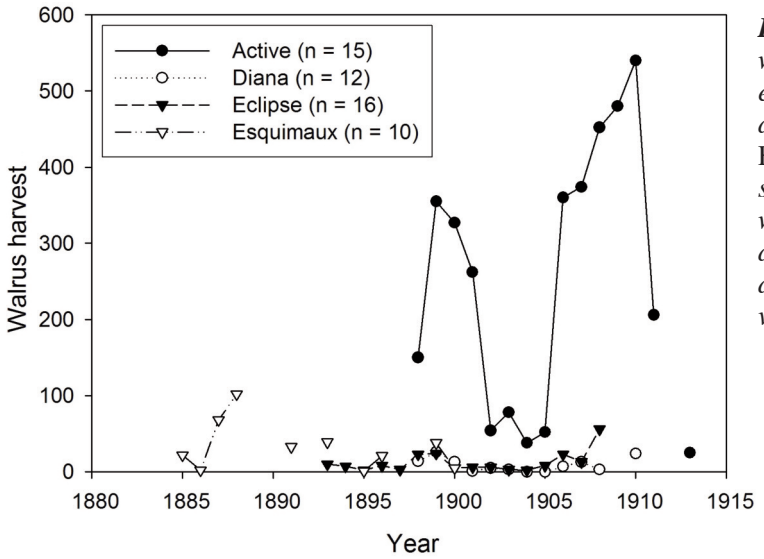


Fig. 7. *Walrus catches by whaling vessels that hunted in Hudson Bay (*Active*) and Davis Strait (*Diana, Eclipse, Esquimaux*) sometimes fluctuated widely from year to year and harvest patterns were different from vessel to vessel.*

southeastern Baffin Island and in northwestern Hudson Bay in the early 1900s. These stations were engaged in hunting year-round and were visited in summer by vessels that returned the products to Scotland or New England (Sanger 2007). The crews of some of the vessels also conducted their own hunts. The Robert Kinnes and Sons vessel *Active*, for example, gathered produce from the firm's shore stations on Southampton Island and at Repulse Bay and Kimmirut (Fig. 6) while also regularly transporting Inuit from the Kimmirut area into Hudson Bay to assist with whaling and walrus hunting (Ross 1975). Kinnes targeted walruses and took them in large numbers, although the annual catches varied widely and tended to be lower in years with successful bowhead hunts (Fig. 7). In contrast, whaling vessels such as the *Diana*, *Eclipse*, and *Esquimaux*, which operated primarily in the Lancaster Sound area and along the east coast of Baffin Island, took walruses only opportunistically.

Commercial hunting by land-based traders

Traders who established year-round posts that were supplied by ships exploited walruses for commerce and subsistence (including dog food). These posts were established much earlier along the mainland coast than on the Arctic Islands (Usher 1971, 1976, Stewart and Lockhart 2005, HBCA Post Histories). The focus of their operations was typically furs but they would also obtain directly or trade for marine mammal products, particularly oil, baleen, hides, ivory, and meat.

Early in its history the HBC showed interest in obtaining walrus products. The company exported 20 walrus ("morse") hides from Hudson Bay between October 1681 and February 1682 (Rich 1946). Employees were encouraged to obtain "seahorse teeth" (i.e., walrus tusks) as early as 1682 (Rich 1948 p.42) and in ca. 1690 George Geyer at York Fort was instructed to send a sloop along the shore of Hudson Bay in search of this ivory (Rich 1959). While the full record was not examined, 30 years of data from Churchill between 1817 and 1865 show small but regular ivory returns, typically less than 100 lbs per year, from at least 1820 onward (D.B. Stewart unpublished data). The ivory returns increased in 1882, when the Churchill post began sending annual sloop voyages up the west coast of Hudson Bay to Marble Island to trade with the Inuit and hunt (Tuttle 1885, Ross 1975 p.143 note 7). These forays appear to have declined by the early 1900s, perhaps due to strong local competition from whalers aboard the *Era* and *Active* (Fig. 6), and later because the HBC began establishing permanent posts in the more northerly regions.

The HBC post established in 1830 at Fort Chimo (Kuujjuaq) on Ungava Bay did not conduct regular coastal trade by sloop, so it was up to the Inuit to visit the post (Ross 1975). Some Inuit

along the east coast of Hudson Bay travelled south to trade, but most remained beyond the range of direct contact until the establishment of posts on Hudson Strait after 1909.

In the eastern Canadian Arctic, posts were not established specifically for the fur trade until the early 1900s (Usher 1971, 1976). Firms or former whaling captains at old whaling stations such as Blacklead Island, Kekerten, and Cape Haven conducted the initial trade (see also Ross 1975, White 1977, Goldring 1986). The reliance of these stations on whaling declined after 1880 as depletion of bowheads and low prices for oil, baleen, and seal skins forced the station owners to rely increasingly on trading with local Inuit for products from other species (Goldring 1986, Sanger 2007). By 1910 the HBC was extending its operations northward from its well-established mainland posts at Churchill, Great Whale River (Kuujjuarapik), and Fort Chimo (see also HBCA Post Histories [Supplement 1]). By the mid-1920s it had extended its operations in western Hudson Bay north to Repulse Bay and in the east along the south coast of Hudson Strait. Posts had also been established on Baffin and Southampton islands. By 1925 the HBC had absorbed many of the smaller whaling and trading companies and had a virtual monopoly on the eastern Arctic fur trade. Révillon Frères and a few independent traders remained but they were not serious competition. Of the 23 posts the HBC had opened in the eastern Arctic region prior to 1940, only nine remained by the end of that year (Usher 1976). This reduction was due to the difficult logistics and high costs and to restrictions on development within the Arctic Islands Preserve, which was established in 1926 to protect wildlife for the sole use of Aboriginal inhabitants (Canada 1926: P.C. 1146).

Walrus catches by traders and Inuit after ca. 1910, particularly prior to ca. 1931, were both commercial and subsistence; the two purposes are difficult to distinguish and separate. The HBC and others sought to obtain walruses for hides, ivory and oil but by the start of World War I, the demand for hides had become much reduced. Throughout this period walruses were a vital source of meat for humans and their dogs. Traders, Inuit, missionaries, and police often worked together to amass enough meat to avoid winter starvation of people and/or dogs and to enable hunters to focus on winter fox trapping, rather than having to hunt seals for food. In lean years the Federal Government, with the HBC as an intermediary, sometimes subsidized these hunts (e.g., HBCA RG3/26B).

In 1928, Canada established regulations that restricted killing of walruses to Aboriginal hunters for their own food and clothing requirements but allowed walruses to be taken under Ministerial permit for scientific purposes (Canada 1928: P.C. 1036). These regulations ended the commercial hunting of walruses in the eastern Canadian Arctic by whalers and traders. They also ended subsistence and sport hunting of walruses by non-Aboriginal peoples. These regulations were an important step toward reducing hunting pressure on the walrus populations but they left important loopholes that enabled the traders to purchase hides and ivory. From 1929 through 1932 the HBC alone exported 42,288 kg (93,146 lbs) of walrus hide and 531 kg (1,170 lbs) of ivory (Loughrey 1959 p.119 [Note: Loughrey's totals were corrected for 1,026 lbs of ivory erroneously listed as hide—D.B. Stewart unpublished data]). These products would have been acquired between 1 June 1928 and 31 May 1932. When double counting of ivory and hides is avoided these exports represent about 614 walruses (D.B. Stewart, unpublished data). In 1931 more explicit regulations were issued forbidding the export of walrus hides and uncarved tusks, and limiting the catch of walruses to seven per family (Canada 1931: P.C. 1543). Further Orders in Council (Canada 1934: P.C. 1274, Canada 1947: P.C. 5361, Canada 1949: P.C. 4991, Canada 1959: P.C. 807) amended the earlier regulations but did not change their main intent (Mansfield 1973).

Commercial demand for walrus products

Commercial whalers and later land-based traders hunted walruses for their thick skin, oil and

ivory, which were marketed primarily in Britain and New England. The meat had no commercial export value but it provided important sustenance for the crews of overwintering vessels and shore stations, and helped prevent scurvy (Ross 1975). Depending upon need and economics, meat and other hunt products were often shared with Inuit for their use or to feed dog teams. Other products were sometimes put to innovative use, for example in 1831 the windows of the HBC men's house at Fort Chimo (Kuujjuaq) were made of "seahorse gut" (Davies 1963 p.136). A few walruses were captured alive and sold (Watson 2003).

When the whale fishery in the eastern Canadian Arctic began, there was little commercial demand for the thick walrus hides, although they were sometimes used onboard whale ships to prevent

Fig. 8. *Walruses have provided materials for many purposes (proceeding clockwise from upper left): upper left) first and foremost they have been and remain an important source of food for Inuit and their dogs (Source: © Library and Archives Canada/ PA-168606, credit: R. Harrington /Richard Harrington fonds); upper right) their strong, durable ivory was vital for making tools such as harpoon heads even after the arrival of metals (collected in 1738 from Hudson Strait; photo © Trustees of the British Museum); lower right) more recently Europeans have incorporated walrus ivory into trade items such as this walking stick (ca. 1850–1900) (credit: D.B. Stewart); and lower left) for the fabrication of dentures (source: Whitby Museum).*

the masts etc. from chafing (O'Reilly 1818). Commercial demand for walrus hides increased in the last quarter of the 19th century, when they were used for bicycle seats (Lubbbock 1968). Whalers began actively seeking out and hunting walruses and soon the tough hides were being used to make industrial belts, carrying bags, and lining for automobile tires (Wakeham 1898, Anderson 1934). The Scots generally made a strong effort to secure walrus hides, but the Americans rarely preserved the hides (Ross 1975). The market for walrus hides declined sharply ca. 1914, when tanners were "full up with orders for the Army, and consequently unwilling to burden themselves with heavy Walrus hides." (HBCA A.12/FT, 327/1 and HBCA A.95/118 cited in Reeves and Mitchell 1986 p.63). By the early 1920s some traders did not consider walruses worth hunting for their hides (Munn 1922), although the HBC continued to purchase them until 1931 (e.g., HBCA B.392/a/5, fo. 49, 50, Loughrey 1959, D.B. Stewart unpublished data).

As bowhead whaling declined, taking walruses for oil increased (Fig. 5) even though the strong smell of walrus oil limited its market largely to Dundee (Fraser and Rannie 1972). The difficulty of securing and processing walruses limited production, while advances in petroleum drilling in the late 19th century provided an alternative source of fine oil. By 1928, when commercial hunting of walruses was prohibited in Canada, only a few were being killed and rendered for oil by commercial whalers or land-based traders.

During the whaling period, walrus ivory was considered inferior to narwhal (*Monodon monocerous*) and elephant (F. Elephantidae) ivory because it was prone to yellowing (Wakeham 1898, Low 1906, Loughrey 1959, McTavish 1963), although dentists considered it ideal for making false teeth (Fig. 8; Sutherland 1993). The whalers placed a fairly high value on walrus ivory. In 1905 Captain Milne, master of the *Eclipse*, received a 4% commission on all walruses taken on the voyage, plus a commission of either 15% (Mitchell and Reeves 1981 citing Lubbock's manuscript notes) or 25% on all tusks (Lubbock 1968, Reeves 1992). In the early 1900s tusks sold for about three shillings a pound and were bought mostly as curiosities (Fraser and Rannie 1972). In the 1950s the HBC also purchased walrus molars at $0.05 apiece (Loughrey 1959). In 2013 the Northern Store in Igloolik sold pairs of walrus tusks for about $90 from November through April but the price declined to about $35 in spring and fall when more ivory was available (W. Qamukaq, pers. comm.).

There is little evidence that commercial whalers or traders marketed walrus bacula (penis bones, singular: baculum) but they were sought after as curiosities (DFO 2013). The HBC paid $0.50 apiece for walrus bacula in the 1950s (Loughrey 1959) and in 1961 the post in Igloolik was purchasing bacula for $1 apiece (Perey 1961). About that time, one of the company sheds contained several hundred bacula destined for England to be made into canes (Burns 2012). The company also kept a supply at its central headquarters in Winnipeg for presentation to retiring northern employees. In 1972, tourists to Grise Fiord were purchasing bacula for $5 or $10 apiece as souvenirs (Riewe and Amsden 1979); in 1974 the Coral Harbour Co-op was purchasing them for $2.50/lb, as they were "fast becoming a collector's item" (Bowden 1974); and in 1992 the Co-op in Igloolik was paying $10/baculum (Anderson and Garlich-Miller 1994). In 2013 the Northern Store in Igloolik was charging about $35 a foot (~30.5 cm) for a baculum (W. Qamukaq, pers. comm.).

The capture and sale of live walruses was not uncommon in later years. In 1887, Captain Adams of the Dundee whaler *Maud* killed at least 10 walruses in Exeter Sound to capture a live adult female and return it to Dundee (Watson 2003). Newspapers at the time claimed that it was the first fully grown walrus ever to arrive in Britain. A number of calves had already been sold to Barnum's circus, but these animals invariably succumbed after a few months. In 1898 the *Nova Zembla* also captured a live walrus, and in 1899, four walrus calves died while being held aboard the *Esquimaux* (Walker 1900).

Effects on Inuit Subsistence

Interactions with whalers affected the subsistence and settlement patterns of the Inuit more in some areas than others. In the Lancaster Sound region contact between the whalers and Inuit was mostly limited to brief summer trading visits until 1903, when Robert Kinnes and Co. established a year-round shore station in the Pond Inlet area (Usher 1971, HBCA Post Histories: Pond Inlet). Contact was likewise limited along the north and south coasts of Hudson Strait, where crews of the HBC ships seldom went ashore and whalers seldom overwintered (Ross 1975). There are no surviving narratives from the Spicer Island station or the Kinnes company's activities along the north coast of Hudson Strait (Ross 1975). Only one whaling voyage visited northern Foxe Basin (Ross 1975).

In contrast, there was year-round contact with whalers who overwintered in Cumberland Sound and Hudson Bay. Whalers began overwintering in Cumberland Sound in 1853 (Lubbock 1968, Goldring 1986, Sanger 2007) and year-round shore stations were soon established at Blacklead Island and Kekerten that operated into the 1900s. Inuit were employed to assist with whaling and to hunt for provisions and trade goods in the off-season. Their populations became more concentrated near the stations, and their seasonal patterns of resource use came to focus more on commercial hunting activities. They also obtained greater access to innovations such as firearms and whaleboats, and became increasingly reliant on the use of firearms (Wakeham 1898, Munn 1922, Goldring 1986). After 1880 only station schooners or tiny supply vessels overwintered in Cumberland Sound, and whaling vessels rarely visited. The Americans withdrew from Cumberland Sound in 1892. Bowheads and belugas (*Delphinapterus leucas*; see Reeves and Mitchell 1981) were still hunted opportunistically but contact was maintained by the trade in ringed seal (*Pusa hispida*) oil and hides, an increasing market for walrus products ca. 1900, and growing international interest after 1900 in the pelts of white foxes (*Alopex lagopus*) and polar bears (*Ursus maritimus*). As whaling collapsed, the number of trading stations increased (Goldring 1986) and the Inuit population shifted away from camps near the floe edge.

American whalers began overwintering in Hudson Bay in 1860 (Ross 1975) but were slow to develop shore stations. Both the Scottish and American whalers employed *Aivillingmiut* people who lived in the Chesterfield Inlet-Repulse Bay area to assist with their hunting activities, and Inuit were attracted in considerable numbers to winter settlements near the ships (Robinson 1973, Ross 1975, Clark 1986). Caribou (*Rangifer tarandus*) and whale hunts were considerably intensified to support the whalers but Inuit subsistence also benefitted from the whale products. The number of Inuit hired and their continuity of employment increased as the number of whalers operating in the region declined. The manpower these Inuit devoted to hunting seals and walruses for their own use may have been reduced, but the yield may have remained relatively stable as technological innovations improved productivity (Robinson 1973). Near the end of the whaling era, large-scale depletion of game resources along the northwestern coast of Hudson Bay led to relocation of the *Aivilingmiut* to Southampton Island (Robinson 1973, Ross 1975).

The introduction of firearms made walrus hunting safer and more productive for the Inuit by increasing the distance at which animals could be killed (Ross 1975). Guns were used by Inuit along the west coast of Hudson Bay by the mid-1800s and in widespread use by the 1880s, progressing from muzzle-loading flintlocks (mid-1800s) and percussion cap guns (1860s) to repeating rifles with greater rates of fire, accuracy and muzzle velocity that made them increasingly effective for taking walruses on land or in the water. In some areas their effectiveness was limited by unreliable access to ammunition and repairs. In northern Foxe Basin, which was far removed from whalers and traders until the late 1930s, firearms did not entirely displace bows until about 1936 (Crowe 1969).

The introduction of whaleboats rivaled the introduction of firearms in terms of impact on Inuit walrus catches. These seaworthy wooden sailboats enabled Inuit walrus hunters to take more

animals in summer and to transport them some distance before the meat spoiled (Damas 1963). They gave hunters a more stable platform for shooting and harpooning walruses and offered them greater protection against wounded animals than did their skin kayaks and *umiaks*. Hunting walruses from whaleboats was not without risk as the boats were sometimes damaged or boarded by an angry walrus (Clark 1986). Sheet lead and canvas were carried to repair holes caused by tusks. Inuit populations in Foxe Basin, and likely other areas, concentrated around owners of whaleboats to benefit from the more reliable supply of food and resources these vessels afforded (Damas 1963). These vessels also improved the people's coastal mobility and opportunities for trade and employment (Ross 1975). Over time motors were added to many whaleboats (Perey 1961) and in the 1950s whaleboats were being built at Kimmirut (Lake Harbour) with masts, sails, oarlocks, and engines (Gray 1955).

Inuit access to whaleboats varied regionally. Inuit in northwestern Hudson Bay obtained a whaleboat in trade from the HBC post at Churchill in 1821 (Fossett 2001) but until 1860 few Inuit in the region owned watercraft larger than a kayak or *umiak*. This changed with the regular visits of whalers who would give or sell the boats to Inuit who hunted marine mammals for them (Ross 1975). By 1865 there were at least three wooden boats owned by Inuit in Wager Bay (Nourse 1879), and by 1874 Inuit in the Marble Island area also owned at least three whaleboats (Fossett 2001). They were present along the west coast of Hudson Bay and north coast of Hudson Strait by the 1890s (Ross 1975) but were not introduced in northern Foxe Basin until ca. 1930 (Damas 1963).

While HBC vessels had obtained large quantities of furs as early as 1867 (*Ocean Nymph* 1867), the commercial whalers and their shore stations did not begin transitioning to a more fur-based harvest economy until the early 1900s. The whalers concentrated largely on catching or trading for marine mammals, although caribou were taken at every opportunity for food (Ross 1975). Beginning in 1900–1902 in northwestern Hudson Bay (*Era 1902*), ca. 1904 in the Pond Inlet area (*Albert 1904*), and 1910 on southeastern Baffin Island (*Seduisante 1910*), the whalers began to obtain large numbers of foxes. They trapped some foxes themselves but most were taken in trade from Inuit. To maintain their trap lines, the Inuit required large dog teams and large caches of meat for the teams. Trapping took hunters away from winter seal hunting so more walruses were sought during the open-water season to build up stores of meat to sustain them and their dog teams in the winter (HBCA B.467/a/8, fos. 18, HBCA B. 485/a/4, fo. 9, HBCA B.397/a/9, fo. 51, Saladin d'Anglure 1984).

Subsistence hunting by explorers, sportsmen, and researchers

Explorers, sport hunters, and researchers also hunted walruses in the 19th and early 20th centuries, sometimes taking substantial numbers. Parry (1824 p.221) stated that walruses were "eagerly sought after on… every…occasion", and during parts of his voyage Hall (1865 p.557) ate walrus "almost exclusively." Reeves (1978) suggested that local and sporadic removals by explorers did little harm to walrus stocks, although Loughrey (1959 p.58) wrote that they took "a heavy toll." Catches by explorers probably remained low until the late 1800s and early 1900s when there was a significant increase in exploration of the High Arctic and North Pole areas with local catches that may have been biologically significant.

During this period, explorers such as R.E. Peary, F.A. Cook, F. Nansen and O. Sverdrup used Inuit travelling methods and lived off the land, which increased their reliance on local game resources including walruses (Reeves 1978). The American expeditions probably had the greatest negative impacts on walrus stocks that were unaccustomed to hunting. Peary commissioned a large slaughter in 1891 (Vibe 1950, Dick 2001) and intensive walrus hunting, much of it in Greenland waters, became a feature of his expeditions (Peary 1903, Senn 1907, Morris 1909, Whitney 1910, Henson 1912, MacMillan 1934, Dick 2001). Peary described his "big, system-

atic walrus hunts," employing up to 50 Greenland Inuit (Inughuit) harpooners, as a way of securing "the maximum meat in the least time" (Peary 1917 p.908–910). Records are lacking for most of these hunts but Peary might have taken a few hundred walruses annually from the region in the years he visited, at intervals, between 1891 and 1909 (Vibe 1950, Dick 2001). Cook (1913) accounted for 73 walruses during his North Pole expedition but did not specify the catch locations (i.e., Greenland or Canada). Later expeditions by MacMillan also resulted in "extensive" walrus kills (Dick 2001, also see Hunt and Thompson 1980). In 1898-1902, the second Norwegian *Fram* expedition took walruses in Smith and Jones sounds (Sverdrup 1904a, 1904b).

Many of the American High Arctic expeditions involved a combination of exploration and big-game hunting. The walrus was considered one of the "Arctic Big Three", and sport hunting for these animals became popular with American and British industrialists after the American Civil War (Reiger 1976). Peary's 1908 expedition included three sportsmen whose main intention was to hunt walruses, bears and other big game (Whitney 1910). Cook's 1907 expedition was financed and accompanied by a wealthy sportsman named John R. Bradley (Cook 1913). While sport hunting seems not to have taken an excessive toll on walrus stocks, it is difficult to determine the extent of the removals (Reeves 1978), since the loss rates could be quite high (Walker 1900).

Walruses and other wildlife continued to be killed by exploring and hunting expeditions through the 1930s (Haig-Thomas 1939, 1940, see Dick 2001) even though sport hunting for walruses had been prohibited in Canada in 1928 (Mansfield 1973). Interest resurfaced in the mid-1960s when Bissett (1968) suggested that walrus sport hunting should be legalized and encouraged as a way of bringing revenue to Resolute and making greater use of boats during the open-water season.

Walruses were also killed in small numbers for human and dog food during government (Gordon 1887, Low 1906) and archaeological or ethnographic expeditions (Degerbøl and Freuchen 1935, Rowley 2007).

Modern Inuit Subsistence (1928 to present)

Large and sometimes wasteful kills of walruses by whalers and traders, often aided by Inuit, raised concern about sustainability and Inuit food security as early as 1906 (Low 1906). It took more than 20 years for the Canadian Parliament to address the problem formally. The regulatory changes in 1928 signalled the end of overlapping commercial, subsistence, and sport hunting. Since then there have been many changes in the subsistence use of walruses, catch reporting, and hunting technology. Many of the HBC posts attracted other services such as government offices and churches that led to the establishment and growth of many of the present-day communities (Usher 1971, Outcrop Ltd. 1990). In the 1960s, cooperatives were established in many communities to sell food and supplies, and to export furs and carvings.

In 1980, the Walrus Protection Regulations were enacted under the *Fisheries Act* (Canada 1980: P.C. 1980 -1216). Under these regulations only "an Indian or Inuk" was allowed to "hunt and kill walruses without a licence" and then "not more than four walruses in one year" (Section 3), except where annual community quotas were scheduled instead for Coral Harbour: 60, Sanikiluaq: 10, Arctic Bay: 10, and Clyde River: 20.

Subsistence use of walruses

> *"Walrus hunters had available a quality and quantity of products much superior to those of seal or caribou hunters—valuable ivory, large quantities of meat and fat—which gave them better dog teams, greater mobility, and relatively comfortable living conditions."* (Saladin d'Anglure 1984 p.489).

In the past Inuit used walrus ivory to construct harpoon foreshafts and heads, needles, needle cases, snow knives, snow goggles, beads, ornaments, figurines, toggles, drill shafts, buckles, games, and handles; to shoe sledges; and to make protective edges on kayak paddles (Fig. 8; Boas 1888, Low 1906, Loughrey 1959, Riewe and Amsden 1979, Saladin d'Anglure 1984, Bennett and Rowley 2004). The thick hide was used to make summer tents, rope, water containers, boats (*umiaks*; Figs. 4 and 6), shoe soles, and waterproof mittens (Boas 1888, 1907, Ross 1975, Bruemmer 1992, Christopher 2005, Bennett and Rowley 2004), frozen to form harpoon shafts or sleds (Bennett and Rowley 2004), or fed to the dogs (Crowe 1969). Thinly scraped intestines and penis membranes were used as window panes in houses (*qarmat*; Bennett and Rowley 2004). The long, straight baculum was an important source of material for Inuit until wood and steel became more readily available. These dense bones were fashioned into tent poles, wedges and other implements that required a strong straight shaft (Boas 1888, 1907, Bennett and Rowley 2004). The blubber was saved for winter use and the meat was eaten or fed to the dogs (Lyon 1824, Nourse 1879, Boas 1888, Bennett and Rowley 2004, DFO 2013).

The need to obtain walruses for human food and for materials has declined over the past half-century as the availability of store-bought alternatives has increased. Now, walruses are hunted mainly for their tusks, which are either sold or carved for sale, and for their meat, which is eaten or fed to dogs (Fig. 9; Freeman 1964, 1969/1970, Brody 1976, Schwartz 1976, Anderson and Garlich-Miller 1994, Born et al. 1995, COSEWIC 2006, DFO 2013). The tusks and the bacu-

Fig. 9. *Inuit cleaning the baculum (upper left), preparing igunak (right), and retrieving clams from the stomach (lower left) of a walrus taken near Igloolik in 2007 (credit: J.W. Higdon).*

Fig. 10. *Examples of walrus ivory carvings including a cribbage board ca. 1930 (upper left), a fine recent sculpture by A. Pijamini of Grise Fiord (right), and a kayak (date unknown; lower left) (authors' collections).*

lum are the property of the hunter who shot the walrus but the meat is typically shared in the community. It may be boiled and eaten fresh, frozen for winter consumption, or aged (aerobically fermented) to make *igunak* (Orr et al. 1986, Anderson and Garlich-Miller 1994). *Igunak* is made by sewing the meat and blubber of walruses landed in summer into a walrus skin bag and burying it on the cobble beach. The bag is recovered and its aged, fermented contents are eaten in the spring. Care must be taken to ensure that the meat does not ferment anaerobically, for example in sealed plastic bags, to avoid botulism (Proulx et al. 1997). Walruses killed too late in the fall to be made into *igunak* are frozen and eaten during the winter. Some Inuit consider molluscs in walrus stomachs to be a delicacy.

There is inter-settlement trade of both walrus meat and tusks (DFO 2013). For health and safety reasons, *igunak* is not handled on a distribution basis and is only available from the producers in the communities (Aarluk Consulting Inc. 2005). The demand for *igunak*, which is an acquired taste, is largely limited to older Inuit who grew up eating it and value it as a traditional food. The Government of Nunavut subsidizes the transport of country foods such as *igunak*. Hall Beach has traded some *igunak* to other communities and has asked to be allowed to sell it (Cosens et al. 1993). Many communities now order their walrus meat from Igloolik rather than conducting their own hunts (Priest and Usher 2004, DFO 2013).

Some products from walrus kills are valued more than others and thus are more likely to be retained and transported. In the early 1960s, hunters in northern Foxe Basin tried to leave behind only the abdominal viscera minus liver and kidneys (Perey 1961). When the load was too large, the scapulae, femurs, tibias, backbones, and ribs would also be left behind. As the season progressed, these parts as well as the lungs would be left behind even in good traveling conditions. Full stomachs were taken to camp only during the first few hunts and, even then, were often fed to the dogs instead of being eaten.

While the value of raw tusks has been small relative to hunting costs and the value of the meat (Anderson and Garlich-Miller 1994), the economic benefits of carving tusks to create value-added products can be quite significant. While the Moravian missionaries in Labrador were encouraging Inuit to carve ivory for sale in the 1890s (Wakeham 1898), the HBC exported most of its walrus tusks raw until the export of unworked walrus ivory was forbidden. In 1932, the company was scrambling to find a use for its stores of ivory and began trying to interest the Inuit in carving (HBCA D.FTR/24, 1932 cited in Reeves and Mitchell 1986). By 1938 the HBC posts at Arctic Bay, Iqaluit, and Kimmirut were trading walrus ivory cribbage boards and kayak carvings from the Inuit and selling them as curios to tourists (Fig. 10; HBCA RG3/26B/7; HBCA RG3/26B/21). Given the recent demand for fine Inuit carvings, A.R. Scott's 1939 assessment of their potential from Arctic Bay now seems prophetic:

> *"The natives are gradually improving in [their] working up of ivory carvings, and with a little encouragement and a sufficient quantity of ivory they should be able to turn first class curios bringing much higher prices than at present." (HBCA RG3/26B/1).*

Changes in Hunt Technology

The widespread introductions of Peterhead boats, motorized canoes, and snowmobiles were key developments that influenced walrus hunting for subsistence. Peterhead boats ranging from about 35 to 45 feet in length (10.6 to 13.7 m) revolutionized the summer hunt for walruses by Inuit (Fig. 6; Gray 1955, Russell 1966, Freeman 1969/1970). These vessels were in use at Fort Churchill by ca. 1890, having been introduced to the region by a carpenter from Peterhead (Scotland), who had lived at Fort Churchill for a long time (Clark 1986). Their use began spreading to other HBC posts ca. 1914 and by the late 1930s Peterhead boats were being widely used in the eastern Canadian Arctic (D.B. Stewart unpublished data). During this period most of these craft were operated by traders and missionaries who, with the help of Inuit, often used them to hunt walruses. Later, many of the Peterheads were Inuit owned. They enabled hunters to travel offshore with relative safety, which greatly improved access to important walrus concentrations on Akpatok, Nottingham, Salisbury, Coats and other islands. Peterheads were capable of carrying many more walruses and were not reliant solely on sails. Communities depended upon Peterheads for their fall walrus hunts (Brooke and Kemp 1986).

The introduction of large freighter canoes with outboard motors was the next step in mechanization of walrus hunting. These craft were introduced in Foxe Basin ca. 1955 (Crowe 1969), perhaps a few years earlier in other areas. They were a relatively affordable and efficient means of reaching walruses and transporting the catch quickly over a significant distance. They replaced whaleboats and are still widely used today but with more powerful engines that enable them to travel much faster. These canoes and many other modern boat configurations give hunters access to walruses far from home and allow them to return with their catch the same or the next day, whereas trips by Peterhead often took weeks.

Introduction of the snowmobile beginning in the early 1960s led to a decline in the use of dog teams for transportation, and in turn reduced the need to obtain walruses for dog food (Freeman 1974/1975, Kemp 1976, Riewe 1976, Riewe and Amsden 1979, Mary-Rousselière 1984). This transition also influenced walrus hunting patterns because hunters using dog teams are safer in moving ice and less vulnerable to mechanical failure (Irngaut 2004 cited in Laidler et al. 2009). In Foxe Basin, the first snowmobiles were used in 1963 (Crowe 1969). Although hunters retained dog teams longer there than in other areas—to facilitate walrus hunting on moving ice (Brody 1976)—dog team use did wane in Foxe Basin with increased snowmobile use, greatly diminishing the need for meat for dog food (Mary-Rousselière 1984). Increasing use of snowmobiles beginning in the mid-1960s was also accompanied by decreasing walrus catches at Coral Harbour

(Welland 1976), Cape Dorset, Kimmirut, and Iqaluit (Kemp 1976, 1984). Similar changes likely occurred around Hudson Bay, where Inuit and Cree in the mid-1990s commented that they "knew walrus better when they were still using dog teams" (Fleming and Newton 2003 p.17). However, walrus hunting has continued as a means of obtaining meat for food and ivory for carving. In recent years more walrus meat has been sought to feed dog teams, which are being used for sledge racing and polar bear sport hunting (DFO 2013).

Sport hunts (1995 to 2011)
Since 1994 a limited hunt has been opened annually for non-resident hunters to benefit communities located near walrus populations. Under the *Fisheries Act*, hunters except "Indian or Inuk" non-beneficiaries require a licence under the Marine Mammal Regulations or Aboriginal Communal Fishing Licence Regulation to hunt walruses (DFO 2002, Hall 2003). Sport hunts are managed by the Nunavut Wildlife Management Board, which limits the number of hunts approved annually. Over an 8-year period (2004 through 2011), approvals were issued to 12 communities but only Igloolik, Coral Harbour, and Hall Beach conducted licensed hunts (DFO Iqaluit unpubl. data). Of the 316 hunts approved, only 101 were licensed and 69 walruses were landed.

Hunting walruses for sport is gaining in popularity and is advertised widely over the internet. Most of the walruses are taken in northern Foxe Basin and some in northern Hudson Bay. Non-resident hunters can keep the tusks, cape (i.e., pelt from the head and neck of the walrus kept for preparation as a hunting trophy) and baculum but must leave the meat in the village.

PART 2 – WALRUS CATCHES

It is clear from Part 1 that walrus hunting has a rich and diverse history. In Part 2, we describe how the walrus catch data were gathered and interpreted with respect to those vagaries, and discuss the catches by biological population and management stock. Aspects of the data record pertinent to future population modelling are also discussed.

Data acquisition
The earliest information on walrus catches comes from archaeological data and we relied on published documents as our source. Bone counts from archaeological sites have little direct value for catch estimation but do provide context and background (see Savelle 1994 for an assessment of archaeological evidence for narwhal and beluga hunting). Bone assemblage data are usually summarized as the number of identifiable specimens (NISP) and occasionally as the minimum number of individuals (MNI). Zooarchaeological data (NISP) collected from numerous sites have been assigned to different cultural complexes and variants based on descriptions from the original sources (radio-carbon dating, artifacts present, etc.). The number of sites is limited but they span a wide geographical area from the High Arctic to Subarctic regions. Paleoeskimo sites (n=20) were classed as either Pre-Dorset (n=7) or Dorset, with the latter further divided into early (n=5), middle (n=4) and late (n=4) periods. Neoeskimo sites (n=16) were divided into three stages, early (n=7), classic (n=6) and late, or modified (n=2) Thule. Total bone counts are summarized in terms of the proportions comprised of walrus, phocid seals (primarily ringed seals at most sites), and all other species (mainly mammals, but including birds and fish at some sites).

For the historical period, walrus catch data were gathered from the widest possible range of archival, published, and unpublished ("gray literature") documents. Whaling documents provided the most consistent early sources, followed chronologically by the Hudson's Bay Company (HBC) as shore-based trading became more important, Royal Canadian Mounted Police (RCMP) as the early representative presence of the Government of Canada in the north, and Fisheries and Oceans Canada (DFO) since 1971. The emphasis shifted from ship whaling and shore-based enterprises that had

a vested interest in recording (as important inventory) the number of walruses secured, to record-keeping for other purposes having more to do with local consumption and use.

Logbooks and journals (both hereafter referred to as 'logs') of whaling voyages to Davis Strait and Hudson Bay were identified in public collections using summaries by Sherman et al. (1986) and Brown et al. (2008). Copies of logs from the early years of the Davis Strait and Hudson Bay whale fisheries were read to supplement walrus catch data compiled (but not presented) earlier by Reeves's beluga catch history (Reeves and Mitchell 1987). That work focussed on voyages in the period from 1873 to 1905 and the material examined pertained particularly to the Pond Inlet, *Eclipse* Sound, Lancaster Sound, Admiralty Inlet, and Prince Regent Inlet areas. Overall, the volumes read represent a small subset of the actual voyages, particularly in the early years of the Davis Strait fishery.

The logs were examined to assess whether the whalers were: (1) seeing walruses; (2) actively hunting them; (3) successful in these hunts; (4) reporting their catches in the annual summaries, and/or (5) obtaining walrus products through trade with Inuit, and in what quantity. Logs were selected to cover the whole time span of each fishery. Several sequences of logs from a single vessel were also examined to learn whether individual vessels altered their walrus hunting patterns over time. Catch summaries that appear in some logbooks were considered authoritative (i.e., accurate and complete). Where no such summary was provided, the catches reported in daily entries were considered to represent the minimum total catch for the voyage. All logs that were read for walrus data are listed in Supplement 2.

Published annual summaries for the whale fisheries were also examined. These included the Dundee Year Books (Dundee Advertiser 1879–1916; only volumes that contributed data are cited in the text and references), Southwell (1884–1894, 1896a, 1896b, 1897–1906, 1909), Bernier (1909, 1910), Lubbock (1968), and Stackpole (1969). John Ingram's unpublished "Whaling and Sealing Notes", held by the Dundee Central Local Studies Library, provided a detailed summary of annual catches by the Dundee whale fishery from 1770 through 1922, including data transcribed from the Dundee Year Books.

Data on the modern subsistence catches of walruses in Canada are incomplete and vary widely in quality (COSEWIC 2006). They have been collected by different agencies, using various methods and for different purposes. Reporting rates have also varied regionally and over time. The HBC Post Journals and Accounts statements provide the best available records of land-based walrus hunting activities in the region for the period from 1903 through ca. 1948. These records were examined at the Hudson's Bay Company Archives (HBCA) in Winnipeg by D.B. Stewart and J.W. Higdon to supplement information obtained earlier by Reeves and Mitchell (1986). Unfortunately, the records are not continuous and vary in quality over time and among posts (Supplement 1). Many of the archived HBC post journals end ca. 1931 or ca. 1941; only the journals for Southampton Island (1947; now Coral Harbour), Sugluk West (1949; Salluit), and Wolstenholme (1949; Ivujivik) extend past 1942 (HBCA Post Histories [see Supplement 1]). The journals available after ca. 1932 often recorded Inuit walrus catches as a matter of interest but the company no longer kept detailed annual ledgers of hide and ivory sales. These reporting gaps make it impossible to track trends in the land-based catches prior to ca. 1950.

Reporting improved in the early 1950s, soon after the RCMP posts were tasked with providing annual summaries of wildlife utilization for the areas under their jurisdiction. Foxe Basin catches went unreported until the early 1950s, when their addition caused a sharp increase in the annual catch of walruses reported from the Central Arctic population. Catch data were seldom reported for Nunavik communities that would have taken walruses from the Central Arctic and Low Arctic populations from the 1940s until the mid-1970s, or for Sanikiluaq (Belcher Islands,

Nunavut) during that period. The transition from RCMP data collection to Government of the Northwest Territories (GNWT) and DFO data collection in the early 1970s was not seamless, as the two resource management agencies initially "made no serious or effective attempt at taking over this important task." (Smith and Taylor 1977 p.14). The very low reported catches in the early 1970s are the result of this lapse, and an artefact of low community reporting rates, not changes in hunting patterns.

Other published and unpublished sources of walrus catch data were identified from searches of bibliographic databases maintained by DFO (WAVES) and the Arctic Institute of North America (ASTIS), the internet (Google search), and the authors' libraries; and from discussions with holders of scientific and traditional knowledge. No temporal limits were set on the searches. Reference materials mentioned in the text are cited in the reference section, while citations of ship logs and archival files are included electronically as supplementary materials (Supplements 1—ship logs examined; and 2—HBC post journals).

Data organization and interpretation

Walrus catch statistics were tabulated by year and population for vessels and shore stations involved in the whale fisheries, for land-based commercial and subsistence hunting, and for the recent sport hunting. Some of these data are based on observations or estimates of landed catches; others derived by conversion from quantities of walrus products. Walrus products obtained in trade from Inuit are included with commercial catch totals, although Inuit often retained products from the same animals for their own use. There is little risk of double counting based on the catch records, as concurrent records of Inuit subsistence catches and commercial catches are rare.

Population affiliation

To facilitate use of the catch history data in relation to current resource management, the catches are organized, whenever possible, by biological population and management stock. Two Atlantic walrus populations have been identified in Canada on the basis of genetic differences: the High Arctic population and the Central Arctic population (Buchanan et al. 1998, de March et al. 2002, Shafer et al. 2014). Both populations are shared with Greenland but the number of animals moving between Canada and Greenland is unknown. The High Arctic population is comprised of three stocks centered in West Jones Sound (WJS), Penny Strait–Lancaster Sound (PS-LS), and Baffin Bay (BB; Stewart REA 2008, Shafer et al. 2014). Genetic studies have been unable to differentiate between the WJS and PS-LS stocks, but have detected a small difference between the WJS and BB stocks (de March et al. 2002, Shafer et al. 2014). Despite this difference, the WJS and BB stocks have been combined for this catch history.

The Central Arctic population is composed of at least three stocks on the basis of geographical distributions, lead isotope ratios, and growth patterns (Stewart REA 2008): northern Foxe Basin (NFB), central Foxe Basin (CFB), and northern Hudson Bay–Davis Strait (NHB-DS) stocks. Genetic analyses have been unable to differentiate these stocks (de March et al. 2002, Shafer et al. 2014), or to distinguish walruses in West Greenland from those in southeastern Baffin Island (Andersen et al. 2014). Recent tagging studies have shown movement between West Greenland and Baffin Island (Dietz et al. 2014). For this catch history the two Foxe Basin stocks (NFB and CFB) have been combined, as caught animals cannot readily be attributed to one or the other. Catches from the NHB-DS stock have been subdivided into south and east Baffin (SEB), north and west Hudson Bay (NWHB), and southern Hudson Strait/Ungava Bay/Labrador (SHSUBL). These areas correspond to catch reporting in the Qikiqtaaluk (NU), Kivalliq (NU), and Nunavik/Nunatsiavut regions, respectively. The only significant area of geographical overlap in hunting effort is in western Hudson Strait around Nottingham and Salisbury islands, where hunters from both the Qikiqtaaluk and Nunavik regions have hunted.

Samples are not available to assess whether walruses in southeastern Hudson Bay and James Bay belong to the Central Arctic population or constitute a third, Low Arctic population, so walrus catches in these areas have been compiled separately. The genetic affiliations of the extirpated Nova Scotia–Newfoundland–Gulf of St. Lawrence population are also unknown. The subspecies of walruses taken in the Northwest Territories by Kugluktuk (Coppermine; 1 in 1960) and Ulukhaktok (Holman; 1 in 1959; J.T. Strong, pers. comm.) is unknown.

Catch location

Attribution of catch data to a particular population or stock relies on the reporting of hunt locations or knowledge of the seasonality of the stock distributions and hunter ranges. Locations were not always reported and, even when they were, records can be difficult to interpret. Archaeological sites provide evidence of where walrus products were used but not whether they were obtained locally, which is most likely, or returned from some distance. Whalers were often uncertain of their location due to limits imposed on navigation by weather and technology. Some records were difficult to interpret due to penmanship, the condition or format (e.g., original MS vs. microfilm) of the document, or the use of informal or archaic geographical names. Some record keepers were more interested in the catches than others or were simply more diligent recorders. Wherever possible the original documents were examined to identify actual catch locations. When locations could not be established from the log or catch summary of a given voyage, the logs of other vessels in its company or operating in the same area were searched for cross-references of positions and catches. The same considerations apply to records of more recent catches, and similar approaches were followed to identify catch locations.

Vessel catches were grouped for analysis by the primary area in which a given vessel's crew hunted walruses. Consequently, some animals from the High Arctic population will have been included with the Central Arctic population, and vice versa. This overlap is unavoidable due to uncertainty in catch locations.

Positional Uncertainty

To assess the impact of positional uncertainty on estimates of walrus catches by whaling ships, estimates of the minimum, best, and maximum catches were compared. For the "minimum" estimate, all uncertain values were removed; only Canadian catches with clear location data were included. If there were discrepancies in the number of animals reported at that location, the lowest number was used. The "best" estimate added to the minimum using ancillary information to judge whether animals were most likely to have been taken from a particular Canadian stock and, if there were reporting discrepancies, which number was likely to be the most accurate. The "maximum" estimate included all walruses landed by the vessel from Canadian and Greenlandic waters and the highest number reported. The "best" estimate was used in the annual, stock, and population catch summaries.

The uncertainty about where catches were made by whalers (positional uncertainty) was greatest early in the Davis Strait whale fishery, when navigation and mapping were relatively crude. But, the effect of this uncertainty on the allocation of catches to different populations is greatest when the catch levels were at or near their peak (Fig. 11). It is also greater for the High Arctic population, since many of the whalers who exploited this population also hunted along the west coast of Greenland and east coast of Baffin Island. Because there is much uncertainty as to where many of the walruses taken in the "Davis Strait" fishery were caught between ca. 1885 and 1910, some of the annual catches from the High Arctic population and the south and east Baffin stock of the Central Arctic population could be under or over estimated. Positional uncertainty was lowest in northwestern Hudson Bay, where the potential for confusion with other populations or stocks was limited by vessel routing and geographical separation.

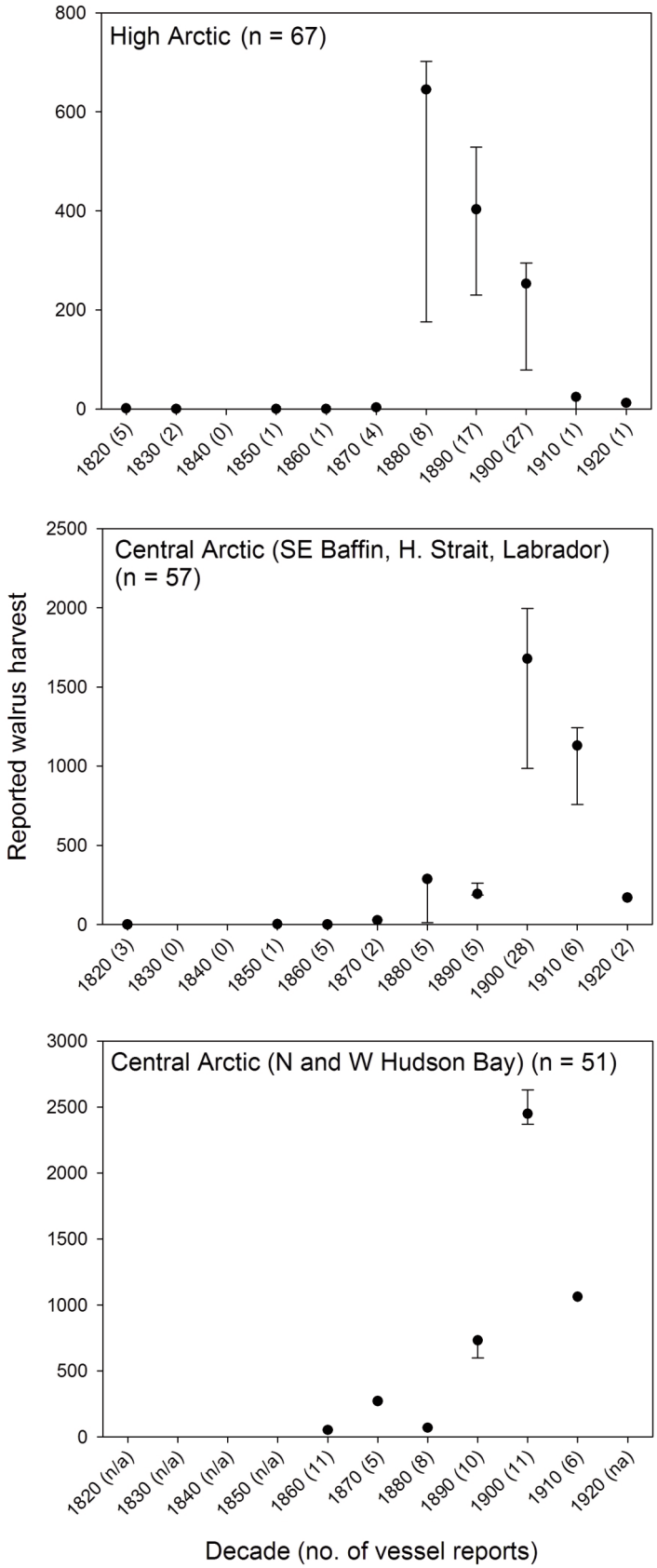


Fig. 11. *Uncertainty in the numbers of walrus caught by commercial whaling vessels resulted from considerable variation between the minimum, best (solid circles), and maximum catch estimates (see text). Variation among these three estimates differed among walrus populations and among decades.*

Positional uncertainty was low following the whaling era. Accounts in trade, RCMP, and wildlife records typically provide clear descriptions of catch locations or associate them with a locale, post, or community. Place names that were unofficial and often spelled phonetically could usually be identified. Nuwata (65°08.5′N, 77°43′W) near Cape Dorchester, for example, was variously spelled Nawatta, Nouwatta, Nurvata, and Muwata. Over time, progressive concentration of human populations near trading posts and, later, settlements or communities, sometimes coupled with limitations on travel imposed by the use of smaller vessels and cost, has tended to concentrate hunting activities in a particular area that can be linked to a stock.

Reporting period

Variation over time in the calendar period used to report catch data is a source of uncertainty for inter-annual and regional catch comparisons. To reduce gaps and overlaps in reporting, catch data were converted to follow the reporting year used most consistently over each period. The goal was to limit the number of transitions between reporting periods and thereby facilitate comparisons, particularly with ongoing catch reporting.

Catches by whaling vessels, including those operated by traders, were reported in the year the catch was returned to port. Most vessels hunted during a single open water season, returning the same year they embarked, so the majority of the annual catches fall within the reporting years used later. A portion of the catch may overlap reporting years when vessels arrived in Canadian waters before the end of June or overwintered (mostly in Hudson Bay or Cumberland Sound), traded extensively with the Inuit, and/or returned produce from shore-based whaling stations or trading posts. Most of these catches were also made during the open water period but sometimes a year prior to delivery. When possible, they were assigned to the appropriate calendar year. The remaining uncertainty is small relative to that from other sources.

From 1903 through ca. 1948 the HBC records provide the most consistent catch reporting for Nunavut and Nunavik (Supplement 1; D.B. Stewart unpublished data). The company's annual reporting period, or "outfit", extended from 1 June through 30 May, so the 1903 reporting year, for example, began on 1 June 1903 and ended on 30 May 1904. Catch and product sale summaries were reported by outfit. Data from HBC post journals, including those compiled by Reeves and Mitchell (1986), were converted to these outfits as were contemporary data from other sources such as explorers (e.g., Peary 1907), early RCMP posts (e.g., Born et al. 1995, Barr 2004), and scientific studies (e.g., Twomey 1939, Twomey and Herrick 1942, Loughrey 1959, Rowley 2007). Loughrey's (1959) reporting of the HBC catches in the year of sale rather than the year of catch was also adjusted.

From ca. 1948 through 1971, the annual game reports prepared by RCMP detachments provide the most consistent catch reporting in Nunavut. The police force's annual reporting period extended from 1 July through 30 June; for example the 1948 reporting year began on 1 July 1948. These data were typically available only in summary form and could not be converted to either the HBC or DFO reporting periods. The original reports are now accessible only through access to information requests. Strong (1989) tabulated walrus data from many of these reports and later gained access to additional reports, and he provided supplemental material to the senior author (J.T. Strong, pers. comm. 1998). Selected RCMP data have also been reported by Lawrie (1950), Loughrey (1959), Brack (1962), Brack and McIntosh (1963), Anders (1966), Anders et al. (1967), Bissett (1968), Higgins (1968), Meldrum (1975), Usher (1975), Riewe (1977), and Riewe and Amsden (1979). Smith and Taylor (1977) summarized the RCMP data from 1962–1971 for communities in Nunavut but did not provide annual catch data, just the mean, maxima, and number of years with records. Walrus catches in Nunavut were also reported during this period by Perey (1961), Freeman (1969/1970), Beaubier (1970), and Born et al. (1995). Neither we nor Makivik Corporation (S. Olpinski and D.W. Doidge, Makivik, pers. comm. 2012) knew of a consistent

source of walrus catch data from Nunavik during this period and we found little Nunavik data (e.g., Dunbar 1949, Grainger 1950, Evans 1964, Roy 1971, Born et al. 1995).

Since 1971, the Government of Canada has provided the most consistent reporting of walrus catches although the Ministers responsible and names of the department collecting the data have varied: Fisheries and Forestry, Environment, Fisheries and the Environment, Fisheries and Oceans, and now Fisheries and Oceans Canada. Hereafter, to avoid confusion these departments are referred to collectively as DFO. These reports use the Federal Government's fiscal year, which is 1 April through 31 March, so the 1971 reporting year, for example, began on 1 April 1971. Nunavut data reported by DFO from 1970 through 1987 were obtained from members of the RCMP, individuals involved in wildlife research projects (e.g., Treude 1977), and Government of the Northwest Territories (GNWT) staff, primarily the Game Management Service (e.g., McLennan 1972), which later became Renewable Resources (Strong 1989). From 1988 through 1996, DFO compiled annual catch estimates in a series of reports (DFO 1991, 1992a, 1992b, 1993, 1994, 1995, 1996, 1997, 1999). These summaries include information from hunts monitored by Fishery Officers or GNWT Renewable Resource Officers, reported by Government Liaison Officers, calculated from long-term averages, or estimated using sales slips and trade records. Since 1997, DFO has compiled data on the annual subsistence walrus catches (DFO Iqaluit unpubl. data, see also COSEWIC 2006) by telephone calls to community Hunters and Trappers Organizations, or the local Government of Nunavut Wildlife Office (A. Currie, DFO Iqaluit, pers. comm. 2012). Approved sport hunts are conducted under a DFO license to the hunter, who must report on the hunt outcome.

Three large harvest studies conducted in Nunavut since 1974 provide data for comparison with the DFO catch reports, and sometimes contributed the data reported by DFO. Use of these data has been reassessed for this catch history. Estimates generated by these harvest studies must be treated with caution. Correction factors used to convert annual hunter reports to annual catch estimates typically have not made adequate allowance for the fact that only a select group of hunters hunt walruses, the hunting varies seasonally, and catches of these large animals are noticeable and likely to be reported. Consequently, where we made changes to the DFO catch reports it was generally to include hunter-reported catches that were larger than those reported by DFO, not the harvest study estimates generated from the hunter's reports.

The first of these harvest studies was conducted in the Qikiqtaaluk Region from 1980 through 1984 by the Baffin Region Inuit Association (BRIA; Donaldson 1983, 1988, Pattimore 1985, J. Pattimore, pers. comm. 1986). When the catch reported to BRIA during the DFO reporting year was greater than the catch reported by DFO we used the catch reported by hunters to BRIA. From October 1981 through March 1986, walrus catch data were collected from the Kivalliq (Keewatin) Region (Gamble 1984, 1987a, 1987b, 1988). The reported catches were compiled monthly and used to estimate the catch for each calendar year. DFO compilations (e.g., Strong 1989) sometimes included either the reported or estimated catch, depending upon which was believed to be more accurate. Neither was based on the DFO reporting year. When this occurred, we used the actual catch numbers reported by hunters during the DFO reporting year. The Nunavut Wildlife Harvest Study (NWHS) collected data on walrus catches by Nunavut communities from June 1996 through May 2000 (Priest and Usher 2004). We included the actual catch data reported by the hunters during the DFO reporting year when DFO lacked data, or when the lower limit of the 95% confidence interval of the NWHS estimate was greater than the catch reported by DFO.

Community agents, hired by DFO, collected the Nunavik walrus catch data from 1974 through 1999 that were summarized in a series of harvest studies (Olpinski 1990, 1991 1993, Portnoff 1994, Brooke 1992, 1995 1996, 1997, 1998, Brooke and Kemp 1986, JBNQNHRC 1988, D.

Baillargeon, DFO Quebec, pers. comm. 2003). Most walruses were taken between June and November so the reported catches fit well into DFO reporting years. The exceptions were Kangirsuk where, in 1985, 1 of 15 walruses was taken in March (Brooke and Kemp 1986) and Kangiqsujuaq where, in 1994, 3 of 9 walruses were taken in February or March (Brooke 1995). The resultant error is only 0.75% of the walruses (4 of 536) reported by these studies, far less than struck-but-lost and other uncertainties. Since 1997 the Nunavik catch data summarized by DFO have been gathered by Makivik Corporation, in part under the Trichinellosis Prevention Program (C. Girard, DFO Quebec, pers. comm. 2012, see also COSEWIC 2006). Because these data are not readily convertible to the DFO reporting year, the entire Nunavik record since 1974 has been left in calendar years. Based on the 1974–1997 studies the difference between Makivik and DFO reporting years should be less than 1% and confined mostly to Kangisujuak and Kangirsuk. When differences were found between the DFO and Makivik data the higher value was used.

Catch estimates based on product yield

In the absence of counts of landed animals, proxies including the cargo capacities of vessels and the returned amounts of products such as hides, tusks, oil, blubber, and meat can be used to estimate the numbers of walruses secured. These estimates are sensitive to assumptions about the yield of oil and hide per walrus, both of which depend on the sizes of the animals caught and the efficiency of the processing operation. To avoid introducing conversion errors, English rather than metric units were used when converting products to numbers of walruses. The monetary value of walrus products was not used for conversion, but some values are provided in text.

Boatloads and other descriptive terms

From ca. 1914 through 1946, the HBC Post Journals sometimes described walrus catches in terms of "boat loads" (e.g., HBCA B.38/a/38, fo. 70 and 73, HBCA B.368/a/3 and 20, Reeves and Mitchell 1986). This usually referred to seaworthy Peterhead boats, which ranged in length from about 35 to 45 ft (10.6-13.7 m; Russell 1966, Freeman 1969/1970) and were powered by diesel engines with sail backup. Over time, most were fitted with progressively larger engines. The capacity for walruses varied with vessel size and design, weather conditions, the composition of the catch, and the nerve of the crew. In calm conditions the vessels were sometimes loaded until they had only a few inches of freeboard. Occasionally an overloaded vessel sank or large quantities of product had to be thrown overboard.

A full load for a Peterhead ranged from 10 to 40 walruses (mean=23.7, median=20; Table 1 and references therein). To maximize the return of edible or useable products, walruses were usually deboned. A vessel capable of carrying 10 large whole walruses could carry the products of 20 deboned individuals. While some Peterheads were clearly capable of carrying over 20 walruses, these may have been the exception rather than the rule. Some crews dangerously overloaded their boats (Russell 1966); others may have been more selective about which products were retained.

The most common capacity mentioned in contemporary accounts as a full Peterhead load was 20 walruses. This number was used for conversion of both "a boatload" and "a successful hunt" in a Peterhead. It was corroborated by an Inuit elder (A. Alasuaq, Cape Dorset, pers. comm.), and falls in the middle of the 15 to 25 walrus range suggested by Born et al. (1995) as a full boatload of meat. For conversion, a "fairly successful hunt" was considered equal to 0.75 of a boatload, or about 15 walruses. Sometimes hunts were described as "very successful", and depending upon its size the Peterhead may have carried more than 20 walruses, but for conversion purposes we considered such hunts as equal to a boatload (20 walruses). Our estimates derived from 'Peterhead loads' may by slightly negatively biased.

Table 1. Conversion factors for estimating walrus catches based on the descriptive term "boatloads", calculated from hunts of the Canadian Central Arctic walrus population using a variety of boat types.

Walrus capacity	Source/Comments
Peterhead load: Median = 20 walruses, Mean =23.2 (Std. Dev. 7.9)	
10	• 10 to 12 depending on the marine conditions (DFO 2013).
15	• full load for a Peterhead (Mansfield 1966).
15	• 5 times a many as a whaleboat which carries 3 walruses (HBCA RG3/26B/12, Annual Report, Southampton Isvland 27 June 1939, p. 6)
20	• 2 boats fully loaded with 40 walruses (HBCA RG3/74A/2 29 Annual walrus hunt).
20	• 10 large whole walruses or 20 large deboned walruses (A. Alasuaq, Cape Dorset, pers. comm. 2011).
20	• 20 walruses (HBCA B.368/a/7 fo. 15).
20	• about 20 carcasses in the hold (Loughrey 1959).
20	• about 20 deboned adult walruses (Freeman 1969/1970). The Peterheads referred to were about 35 ft in length (p. 158).
20	• as many as 20 carcasses (Reeves 1978).
23	• full load of 23 walruses (Twomey and Herrick 1942, see also Twomey 1939). (HBCA RG3/26B/10, Annual report, Ungava District, Port Harrison Post, Outfit 269, p. 11).
24	• HBC Peterhead *Toodelik* went on 3 walrus hunts and secured upwards of 70 walruses (HBCA B.481/a/8, fo 113; HBCA B.481/a/8, fo 2, 15)
26	• the *Kik* returned to Cape Dorset with 26 walruses (HBCA B.397/a/10, fo. 43-51).
29	• 41 walruses, bone and all in 2 Peterheads: *Keegadveealuk* 29 and Agpa 12(HBCA B.368/a/17 fo. 19; B.397/a/8, fo. 34-40; see also Tweedsmuir 1951). (*Keegadveealuk* or *Keegarveearluk* was 36 ft Peterhead with a 12-16 H.P. Acadia 4-cycle engine (HBCA RG3/26B/17 Annual Report, Cape Dorset Post, Outfit 270, p. 10).
33.5	• 65 walruses (meat, hides and tusks) in 2 Peterheads (Russell 1966) with only about 4 in. of freeboard. Vessel size was not specified, although one may have been 45 ft long.
35	• *Metik* carried a full load of ~ 35 large deboned walruses (HBCA B.397/a/5, fo. 25, 28)
40	• Estimate 40 walruses with little freeboard (DFO 2013)
Whaleboat load: 2 to 4 large male walruses or 3 to 5 smaller female or juvenile walruses	
2 or 3	• up to 2 or 3 with a crew of 2 or 3 men (Beaubier 1970).
3	• 3 walruses and 3 crew (HBCA RG3/26B/12, Annual Report, Southampton Island 27 June 1939, p. 6)
3 or 4	• adult walruses (Freeman 1969/1970).
Mean 3.5, maximum 7	• four hunting trips average of 3.5 walruses per boat (Freeman 1962 incl. Appendix I). [Note: It was not stated whether all 7 walruses were carried in the boat at once.]
3 large males or 5 females	• deboned, little freeboard with males (Kappianaq 1997).
4 large or 5 young	• deboned, little freeboard with 4 large walruses (Kunuk 1998).
Canoe load: 1 to 6 walruses depending upon the weather and sizes of the canoe, crew, and walruses	
1 or 2	• limited to harvesting 1 or 2 walruses (Beaubier 1970).
3	• 22 ft canoes with four men and 3 deboned walruses in calm weather (Loring 1996).
2 to 4	• 4 in a large canoe with a sail. Most canoes full with 2 male walruses (Amaaq 1989)
4 to 6	• average of 5 walruses; at least one of the canoes was 22 ft long (Perey 1961)
Rowboat (kippaku) load: 1 full walrus	
1	• loading capacity of 1 full walrus (Kappianaq 2000).

Walruses were also transported in a variety of other boats. Two types in common use historically were whaleboats and canoes. Each whaleboat was different than the next (Kunuk 1998). Those obtained from the whalers were typically open, double-ended, 30 ft wooden sailboats; those from the HBC were smaller, about 26 or 27 ft (Gray 1955, Ross 1975, Rowley 2007). Some were later fitted with engines (Loughrey 1959, Perey 1961, Rowley 2007). Most whaleboats operated with a crew of 3 to 5 hunters and could transport the deboned products of 2 to 4 large male walruses or 3 to 5 smaller female or juvenile walruses (Table 1). In northern Foxe Basin caches of walrus meat typically contained the equivalent of a whaleboat load of walruses (Kappianaq 1997). Canoes were typically square-stern freighter canoes about 22 ft in length (range 18 to 26 ft) that could be sailed or powered by an outboard motor (Perey 1961, Anders 1966, Loring 1996). Their capacity varied from 1 to 6 walruses depending upon the weather conditions and sizes of the canoe, crew, and walruses (Table 1). Some long rowboats could carry a single walrus (Kappianaq 2000).

Hide weight

Sometimes the weight of hide was reported when the number of walruses was not, particularly in HBC trade ledgers. Few records include both the number of animals landed and weight of hide marketed. A conversion factor of 228 lbs (103 kg) of hide per walrus was calculated based on a sample of 263.5 walruses from ships' logs (*Diana 1898, Erme 1912, Vera 1920*) and HBC records (Table 2; Reeves and Mitchell 1986). This conversion will overestimate catches that consisted mostly of bull walruses and underestimate those consisting largely of cows and calves, especially since the hide of a large bull could weigh over 28 stone (~400 lbs or 180 kg; Smith 1923) while hides of small walruses were not always kept. The proportion of older, larger animals in the herds may have declined over time, but both the conversion and most of the hide records are from after 1897.

For ease of handling, the HBC exported walrus hides as half-hides, weighing between 60 and 175 lbs (~27 to 79 kg; Richard and Campbell 1988). These hides were typically pickled in salt and then dried. In later years, Post Managers were told that half-hides weighing less than 150 pounds were not suitable for tanning. On average, skin makes up about 12% of the total mass of an Atlantic walrus (S.D. = 1.6, N = 16, range: 9–15%; Knutsen and Born 1994, see also Freeman 1962).

Ivory weight

Because ivory tusks were a valued product of the walrus hunts, tusk weights and/or numbers were sometimes recorded when other products were not. Sometimes tusks were the only product kept or traded, particularly earlier in the catch record. At other times various products were reported from an individual walrus, raising the risk of double counting. Walrus numbers were estimated from tusk counts by dividing the number of tusks by 2 and rounding up. The number of walruses represented by a weight of tusks varies with the composition of the catch. Young animals do not have tusks worth collecting, while a single tusk from a very large male can weigh at least 9 lbs 9 oz (4.4 kg; Southwell 1881). The average weight of walrus tusks also may have varied over time in response to exploitation, if animals with larger tusks were selectively removed from the population. The log of the *Eclipse (1893)*, which listed the weight of 20 walrus tusks as 50 lbs, provides one of the few reports that link tusk weights and numbers. The mean of 5 lbs (2.27 kg) of ivory per walrus was used to convert ivory weights to walrus numbers. When hunters took predominately females and calves, this may tend to underestimate numbers; when they took predominately adult males, numbers may be overestimated. We did not correct for broken, otherwise damaged or anomalous tusks.

Edible flesh

Anderson and Garlich-Miller (1994) estimated the average edible weight of a walrus at 462 kg based on data summarized from Anders (1966), Loughrey (1959), Freeman (1969/1970), Friesen

Table 2. Conversion factor for estimating walrus catches based on the reported hide weights, using data from hunts in Baffin Bay and Davis Strait.

Number of walruses	Total Hide Weight		Average Hide Weight		Source/Comments
	lbs	kg	lbs	kg	
1.5	318	144	212	96	HBCA A.95/94 cited in Reeves and Mitchell (1986)
3.0	704	320	235	107	" "
2.0	538	244	269	122	" "
72.0	19040	8644	264	120	*Diana 1898*: catch of 72 walrus yielded 8.5 tons (UK ton = long ton = 2240 lbs) or 0.1181 ton/hide, most animals were from the Disko Bay area of West Greenland.
154.0	31360	14237	204	92	The number and weight are estimates provided in the summary of the *Erme*'s 1912 catch from eastern Baffin Island.
31.0	8020	3641	259	117	The number and weight are estimates provided in the summary of the *Vera*'s 1920 catch from south eastern Baffin Island. The hides are described as "62 pieces" suggesting half-hides. The weight was variously reported as 3 or 4 tons, but the cost estimate appears to have been based on a weight of 3 tons, 13 cwt.
263.5	59980	27231			**Totals**
			228	**103**	**Averages (based on totals)**

(1975), Orr et al. (1986), and their own study. We used this number for conversion when weight of flesh was the only record.

Blubber and oil

Walruses were hunted commercially for the oil that could be rendered from their blubber (fat). This oil was typically mixed with seal or beluga oil (Wakeham 1898) and was seldom reported separately. No conversions of walrus oil to walrus numbers were needed for our work, since walrus numbers were always reported with yields of walrus oil, but the conversion data obtained are reported as they may be useful for future studies (Supplement 3).

Conflicting reports

Discrepancies occurred between the tallies from ships' logs and the lists of cargo delivered to port. Usually the tally from the log was lower. When this occurred, it often appeared to be an artefact of diligence or interest on the part of the keeper of the log. On occasion the cargo delivered was smaller than the tally of log entries, perhaps because some of the products recorded in the log were the personal property of an individual rather than the company, or the products were retained for company use, sold privately, or lost through spoilage (hides). When a range of values was reported, the largest credible value was used for catch estimation.

Contemporary accounts of direct observation were considered the most credible sources of information, followed in descending order by (a) accounts based on second-hand reports, (b) conversions of walrus products, (c) later second-hand accounts, and (d) estimates or approximations

based on second- or third-hand accounts. Many source types include reports of varying credibility. Whaling logs, for example, often recorded their own catches in detail in daily notations and sometimes reported catches by other vessels. The HBC Post journals noted the post's own catches daily, as well as reporting product yields and information on catches by others that post employees came into contact with, sometimes well after the catches had occurred and/or before the hunting season had finished.

Walrus catches from each population

Overall patterns

Catches of walruses in Canada were, and are, driven by the demand for walruses or walrus products and constrained by access to these animals, hunting technology, and regulation. The sources and quality of catch data vary significantly with hunt type, over time and space.

The catches landed for subsistence by Paleoeskimos of the Pre-Dorset and Dorset cultures (ca. 4,200–1,000 yBP) and Neoeskimos of the Thule Culture (ca. 1,000 yBP to European contact) are unknown, although walruses were an important resource for these cultures. The archaeological record could not be translated into numbers of walruses that might have been caught but does demonstrate use by prehistoric people. At archaeological sites, walrus bones were found in most assemblages, but with significant spatiotemporal variation and only rarely exceeding 25% of the identifiable specimens (NISP). Walrus remains were generally more prevalent in Paleoeskimo (Taylor 1968, Mary-Rousselière 1976, McGhee 1979, Cox and Spiess 1980, Julien 1980, Maxwell 1985, Schledermann 1989, Murray 1996, 2005) than Neoeskimo (Schledermann 1975, Mary-Rousselière 1976, Staab 1979, Taylor and McGhee 1979, Rick 1980, Sabo 1981, Park 1983, 1989, Stenton 1983, McCullough 1989, Whitridge 1992, Murray 1996) assemblages, especially at early Dorset sites. For all sites combined, there were significantly more walrus bones at Paleoeskimo sites (n=20 sites, mean=7.5% of identified specimens) than Neoeskimo sites (n=16, mean=3.1%; one-tailed t-test assuming unequal variances: t=1.874, df=26, P=0.036). Phocid seal remains dominated most assemblages.

The decline in the relative proportion of walrus fragments suggests that walruses represented a smaller proportion of the Thule diet but it does not necessarily indicate a decline in walrus catches compared to Paleoeskimo cultures. Maxwell (1985) suggested that the greater variability of Thule hunting implements reflected increased variability in prey items compared to Paleoeskimo cultures. The substantial supply of meat and oil provided by bowhead whales (Savelle 2010) may have enabled Thule hunters to avoid the added risk of hunting walruses.

There may be exceptions to this general pattern. Mathiassen (1927) identified five types of Thule harpoon head and one was a smaller version of those used for whales. This harpoon head was less common and changed little through time throughout the Thule cultural complex. In the early 20th century, Mathiassen (1927) observed the same type of harpoon head being used for walrus hunting by *Iglulingmiut* in Foxe Basin. Desjardins (2013) presented new data from a winter site in Foxe Basin that indicated intensive walrus hunting by classic Thule Inuit, comprising almost half the sample of specimens that could be identified to species. No other archaeofaunal assemblage studied in the Canadian Arctic has produced such a high proportion of walrus remains. Walruses have long been important to Inuit in this region (Lyon 1824) and retain a significant cultural and nutritional role today. Thule reliance on bowhead whales decreased after ca. 1600 AD (Schledermann 1979, Coltrain et al. 2004) and walruses possibly increased in importance. Data from post-classic (or late) Thule sites are rare, but Maxwell (1985) noted that 16 Thule houses at Pritzler Harbour on the southeastern tip of Baffin Island may have constituted an important settlement for this phase. The houses have not been excavated but few bowhead bones are exposed on the surface, and there are "quantities of walrus bones and skulls around the house pits" (Maxwell 1985 p.306).

The numbers of walruses landed for subsistence by Historic Inuit (contact to 1928) for their own use also represents a significant gap in the catch record and in our understanding of removals over time from walrus populations in the eastern Canadian Arctic. Where walruses were available they were an important resource for local Inuit. However, most catch reports from this period are by non-Inuit who received hunt products from the Inuit as gifts or in trade, employed Inuit to hunt, or conducted group hunts with Inuit for walruses. While the Inuit often used products from these catches it was seldom clear whether the walruses were being taken primarily for subsistence or for commerce, or what proportion of the overall Inuit subsistence catches these animals might represent. Even when the Inuit used most of the hunt products there was often an underlying commercial interest in that these products freed them from other hunting activities and kept the people and their dogs healthy for whaling and/or trapping. Because of these uncertainties Inuit subsistence catches of walruses prior to 1928 may have to be estimated by simulations based on demographic variables, use of dog teams, and information on the catches of other species.

Better records exist for the number of walruses landed by non-Inuit for commerce and sport, and landed by recent Inuit (post 1928) for subsistence. Overall, since 1820, we found records for a total of 41,369 walruses landed (Fig. 3, Tables 3 and 4, Supplements 4 and 5). Peak landings occurred in the early 1900s, primarily from whaling activities in areas where the Central Arctic

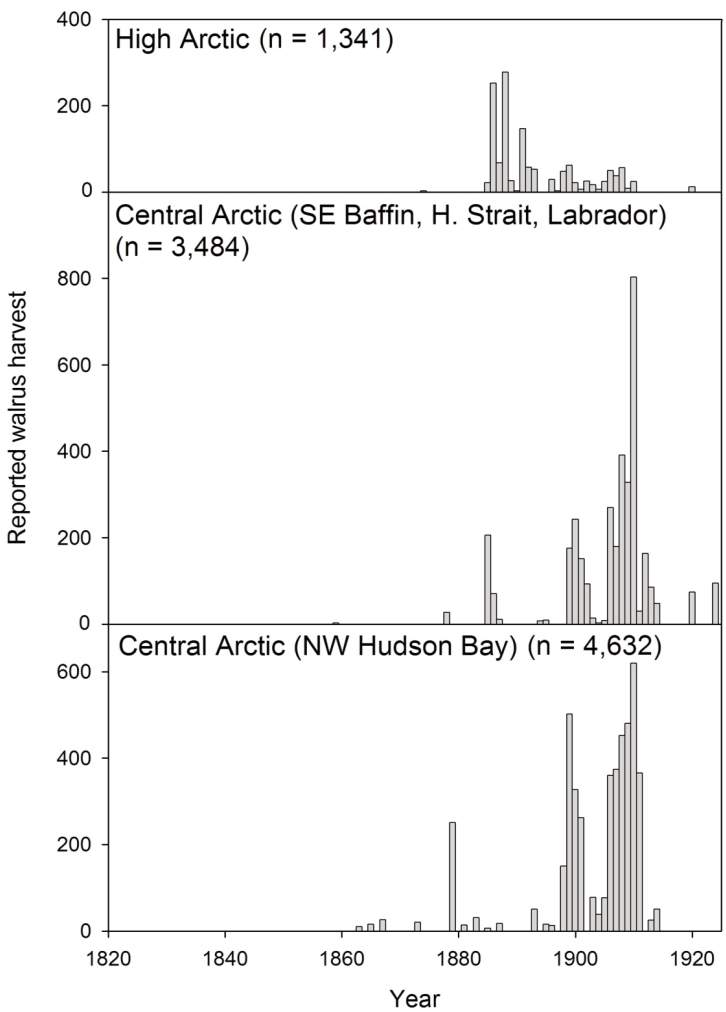


Fig. 12. *Commercial vessel catches from walrus populations in the eastern Canadian Arctic, 1820–1925.*

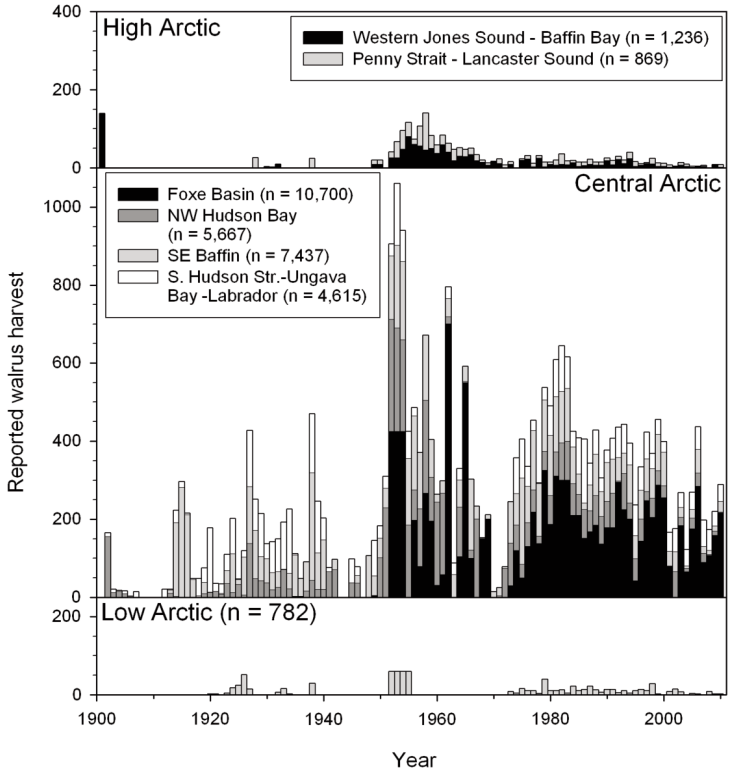


Fig. 13. *Subsistence and land-based trade catches from walrus populations in the eastern Canadian Arctic, 1900–2010. Catches by recent sport hunts are not included.*

population of walruses would have been hunted. A second peak that occurred in the late 1950s is attributable to improvements in subsistence hunting technology and catch reporting. From 1820 through 1928, commercial hunts by whaling vessels and shore-based whaling stations landed a minimum of 9,457 walruses (Fig. 12). From 1900 through 2010, commercial hunts by land-based traders, subsistence hunts by Inuit, and sport hunts together landed at least 31,447 walruses (Fig. 13). Accounting for gaps in the catch record and for animals that were removed from the population but not landed would result in much higher removal estimates over the same periods, and might shift the apparent peak in the 1950s into the 1930s.

High Arctic Population

At least 3,481 walruses were landed from the High Arctic population from 1820 to 2010 (Fig. 3). From 1820 through 1928, commercial hunts by whaling vessels and shore-based whaling stations landed a minimum of 1,341 walruses (Fig. 12, Table 3), peaking in the mid-1880s. From 1900 through 2010, commercial hunts by land-based traders and subsistence hunts by Inuit together landed at least 2,140 walruses (Fig. 13, Table 4), with a maximum in the late 1950s. This estimate is negatively biased due to gaps in the catch record and animals that were removed from the population but not landed.

Catch data were compiled from 67 vessels that operated between 1821 and 1920 primarily in areas inhabited by the High Arctic population of walruses (Fig. 1, Table 3, Supplement 2). Although small numbers of walruses were mentioned occasionally in earlier logs, the first substantial catch from the Canadian High Arctic population mentioned in the whaling records was 22 in 1885 (Fig. 12; *Esquimaux 1885*). This was followed by relatively large catches in 1886 (220—*Maud* and 30—*Terra Nova*; Dundee Advertiser 1887 p.166), 1888 (102—*Esquimaux 1888*; 175—*Maud* from Southwell 1889), and 1891 (33—*Esquimaux 1891*; 114—*Maud 1891*), after which the annual reported catch by the Arctic whalers declined to fewer than 63 walruses.

Table 3. Ship-based commercial catches of walruses and bowheads from the eastern Canadian Arctic (see below for explanatory notes).

Ship/Port/Voyage Dates/Master of Ship/ Keeper of Journal	Walrus Catch Estimate			Bowhead	Sources of Vessel Data
	Best	Min.	Max.	Harvests	(primary source first)
HIGH ARCTIC (HA) WALRUS POPULATION					
Royal George (Ship). Hull, England May 5—October 11, 1821. Master: Pickitt.	0	0	0	9	Ships logbook (S)
Duncombe 12 April -June 21, 1822	0	0	0	1	Ships logbook (S)
Ariel (Ship). Hull, England March 20—November 4, 1828. Master: Richard Rogers.	1	1	1	13.5	Ships logbook (S)
Dordon (Barque). Hull, England, March	0	0	0	13.5	Ships logbook (S)
Laurel (Ship). Hull, England March 18—October 12, 1828. Master: William Manger.	0	0	0	20	Ships logbook (S)
Eagle (Ship). Hull, England March 15—November 3, 1830. Master: Matthew Wright. Keeper: A. Turnbull.	0	0	0	7	Ships logbook (S)
Dordon (Ship). Hull, England February 24—November 6, 1831. Master: Edward Willis.	0	0	0	7	Ships logbook (S)
Orion (Brig). Hull, England March 8—November 12, 1852. Master: Emmanuel	0	0	0	0	Ships logbook (S) Wells.
Truelove (Bark). Hull, England March 15—November 19, 1860. Master: John Parker.	0	0	0	2	Ships logbook (S)
Erik (Ship). London, England May 6, 1870—September 14, 1871. Master: John Barnard Walker.	0	0	0	21	Ships logbook (S)
Arctic (Ship). Dundee, Scotland. 1873. Master: Captain Adams.	0	0	0	28	Ships logbook (S), Markham (1875:293)
Victor, Dundee, Scotland May 3—November 3, 1873. Master: J. Edwards	0	0	0	13	Ships logbook (R)
Arctic (Ship). Dundee, Scotland. 1874. Master: Captain Adams.	3	0	3	17	Dundee Whale and Seal Fishing Extracts (1837-1886), Dundee Central Library Ref: D8344. p. 27--Excerpt from the Dundee Advertiser, Friday September 11th, 1874.
Esquimaux. Dundee, Scotland January 29—October 18, 1885. Master: W. F. Milne.	22	22	36	2	Ships logbook (R), Dundee Advertiser (1886)
Esquimaux. Dundee, Scotland February 9—October 27, 1886. Master: W. F. Milne.	2	2	30	2	Ships logbook (R), Dundee Advertiser (1887), Ingram's Whaling and Sealing
Maud. Dundee, Scotland. 1886. Master: Captain Adams.	220	0	220	0	Dundee Advertiser (1887)
Terra Nova, Dundee Scotland. 1886. Master: Captain A. Fairweather.	30	0	30	5	Dundee Advertiser (1887)
Esquimaux. Dundee, Scotland February 10—. November 6, 1887. Master: W. F. Milne	68	62	83	1	Ships logbook (R), Southwell (1888)
Esquimaux. Dundee, Scotland May 22—November 1, 1888. Master: W. F. Milne.	102	90	102	1	Ships logbook (R), Ingram's Whaling and Sealing

Ship/Port/Voyage Dates/Master of Ship/ Keeper of Journal	Walrus Catch Estimate			Bowhead	Sources of Vessel Data
	Best	Min.	Max.	Harvests	(primary source first)
Maud. Dundee, Scotland 1888. Master: Captain Adams.	175	0	175	3	Southwell (1889), Lubbock (1968)
Maud. Dundee, Scotland 1889. Master: Captain Adams.	26	0	26	3	Dundee Advertiser (1890), Watson (2003)
Polynia 1890. Dundee to Davis Strait, May 25—November 18, 1890. Master: William F. Milne	3	3	3	5	Ships logbook (R)
Esquimaux. Dundee, Scotland January 5—October 24, 1891. Master: Jeffery Phillips. Keeper: W. Stenhouse.	33	33	50	4	Ships logbook (R)
Maud. Dundee, Scotland March 19—October 1, 1891. Master: W. F. Milne.	114	105	123	1	Ships logbook (R)
Maud. Dundee, Scotland March 28—October 7, 1892. Master: W. F. Milne.	54	0	56	3	Lubbock (1968), Ships logbook (R)
Nova Zembla. Dundee Scotland. 1892. (1968)	3	3	3	0	Southwell (1893), Lubbock
Eclipse. Dundee, Scotland March 19—October 30, 1893. Master: W. F. Milne.	10	1	10	8	Ships logbook (R)
Esquimaux. Dundee, Scotland. 1893. Master: Captain J. Phillips	39	0	39	4	Southwell (1894)
Nova Zembla. Dundee, Scotland. 1893. Master: Captain Guy.	4	0	4	4	Southwell (1894)
Esquimaux. Dundee, Scotland March 25—September 16, 1895. Master: William Adams, Jr.	1	1	2	1	Ships logbook (R), Southwell (1896)
Eclipse. Dundee, Scotland April 3—November 9, 1896. Master: W. F. Milne.	8	0	21	1	Southwell (1897), Ships logbook (R)
Esquimaux. Dundee, Scotland. 1896. Master: Captain J. Phillips	21	0	21	0	Southwell (1897)
Diana (Steam Barkentine). Dundee, Scotland May 3—September 20, 1898. Master: William Adams, Jr.	14	11	81	1	Ships logbook (R), Southwell (1899)
Eclipse. Dundee, Scotland. 1898. Master: W. F. Milne.	23	0	23	5	Southwell (1899)
Nova Zembla. Dundee, Scotland. 1898. Master: Captain Guy.	11	11	11	0	Southwell (1899)
Eclipse. Dundee, Scotland April 28—November 14, 1899. Master: W. F. Milne.	24	24	37	3	Ships logbook (R), Southwell (1900)
Esquimaux. Dundee, Scotland April 7—July 10, 1899. Master: Henry McKay. Keeper: A. Barclay Walker.	38	38	42	2	Ships logbook (S, R), Southwell (1900), Walker (1900)
Eclipse. Dundee, Scotland. 1900. Master: W. F. Milne.	5	0	5	3	Southwell (1901), Ingram's Whaling and Sealing
Esquimaux. Dundee, Scotland February 5—November 11, 1900. Master: Henry McKay. Keeper: Robert Davidson.	5	0	5	3	Ships logbook (R), Ingram's Whaling and Sealing
Nova Zembla. Dundee, Scotland. 1900. Master: Captain Guy.	12	0	12	2	Southwell (1901)
Diana (Steam Barkentine). Dundee, Scotland. 1901. Master: William Adams, Jr.	1	0	1	2	Southwell (1902)

Ship/Port/Voyage Dates/Master of Ship/ Keeper of Journal	Walrus Catch Estimate			Bowhead Harvests	Sources of Vessel Data (primary source first)
	Best	Min.	Max.		
Eclipse. Dundee, Scotland. 1901. Master: W. F. Milne.	6	0	6	3	Southwell (1902)
Balaena. Dundee, Scotland. 1902.	14	0	14	0	Southwell (1903)
Diana (Steam Barkentine). Dundee, Scotland May 28—July 21, 1902. Master: William Adams, Jr. Keeper: Mate W. Skinner	5	0	5	5	Southwell (1903), Ships logbook (*Diana* 1902b; R)
Eclipse. Dundee, Scotland. 1902. Master: W. F. Milne.	6	0	6	5	Southwell (1903)
Albert (ketch). Dundee, Scotland. 1903. Master: Mutch.	11	11	11	0	Ingram's Whaling and Sealing
Diana (Steam Barkentine). Dundee, Scotland Master: Wm. Adams, Jr.April 19—November 15, 1903.	3	3	3	2	Ships logbook (R), Southwell (1904)
Eclipse. Dundee, Scotland April 9—November 15, 1903. Master: W. F. Milne.	3	3	4	4	Ships logbook (R), Southwell (1904)
Albert (ketch). Dundee, Scotland. 1903. Master: Mutch.	5	5	5	2	Southwell (1905:26)
Diana (Steam Barkentine). Dundee, Scotland Master: William Adams, Jr. April 15—October 10, 1904.	0	0	0	3	Ships logbook (R), Southwell (1905:27)
Eclipse. Dundee, Scotland April 11—. October 9, 1904. Master: W. F. Milne	2	0	2	2	Southwell (1905), Ships logbook (R)
Albert (ketch). Dundee, Scotland. 1905.	13	13	13	0	Ingram's Whaling and Sealing
Balaena. Dundee, Scotland. 1905. Master: Capt. Guy sr.	0	0	0	4	Ingram's Whaling and Sealing
Morning (Steam Bark). Dundee, Scotland April 27—November 2, 1905. Master: William Adams, Jr.	4	4	44	3	Ships logbook (R), Ingram's Whaling and Sealing
Scotia. Dundee, Scotland. 1905. Master: Captain T. Robertson.	3	0	3	1	Ingram's Whaling and Sealing
Snowdrop (Ketch), Dundee. 1905. Master: Captain Ogston (Forsyth-Grant, Trader)	2	2	2	1	Fraser and Rannie (1972)
Windward. Dundee, Scotland. 1905.Master: Captain J. Cooney.	2	0	2	2	Ingram's Whaling and Sealing
Albert (ketch). Dundee, Scotland. 1906.	0	0	0	0	Ingram's Whaling and Sealing
Windward. Dundee, Scotland. 1906. Master: Captain J. Cooney.	50	0	50	0	Ingram's Whaling and Sealing
Albert (ketch). Dundee, Scotland. 1907	21	21	21	0	Bernier (1909), Ingram's Whaling and Sealing
Balaena. Dundee, Scotland. 1907.	3	0	3	0	Bernier (1909), Ingram's Whaling and Sealing
Diana (Steam Barkentine). Dundee, Scotland. 1907.	13	0	13	1	Bernier (1909), Ingram's Whaling and Sealing
Eclipse. Dundee, Scotland. 1908. Master: Captain Milne.	56	9	56	0	Bernier (1910), Ingram's Whaling and Sealing
Morning (Steam Bark). Dundee, Scotland May 4—November 7, 1909. Master: William Adams, Jr.	8	8	9	2	Ships logbook (R)

Ship/Port/Voyage Dates/Master of Ship/ Keeper of Journal	Walrus Catch Estimate			Bowhead	Sources of Vessel Data
	Best	Min.	Max.	Harvests	(primary source first)
Diana (Steam Barkentine). Dundee, Scotland. 1910. Master: Captain Milne.	24	0	24	0	Ingram's Whaling and Sealing
Albert. Peterhead, Scotland. June 10—October 9, 1920. Master: Captain Beavan. (Capt. H.T. Munn, trader)	12	12	12	0	Ships logbook (S)
Catch totals (HA):	**1341**	**498**	**1566**	**264**	
Ship count (HA):	**67**				
CENTRAL ARCTIC (CA) WALRUS POPULATION					
SOUTH AND EAST BAFFIN (SEB)					
Dordon (Ship). Hull, England, April 9—October 30, 1827. Master: William Linskill.	0	0	0	10	Ships logbook (S)
Laurel (Ship). Hull, England March 31—October 30, 1827. Master: William Manger.	0	0	0	9	Ships logbook (S)
Andrew Marvel (Ship). Hull, England April 7—November 1, 1828. Master: George Silcock	0	0	0	5	Ships logbook (S)
Narwhal (Ship). Dundee, Scotland May 3—September 24, 1859. Master: Deuchass. Keeper: R. H. Hilliard.	2	2	2	13	Ships logbook (S), Lubbock (1968)
Ansel Gibbs (Ship). Fairhaven, Mass. April 11, 1860—November 11, 1861. Master: Henry Y. Chapel. Keeper: Stephen B. Bennett.	0	0	0	2	Ships logbook (S)
Antelope (Bark). New Bedford, Mass. March 25, 1860—September 22, 1861. Master: Isaac Wrisley.	0	0	0	2	Ships logbook (S)
Black Eagle (Bark). New Bedford, Mass. May 20, 1860—November 3, 1861. Master: Charles E. Allen. Keeper: Israel Reed.	0	0	0	9	Ships logbook (S)
Daniel Webster (Ship). New Bedford, Mass. March 21, 1860—September 13, 1862. Master: Isaac Allen. Keepers: Richard H. Fisher and F. H. Bailey.	0	0	0	14	Ships logbook (S)
Andrews (Bark). New Bedford, Mass. May 21—November 28, 1867. Master: Timothy C. Packard.	0	0	0	0	Ships logbook (S)
Perseverance (Bark). Peterhead, Scotland July 19, 1877—August 8, 1878.	27	27	27	1	Ships logbook (S)
Franklin (Schooner). New Bedford, Mass. July 25, 1878—August 31, 1879. Master: Erastus Church, Jr.	0	0	0	1	Ships logbook (S)
Perseverance (Bark). Peterhead, Scotland August 5, 1879—April 4, 1880.	0	0	0	4	Ships logbook (S)
Chieftain. Dundee, Scotland. 1885. Master: Captain Malcolm.	36	0	36	0	Dundee Advertiser (1886)
Maud. Dundee, Scotland. 1885. Master: Captain Watson.	170	0	170	1	Dundee Advertiser (1886)
Chieftain. Dundee, Scotland. 1886. Master: Captain Watson.	70	0	70	1	Dundee Advertiser (1887)
Maud. Dundee, Scotland. 1887. Master: Captain Adams.	11	11	11	1	Watson (2003)

Ship/Port/Voyage Dates/Master of Ship/ Keeper of Journal	Walrus Catch Estimate			Bowhead	Sources of Vessel Data
	Best	Min.	Max.	Harvests	(primary source first)
Eclipse. Dundee, Scotland March 20—October 6, 1894. Master: W. F. Milne.	7	7	23	5	Ships logbook (R)
Eclipse. Dundee, Scotland March 25—November 5, 1895. Master: W. F. Milne. Keeper: J. Watson.	2	2	2	2	Ships logbook (R)
Terra Nova. Dundee, Scotland. 1895. Master: Captain H. McKay	7	0	7	0	Southwell (1896)
Alert. Peterhead, Scotland, 1899	150	150	150	2	Southwell (1900)
Diana (Steam Barkentine). Dundee, Scotland April 24—October 4, 1899. Master: William Adams, Jr.	26	26	80	10	Ships logbook (R), Southwell (1900), Walker (1900)
Alert. Peterhead, Scotland. 1900.	138	138	138	1	Lubbock (1968:)
Balaena. Dundee, Scotland. 1900. Master: Captain Roberts	91	0	91	1	Southwell (1902)
Diana (Steam Barkentine). Dundee, Scotland April 27—November 8, 1900. Master: William Adams, Jr.	13	2	54	6	Ships logbook (R)
Alert. Peterhead, Scotland. 1901.	149	149	149	2	Southwell (1902)
Balaena. Dundee, Scotland. 1901.	2	0	2	2	Southwell (1902)
Active. Dundee, Scotland. 1902.	54	54	54	1	Southwell (1903)
Kate. Peterhead, Scotland. 1902.	39	39	39		Southwell (1903)
Balaena. Dundee, Scotland. 1903.	2	0	2	1	Southwell (1904)
Greda. Peterhead, Scotland. 1903.	12	12	12	2	Southwell (1904)
Queen Bess. Dundee, Scotland. 1904 Master: Stephen.	2	2	2		Ingram's Whaling and Sealing, Southwell (1905)
Diana (Steam Barkentine). Dundee, Scotland. 1905.	0	0	0	2	Ingram's Whaling and Sealing
Eclipse. Dundee, Scotland April 13—November 6, 1905. Master: W. F. Milne.	8	7	8	7	Ships logbook (R)
Queen Bess. Dundee, Scotland. 1905 Master: Stephen.	0	0	0		Ingram's Whaling and Sealing
Balaena. Dundee, Scotland. 1906. Master: Captain Guy jr.	6	0	6	1	Ingram's Whaling and Sealing
Diana (Steam Barkentine). Dundee, Scotland. 1906.	7	0	7	0	Ingram's Whaling and Sealing
Eclipse. Dundee, Scotland April 15—November 7, 1906. Master: W. F. Milne.	23	23	66	0	Ships logbook (R, S), Ingram's Whaling and Sealing
Morning (Steam Bark). Dundee, Scotland Master: William Adams, Jr. April 16—November 7, 1906.	34	25	35	1	Ingram's Whaling and Sealing, Ships logbook (R)
Snowdrop (Ketch), Dundee. 1906. Master: Captain Walter J. Jackson (Forsyth-Grant, Trader)	200	200	256		Fraser and Rannie (1972)
Eclipse. Dundee, Scotland. 1907.	13	0	13	0	Bernier (1909), Ingram's Whaling and Sealing
Morning (Steam Bark). Dundee, Scotland April 19—November 13, 1907. Master: William Adams, Jr.	2	1	7	0	Bernier (1909), Ingram's Whaling and Sealing, Ships logbook (R)

Ship/Port/Voyage Dates/Master of Ship/ Keeper of Journal	Walrus Catch Estimate			Bowhead	Sources of Vessel Data
	Best	Min.	Max.	Harvests	(primary source first)
Queen Bess. Dundee, Scotland. 1907 Master: Stephen.	8	8	8		Ingram's Whaling and Sealing
Snowdrop (Motor Ketch). Dundee, Scotland. June 13—November 11, 1907. Master: Captain James Brown (Forsyth-Grant, Trader)	156	156	205		Ships logbook (S), E. Parmi, p. 7, intro to Stefansson Collection in Dartmouth; Bernier (1909), Ingram's Whaling and Sealing
Diana (Steam Barkentine). Dundee, Scotland. 1908. Master: Captain MacKay.	3	0	3	1	Bernier (1910), Ingram's Whaling and Sealing
Morning (Stearn Bark). Dundee, Scotland. 1908. Master: William Adams, Jr.	68	0	68	2	Bernier (1910), Ingram's Whaling and Sealing
Queen Bess. Dundee, Scotland. 1908 Master: Captain Stephen.	82	82	82		Southwell (1909), Bernier (1910), Ingram's Whaling and Sealing
St. Hilda (ketch). Dundee, Scotland. 1908. Master: Captain Cooney.	238	0	238		Southwell (1909), Bernier (1910), Ingram's Whaling and Sealing
Snowdrop (Motor Ketch). Dundee, Scotland. 23 April 1908—September 1909. Master: Captain James Brown (Forsyth-Grant, Trader)	88	88	210		Ships logbook (S), Fraser and Rannie (1972)
St. Hilda (ketch). Dundee, Scotland. 1909. Master: Captain Cooney.	240	0	240	1	Ingram's Whaling and Sealing
Seduisante (steam auxiliary schooner). Dundee, Scotland. April 27—November 10, 1910. Master: Captain James Brown (Forsyth-Grant, Trader)	433	433	433		Ships logbook (S), Fraser and Rannie (1972)
St. Hilda (ketch). Dundee, Scotland. 1910. Master: Captain Cooney.	370	0	370		Ingram's Whaling and Sealing
Thomas. Dundee, Scotland. 1911. Master: Benson.	30	30	30	0	Dundee Advertiser (1912), Ingram's Whaling and Sealing, Sutherland (1996)
Erme. London, England. April 15—November, 27 1912.	163	163	163		Ships logbook (S), E. Parmi, p. 16, intro to Stefansson Collection in Dartmouth
Erme (Auxilliary Motor Schooner). London, England. March 25—November 3, 1913. Captain Fletcher (J. Mutch, Trader).	85	85	144		Ships logbook (S), E. Parmi, p. 18, intro to Stefansson Collection in Dartmouth
Erme (Auxillary Motor Schooner). London, England. March 28—November 16, 1914. Master: Donaldson (J. Mutch, In charge and Ice Master).	48	48	103		Ships logbook (S)
Vera (Auxilliary Schooner). Peterhead, Scotland. June 19—November 11, 1920. Master: Captain Fletcher.	74	74	74		Ships logbook (S)
Rosie (Motor Ketch). Peterhead, Scotland. June 26—October 8, 1924. Master: J. Pearson (J. Mutch, Trader).	95	95	95		Ships logbook (S)
Catch totals (CA: SEB):	**3484**	**2139**	**3985**	**123**	
Vessel count (CA: SEB):	**57**				

Ship/Port/Voyage Dates/Master of Ship/ Keeper of Journal	Walrus Catch Estimate			Bowhead Harvests	Sources of Vessel Data (primary source first)
	Best	Min.	Max.		
NORTH AND WEST HUDSON BAY (NWHB)					
Antelope (Bark). New Bedford, Mass. December 8, 1861—September 18, 1863. Master: George Taber. Keeper: Charles H. Wilbur.	6	6	6	16	Ships logbook (S)
Black Eagle (Bark). New Bedford, Mass. May 5, 1862—September 25, 1863. Master: Charles E. Allen.	4	4	4	23	Ships logbook (S)
Daniel Webster (Ship). New Bedford, Mass. April 21, 1863—October 28, 1864. Master: Merrill W. Sanborn.	0	0	0	12	Ships logbook (S)
Ansel Gibbs (Bark). New Bedford, Mass. March 25, 1864—October 7, 1865. Master: C.B. Kilmer	3	3	3	22	Ships logbook (R)
Black Eagle (Bark). New Bedford, Mass. May 7, 1864—October 1, 1865. Master: Edwin W. White. Keeper: James Fisher.	1	1	1	17	Ships logbook (S)
Cornelia (Schooner). New London. May 9, 1864—October 9, 1865. Master: James T. Skinner. Keeper: George W. Bailey	7	7	7	15	Ships logbook (S)
Glacier (Schooner), New Bedford, Mass. June 21, 1864—November 13, 1865. Master: Geo. F. Taber.	1	1	1	10	Ships logbook (R)
Morning Star (Bark). New Bedford, Mass. May 14, 1864—October 14, 1865. Master: Charles E. Allen.	1	1	1	17	Ships logbook (S)
Orray Taft (Bark), New Bedford, Mass. April 9, 1864—October 6, 1865. Master: Geo. J. Parker.	3	3	3	7	Ships logbook (R)
Ocean Nymph ((Barque), 1866—1867. Master James Taylor.	26	26	26	0	Ross (1973a)
Isabella (Brig). New London, Conn. May 25, 1867—September 12, 1868. Master: George N. Bailey.	0	0	0	7	Ships logbook (S)
Glacier (Schooner), New Bedford, Mass. July 19, 1871—September 24, 1873. Master: Edwin A. Potter.	20	20	20	2	Ships logbook (R)
Abbie Bradford (Schooner). New Bedford, Mass. September 20—December 30, 1874. Master: Elnathan B. Fisher. Keeper: Joseph A. Mosher.	0	0	0	2	Ships logbook (S)
A. Houghton (Bark). New Bedford, Mass. May 23, 1876—June 22, 1877. Master: James G. Sinclair.	0	0	0	4	Ships logbook (S)
A. J. Ross (Brig). New Bedford, Mass. May 15—25, 1878. Master: James G. Sinclair. [shipwrecked in 1878, walrus harvested following shipwreck and reported ca. 1879]	160	160	160	0	Ferguson (1938)
Abbie Bradford (Schooner). New Bedford, Mass. May 8, 1878—August 30, 1879. Master: E.B. Fisher, Keeper: R. Ferguson.	91	91	91	7	Ferguson (1938)

Ship/Port/Voyage Dates/Master of Ship/ Keeper of Journal	Walrus Catch Estimate			Bowhead	Sources of Vessel Data
	Best	Min.	Max.	Harvests	(primary source first)
Abbie Bradford (Schooner). New Bedford, Mass. May 6, 1880—September 6, 1881. Master: W.H. Murphy.	1	1	1	3	Ships logbook (R)
Abbott Lawrence (Brig). New Bedford, Mass. April 6, 1880—September 8, 1881. Master: Joseph A. Mosher.	13	13	13	1	Ships logbook (S)
Isabella (Brig). New Bedford, Mass. May 31, 1880—September 18, 1881. Master: Benjamin C. Blossom. Keeper: Philip Henry Cook (First Officer).	0	0	0	3	Ships logbook (S)
Abbie Bradford (Schooner). New Bedford, Mass. June 15, 1882—October 3, 1883. Master: J. Emmons Dyer.	0	0	0	4	Ships logbook (S)
Isabella (Brig). New Bedford, Mass. June 13, 1882—September 13, 1883. Master: Benjamin C. Blossom. Keeper: John C. Freeman.	31	31	31	6	Ships logbook (S)
Abbie Bradford (Schooner). New Bedford, Mass. May 22, 1884—September 29, 1885. Master: Gilbert B. Borden.	6	6	6	2	Ships logbook (S)
Wave (Bark). New Bedford, Mass. June 22, 1885—September 15, 1886. Master: Anthony P. Benton.	1	1	1	2	Ships logbook (S)
Alexander (Brig). New Bedford, Mass. July 6, 1886—September 28, 1887. Master: Benjamin C. Blossom. Keeper: John C. Freeman.	17	17	17	1	Ships logbook (S)
Perseverance (Barque), London. June 20, 1892—October 31, 1893 (Churchill). Master: Alexander Murray	50	50	50	3	HBCA c.1/664a in Search File: Whales and Whaling
Perseverance (Barque), London. June 16, 1894—August 10 1895. Master: Alexander Murray	16	16	16	3	Ross (1973b), HBCA c.1/664b in Search File: Whales and Whaling
Canton (Bark), New Bedford, Mass. May 1, 1895—October 7, 1896. Master: W.H. Poole.	8	8	8	2	Ships logbook (S)
Era (Schooner). New Bedford, Mass. June 25, 1895—October 3, 1896. Master: George Comer. Keeper: George Comer.	2	2	2	3	Ships logbook (S, R)
Perseverance (Barque), London. August 26, 1895 (Churchill)—August 13, 1896 (Churchill). Master: Alexander Murray	3	3	3	1	HBCA c.1/664a in Search File: Whales and Whaling
Perseverance (Barque), London. 17 August 1896 (Churchill)—October 24, 1897. Master: John N. Murray	0	0	0	2	HBCA c.1/666 in Search File: Whales and Whaling
Active, Dundee, Scotland. 1898	150	150	150	0	Era 1899 (R), Southwell (1899)
Active, Dundee, Scotland. 1899. Master: Captain Murray.	355	223	355	0	Dundee Advertiser (1900), Southwell (1900), Clark (1986)
Era (Schooner). New Bedford, Mass. June 19, 1897—September 21 1899. Master: George Comer.	15	15	15	14	Ships logbook (R), Stackpole (1969)

Ship/Port/Voyage Dates/Master of Ship/ Keeper of Journal	Walrus Catch Estimate			Bowhead	Sources of Vessel Data
	Best	Min.	Max.	Harvests	(primary source first)
Polar Star (Ship). Dundee Scotland. 1899.	132	132	132	0	Dundee Advertiser (1900), Southwell (1900)
Active, Dundee, Scotland. 1900. Master: Murray	327	327	327	1	Southwell (1901), Watson (2003)
Active, Dundee, Scotland. 1901. Master: Murray	262	262	262	5	Southwell (1902)
Era (Schooner). New Bedford, Mass. June 30, 1900—October 9, 1902. Master and Keeper: George Comer.	0	0	0	8	Ships logbook (S, R)
Active, Dundee, Scotland. 1903	78	0	260	5	Southwell (1904)
Active, Dundee, Scotland. June 6—October 20, 1904. Master: John Murray	38	38	38	2	Southwell (1905), Clark (1986)
Active, Dundee, Scotland. 1905.	52	52	52	3	Ingram's Whaling and Sealing, Clark (1986)
Era (Schooner). New Bedford, Mass. June 30, 1903—October 15, 1905. Master: George Comer. Keeper: George Comer.	25	25	25	13	Ships logbook (S), Ross (1984)
Active, Dundee, Scotland. 1906.	360	360	360	1	Ingram's Whaling and Sealing
Active, Dundee, Scotland. 1907.	374	374	374	0	Bernier (1909)
Active. Dundee, Scotland. 1908. Master: Murray	452	452	452	1	Bernier (1910), Dundee Advertiser (1909)
Active. Dundee, Scotland. 1909. Master: Murray	480	480	480	1	Bernier (1910), Ingram's Whaling and Sealing
Active. Dundee, Scotland. 1910. Master: Murray	540	540	540	2	Ingram's Whaling and Sealing
Ernest William. Dundee, Scotland. 1910. Master: Cannon.	80	80	80		Ingram's Whaling and Sealing
Active. Dundee, Scotland. 1911. Master: Bannerman	206	206	206	3	Ingram's Whaling and Sealing
Ernest William. Dundee, Scotland. 1911. Master: Lindsay.	160	160	160		Ingram's Whaling and Sealing
Active. Dundee, Scotland. 1913. Master: John Murray.	25	25	25	6	Ingram's Whaling and Sealing
A.T. Gifford (Schooner), Stamford, Connecticut. June 10, 1913—September 20, 1914. Master: J.A. Wing.	50	50	50	0	Ships logbook (S)
Catch totals (CA: NWHB):	**4632**	**4422**	**4814**	**262**	
Vessel count (CA: NWHB):	**51**				

Ship: the original spellings of the ship types were retained (e.g., Bark, Barque).

Uncertainty in walrus harvest estimates: Uncertainty is denoted with a question mark (?). Walrus (best) includes known Canadian data and others that are likely to be from Canadian waters; Walrus (min. or minimum) removes any uncertain catches; Walrus (max. or maximum) includes all catches (e.g., from Greenland) and any higher reports. Struck and lost animals are not included but salvaged animals are.

Blank cells: Some later catches were reported by vessels that were not whalers but carriers of produce from shore whaling stations. These rows have blank cells for bowhead, which were not being targeted or at least taken opportunistically and are not included in the comparison of walrus and bowhead catches (Fig. 5).

Ships logbook codings: R = read by R.R. Reeves, S = read by D.B. Stewart.

Table 4. Summary of annual landed catches reported from walrus populations in the eastern Canadian Arctic by subsistence and shore-based commercial hunts. See Supplement 4 for community data.

Year	High Arctic			Central Arctic					Low Arctic	Eastern
	WJS-BB	PS-LS	Total	FB	NWHB	SEB	SHSUBL	Total	SEHB	Canadian Arctic Total
2010	2	7	9	216	2	28	42	288	2	299
2009	7	2	9	159	10	14	36	219	2	230
2008				107	3	10	53	173	8	181
2007	4	2	6	89	24	17	67	197	0	203
2006	5	0	5	284	34	61	57	436	2	443
2005	2	2	4	175	28	22	44	269	3	276
2004	5	5	10	66	8	6	42	122	0	132
2003	7	7	14	184	21	25	38	268	7	289
2002	3	1	4	1	64	52	59	176	15	195
2001	2	6	8	80		38	48	166	8	182
2000	4	8	12	255	30	86	28	399	1	412
1999	5	8	13	287	37	94	37	455	2	470
1998	11	13	24	205	49	76	38	368	28	420
1997	12	2	14	248	23	83	69	423	11	448
1996	8	3	11	144	57	73	60	334	13	358
1995	5	11	16	42	57	59	78	236	10	262
1994	24	16	40	201	41	97	55	394	4	438
1993	12	8	20	225	92	52	74	443	10	473
1992	22	8	30	295	3	60	77	435	5	470
1991	9	10	19	178	89	86	54	407	13	439
1990	19	6	25	178	68	99	32	377	14	416
1989	7	8	15	137	70	64	34	305	6	326
1988	8	7	15	185	75	106	62	428	12	455
1987	10	12	22	168	53	66	56	343	22	387
1986	6	9	15	151	74	17	163	405	13	433
1985	4	11	15	210	53	53	92	408	11	434
1984	14	5	19	210	81	94	40	425	22	466
1983	9	9	18	300	100	135	80	615	4	637
1982	10	26	36	300	95	132	117	644	12	692
1981	7	13	20	310	62	142	94	608	10	638
1980	10	5	15	187	73	154	76	490	10	515
1979	3	12	15	325	48	132	32	537	40	592
1978	25	7	32	138	19	134	2	293	3	328
1977	3	9	12	218	57	152	26	453	10	475
1976	23	9	32	130	61	93	51	335	10	377
1975	20	3	23	50	34	221	100	405	16	444
1974				120	65	80	92	357	4	361
1973	10	6	16	30	109	105		244	8	268
1972		8	8		74	4		78		86
1971	12	11	23		4	21		25		48
1970	17		17			14		14		31

Year	High Arctic			Central Arctic					Low Arctic	Eastern
	WJS-BB	PS-LS	Total	FB	NWHB	SEB	SHSUBL	Total	SEHB	Canadian Arctic Total
1969	7	6	13	200		11		211		224
1968	15	5	20	150	2			152		172
1967	19	15	34		201	32		233		267
1966	35	15	50	100	21	181		302		352
1965	30	17	47	550	2	39		591		638
1964	31	21	52	104	127	69	30	330		382
1963	19	28	47			58	30	88		135
1962	41	22	63	700	18	47	30	795		858
1961	60	24	84	58	209	31		298		382
1960	38	21	59	31	212	20		263		322
1959	50	33	83	195	113	96		404		487
1958	46	95	141	267	237	167		671		812
1957	57	50	107	79	148	143		370		477
1956	61	13	74	198	77	190	20	485		559
1955	81	35	116		185	171	69	425	60	601
1954	48	47	95	425	234	200	80	939	60	1094
1953	26	41	67	425	265	212	158	1060	60	1187
1952	26	15	41	425	287	162	30	904	60	1005
1951					229	50	30	309		309
1950	10	10	20		101	50	32	183		203
1949	10	10	20	5		50	90	145		165
1948						106		106		106
1947										
1946					36	20	22	78		78
1945					37		61	98		98
1944										
1943										
1942					71	26		97		97
1941					66		10	76		76
1940					20	127	56	203		203
1939					20	94	132	246		246
1938		24	24		44	275	151	470	29	523
1937					16	74		90		90
1936					2	46		48		48
1935					2	106	3	111		111
1934					21	40	165	226	2	228
1933	1		1		71	1	120	192	16	209
1932	10		10		26	40	83	149	6	165
1931	2		2		19	44	79	142		143
1930	3		3		37	62	38	137	1	141
1929					42	60	110	212		212
1928		27	27		48	122	80	251	1	279
1927					138	145	1424	427	15	442
1926					6	97	16	118	51	169

Year	High Arctic			Central Arctic					Low Arctic	Eastern
	WJS-BB	PS-LS	Total	FB	NWHB	SEB	SHSUBL	Total	SEHB	Canadian Arctic Total
1925					33	12	2	47	24	71
1924					12	99	91	202	18	220
1923					35	33	41	109	4	113
1922					8	2	24	34		34
1921					15		20	35	2	37
1920					12	1	164	177	2	179
1919					9	29	37	75		75
1918						4	44	48		48
1917						45	3	48		48
1916						211	4	215		215
1915						281	15	296		296
1914					3	188	31	222		222
1913					10	8	2	20		20
1912							20	20		20
1911										
1910							1	1		1
1909										
1908							1	1		1
1907							14	14		14
1906					2			2		2
1905					9		7	16		16
1904					15		2	17		17
1903					12		8	20		20
1902	1		1		155		10	165		166
1901	140		140							140
1900	3		3							3
1898	35		35				1	1		36
1889							1	1		1
1883					40			40		40
1882					70			70		70
1876							1	1		1
1874							4	4		4
1873							1	1		1
1865					4			4		4
1864					7			7		7
1863					4			4		4
1862					23			23		23
1856					12			12		12
1854					4			4		4
1851					12			12		12
1850					12			12		12
1843					5			5		5
1842					3			3		3
1841					1		1	2		2

Year	High Arctic			Central Arctic					Low Arctic	Eastern
	WJS-BB	PS-LS	Total	FB	NWHB	SEB	SHSUBL	Total	SEHB	Canadian Arctic Total
1839					1			1		1
1838							1	1		1
1837					15		30	45		45
1836					15		18	33		33
1835					3			3		3
1834					5			5		5
1833					11			11		11
1832							54	54		54
1831					9		1	10		10
1830					20		1	21		21
1829					28			28		28
1828					5			5		5
1822					7			7		7
Totals	1271	869	2140	10700	5983	7437	4729	**28849**	**782**	**31771**

There is much uncertainty as to locations of walrus catches in the "Davis Strait" fishery between ca. 1885 and 1910, so some of the annual estimates for the High Arctic and Central Arctic (south and east Baffin) populations could be positively or negatively biased (Fig. 11). No walrus catch data were found for 1911 through 1919, but this may be an artefact of the availability of archival records from the shore-based traders and reduced vessel activity in the Arctic during World War I.

Inuit had been trading with whalers during the summer for many years but year-round, shore-based stations were not established in the Pond Inlet area until 1903, by Robert Kinnes and Company (Usher 1971, HBCA Post Histories - Pond Inlet [see Supplement 1]). J.E. Bernier, the Arctic Gold Exploration Syndicate, and H.T. Munn later established posts in the area. The *Albert* and *Eclipse* transported walrus products from these shore stations to Dundee (Ingram's Whaling and Sealing undated, Bernier 1909, 1910). The walruses returned by these vessels were reported along with whale catches, as both vessels hunted whales when the opportunity arose.

Significant numbers of walruses were killed by explorers for subsistence and by sportsmen for recreation in the Canadian High Arctic in the late 1800s and early 1900s. Only some of these animals, a portion of those killed by Sverdrup (1904a, 1904b) and Peary (1907), were reported and were taken from Canadian waters. They are included in the catch history. Unspecified numbers (at least 51 but probably nearer 75-100) were killed in the Rice Strait area, between Ellesmere and Pim islands, for winter meat during the second Norwegian *Fram* expedition in 1898-1902 (Sverdrup 1904a, 1904b). While the expedition was visiting Alexandra Fiord, Sverdrup referred to a large group of walruses on a floe as a "meatberg" (Sverdrup 1904a p.185). American polar explorer Robert Peary landed 128 walruses from the Canadian High Arctic in July 1901 (Peary 1907), likely along the coasts of Nares Strait in the Payer Harbour—Bache Peninsula area of Ellesmere Island but possibly along the nearby Greenland coast (Fig. 14; see also Hobbs 1936, Loughrey 1959).

By 1923 the HBC had purchased many of its opposition's posts and had a monopoly on trade in the Pond Inlet area. The company established a post at Arctic Bay in 1926 but closed it in 1927

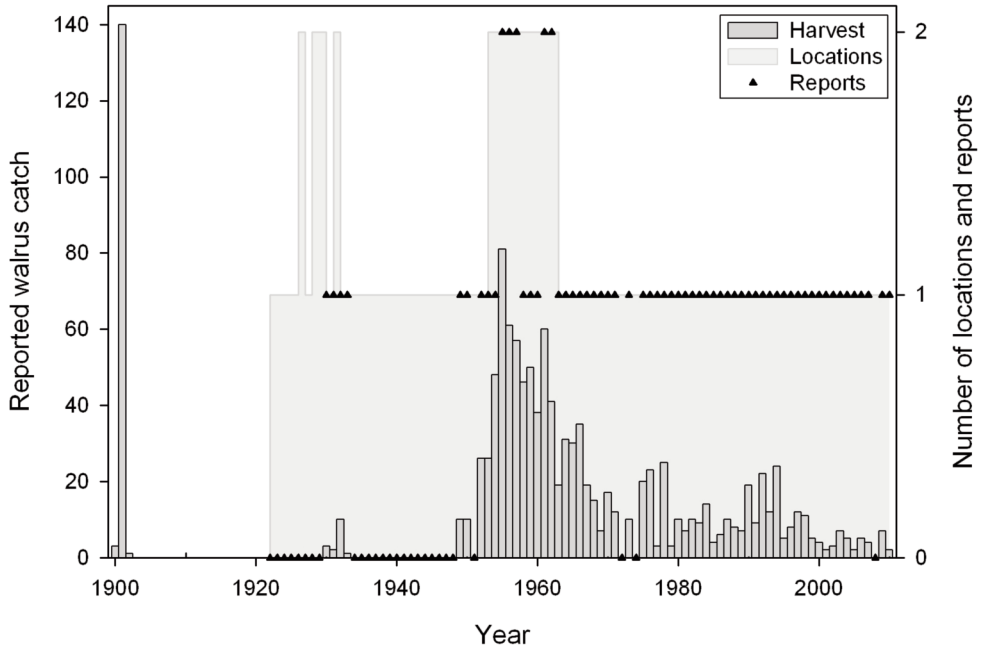


Fig. 14. *Catches by Inuit and shore-based traders, and community reporting rates, from the Western Jones Sound–Baffin Bay (WJS-BB) area of the Canadian High Arctic walrus population, 1900–2010.*

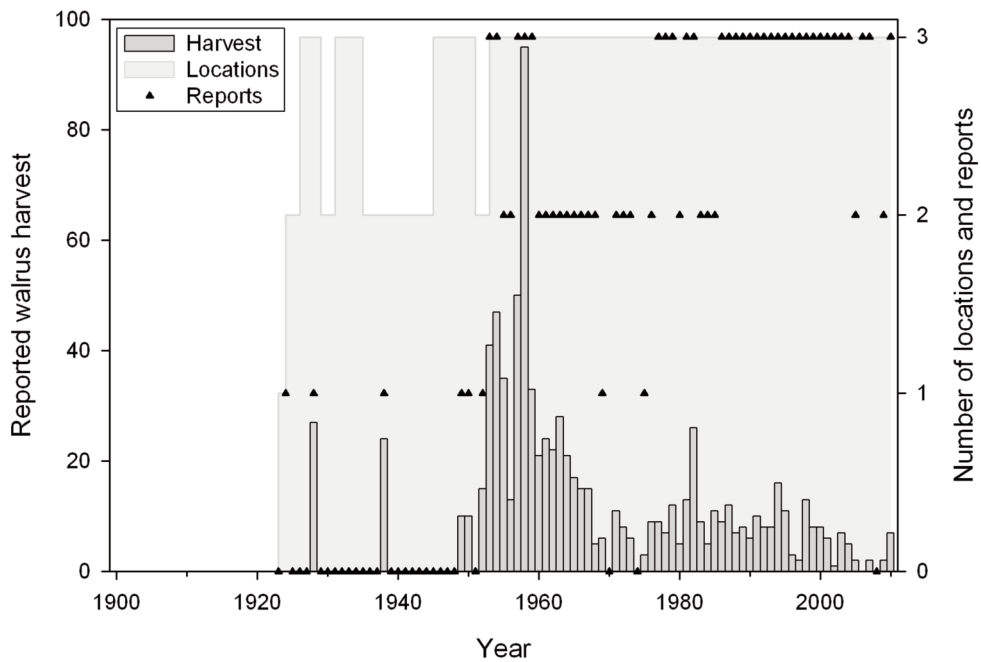


Fig. 15. *Catches by Inuit and shore-based traders, and community reporting rates, from the Penny Strait–Lancaster Sound (PS-LS) stock of the Canadian High Arctic walrus population, 1900–2010.*

(Usher 1971, HBCA Post Histories: Arctic Bay and Pond Inlet [see Supplement 1]). The post was re-established in 1931. Communities eventually developed at both Pond Inlet and Arctic Bay. No evidence was found to suggest that significant commercial hunting of walruses from the High Arctic population took place.

During the past century the RCMP hunted walruses to feed humans and dogs and for materials. The High Arctic catch data from 1949 through 1970 are primarily from the RCMP. A detachment was established at Craig Harbour on Ellesmere Island in 1922 to secure Canadian sovereignty of the island (Adams 1941, Barr 2004). This detachment was maintained until 1926, when it was replaced by another on the Bache Peninsula that closed in 1932. Members of the Bache Peninsula detachment spent much of the open-water season using motorboats and whaleboats to hunt walruses and bearded seals to stockpile dog food (Dick 2001). In 1928, one officer at the detachment reported that he had "lived solely on a diet of seal and walrus meat all winter" (Dick 2001 p.296). The Craig Harbour detachment re-opened in 1933 and, except for a brief closure in 1950, was manned continuously until 1956 when the RCMP relocated to the Inuit settlement at Grise Fiord 70 km west (Qikiqtani Truth Commission 2013).

A government trading post was established at Craig Harbour by the Department of Northern Affairs and National Resources in 1953 and operated until 1957 (Usher 1971). Inuit families from Inukjuak (formerly Port Harrison or Inoucdjouac) and Pond Inlet were relocated to Grise Fiord in 1953 but the RCMP detachment only moved there in 1956 (Qikiqtani Truth Commission 2013; see also Usher 1971, Outcrop Ltd. 1990). An RCMP detachment was also stationed at Alexandra Fiord on the east coast of Ellesmere Island from 1953 to 1963. During that time the detachment's annual catch averaged about 16 walruses, of which less than 20% were females (Born et al. 1995 based on 7 years of RCMP Game Reports).

The RCMP had a detachment at Dundas Harbour on the south coast of Devon Island at from 1924 to 1933 and from 1945 to 1951. The Post was operated by the HBC from 1934 to 1936 (Usher 1971). In 1934, nine Inuit families from Pond Inlet, Cape Dorset and Pangnirtung were relocated to Dundas Harbour by the Government of Canada to trap and provide furs to the post. Game was plentiful but the area was uninhabitable so, after 2 years, the people from Pangnirtung were allowed to return home and the others were sent to Arctic Bay (Qikiqtani Truth Commission 2013). The RCMP landed 10 walruses in 1949 (Appendix A7 in Lawrie 1950) and 10 more in 1950 (Loughrey 1959).

The HBC operated a post at Fort Ross in the 1940s but no reports of walrus catches were found. The community of Resolute was established in 1953 by the Department of Indian and Northern Affairs (Usher 1971). Inuit living at Creswell Bay on Somerset Island sometimes caught a walrus (Strong 1989). The community of Nanisivik, on Strathcona Sound, was established in 1975 to support the lead-zinc mining and mineral processing operations for the Nanisivik Mine, which ceased production in 2002 (Harris 2002).

Hunters from Resolute, Arctic Bay, Pond Inlet, and Grise Fiord kill walruses from the High Arctic population (Fig. 1 and 2, Table 4, Supplement 4). Timing of the hunt varies among communities but most animals are taken from May through September (Pattimore 1985, J. Pattimore, pers. comm. 1986, Priest and Usher 2004). Hunters from Grise Fiord also land a few walruses in October, November, February and April. The transition from hunting by dog team to hunting by snowmobile occurred in Grise Fiord between 1967 and 1969 and was accompanied by a sharp decline in walrus catches (Bliss et al. 1973, Riewe and Amsden 1979). A similar decline occurred at Resolute ca. 1965-74 (Riewe 1976). Walrus catches increased in the early 1990s when dog teams were reintroduced in Grise Fiord (D. Akeeagok cited in Born et al. 1995) but this increase was short-lived. Catches from 1969 through 1976 and 1980 through 1986 will have been underestimated by about

50% and 20% respectively, due to reporting gaps (Supplement 4). A gap in catch reporting from Arctic Bay in 1960 through 1976 likely would have caused only a small negative bias in the annual estimate (Fig. 15) as the people there take few walruses in most years.

Since 1950, the landed catches of walruses by Grise Fiord (Fig. 16) and Resolute appear to have declined rather than increased while Inuit populations increased. Sport hunts were approved for Grise Fiord (2008) and Resolute (2011) but no hunts were licensed and no walruses were landed (Supplement 5).

Hunters in northwestern Greenland have historically taken many walruses from this shared population (Born et al. 1995). On occasion, hunters may also travel between jurisdictions to hunt. Based on reports obtained from DFO, Greenland, and the Nunavut Wildlife Harvest Study, an estimated average of 122 walruses was removed each year from 1996–2001 (110 North Water, 4 west Jones Sound, 8 Penny Strait–Lancaster Sound; NAMMCO 2006).

Central Arctic Population

At least 37,106 walruses were landed from the Central Arctic population over the period from 1820 through 2010 (Fig. 3). From 1820 through 1928, commercial hunts by whaling vessels and shore-based whaling stations landed a minimum of 8,116 walruses (Fig. 12). These catches peaked in 1910. From 1820 through 2010 commercial hunts by land-based traders, subsistence hunts by Inuit, and sport hunts by non-Inuit landed a total of at least 28,990 walruses; most (28,419) were taken between 1900 and 2010 by land-based traders and Inuit, with catches peaking in the early 1950s (Fig. 13). Accounting for gaps in the catch record and for animals that were removed from the population but not landed would result in much higher removal estimates over the same periods, and might shift the apparent peak in the 1950s into the 1930s.

Foxe Basin stock

Whalers and traders did not hunt walruses commercially in Foxe Basin. In 1879 Captain Spicer, in the schooner *Era*, ventured north into Foxe Basin to islands that bear his name (Ross 1975). He did not find good whaling prospects and no one else looked. Instead, the whalers concentrated their efforts on northwestern Hudson Bay, travelling through Roes Welcome Sound to Repulse Bay and Frozen Strait, but seldom further north. This was likely due in part to the presence of pack ice that drifted south throughout the summer to concentrate in the area north of Southampton Island, where it sometimes persisted year-round (Ross 1975, Canadian Ice Service 2011). The extensive shallows in eastern Foxe Basin would also have been a hazard to whaling vessels.

Parry (1824), Lyon (1824), Hall (Nourse 1879), and Mathiassen (1928) were among the few scientists and explorers to visit the region by sea during the periods when walruses were being hunted commercially. They described walrus catches and product use by the Inuit but provided few catch records. Walruses in northern Foxe Basin were also far removed from trading posts. In November 1905 the Kinnes vessel *Ernest*, which was wintering in Lyon Inlet, sent a sled north to trade at Igloolik (Clark 1986). It returned after three months with only a few bear and fox skins.

The first trading post on the Foxe Basin coast was established by the HBC in 1938 but it was closed from 1943 to 1948 due to unfavourable ice conditions (Usher 1971, HBCA Post Histories: Igloolik [see Supplement 1]). Gaps in catch reporting were common between 1950 and 1972 (Fig. 17) but since then there are only four years with missing data.

Their success at hunting walruses gave the *Iglulingmiut* a predictable supply of food and other resources and enabled them to develop large dog teams that gave them mobility (Fig. 8; Crowe

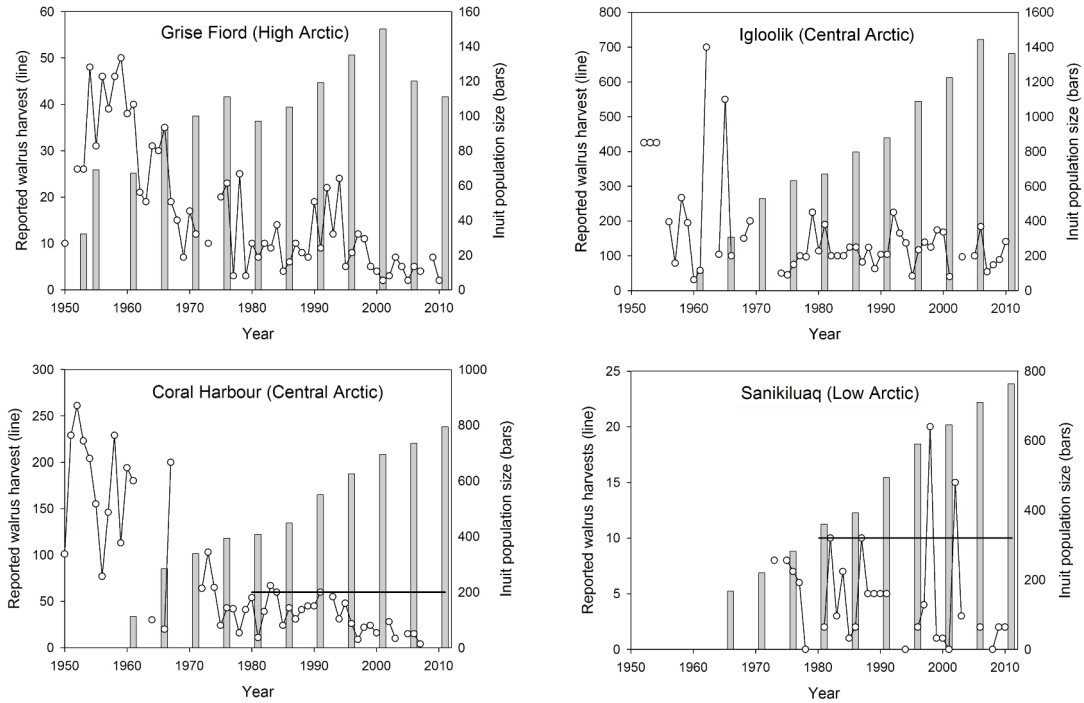


Fig. 16. *Comparisons of the annual landed walrus catches and Inuit populations of representative communities in the eastern Canadian Arctic, 1950 to 2011 (catch data: Supplement 4; census data: Marcus 1992, NPC 2008, Statistic Canada 2012).*

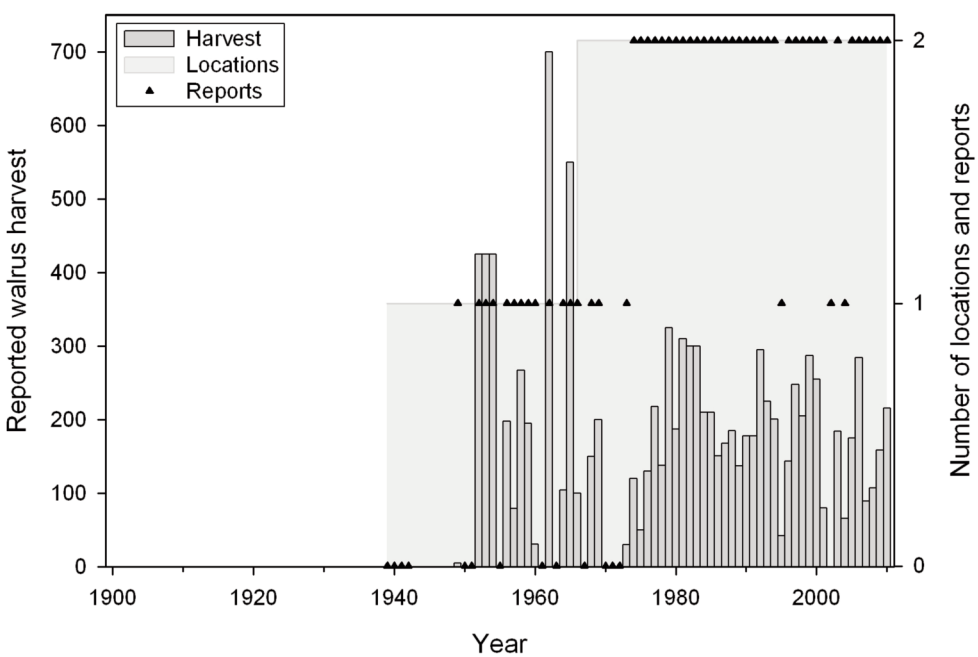


Fig. 17. *Catches by Inuit and shore-based traders, and community reporting rates, from the Foxe Basin (FB) stock of the Canadian Central Arctic walrus population, 1900–2010. Recent sport hunts not included.*

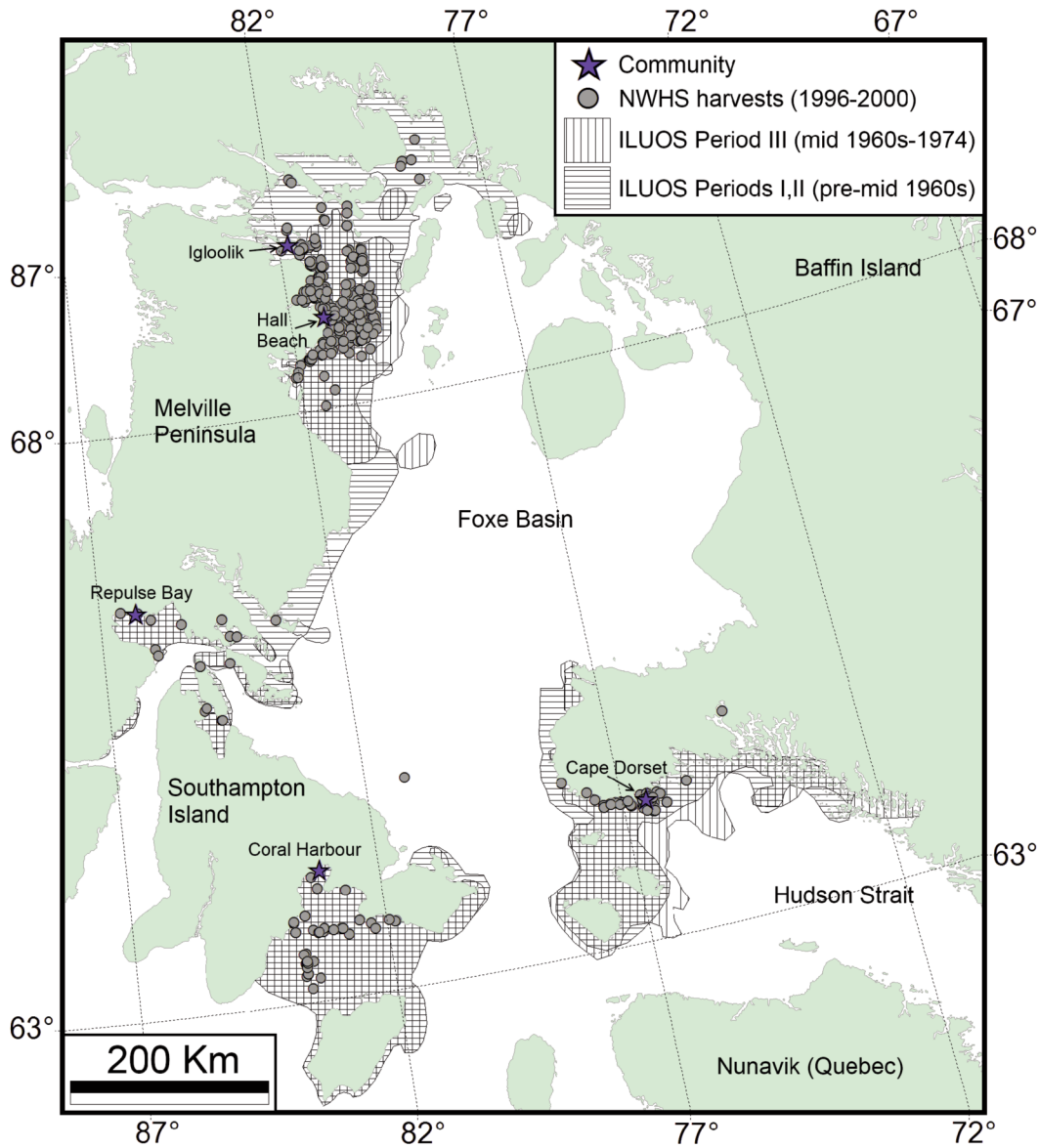


Fig. 18. *Areas where Inuit from the communities of Igloolik, Hall Beach, Repulse Bay, Coral Harbour and Cape Dorset hunted walruses prior to the mid-1960s, from then until 1974, and between 1996 and 2000. Data for harvest areas used prior to 1974 are from the Inuit Land Use and Occupancy Study ('ILUOS')—period III began in 1965 for Igloolik and Hall Beach (Brody 1976), 1963 for Repulse Bay (Brice-Bennett 1976), 1962 for Coral Harbour (Welland 1976), and 1965 for Cape Dorset (Kemp 1976) (see also supporting maps in Freeman 1976). The 1996 to 2000 data are from the Nunavut Wildlife Harvest Study (NWHS) (Priest and Usher 2004).*

1969, Brody 1976, Saladin d'Anglure 1984, Rasing 1994). Loughrey (1959) estimated that the 1953 subsistence hunt landed 425 walruses. Since then the combined annual catches reported by Igloolik and Hall Beach (Sanirajak, established in 1965) have averaged about 200 animals. The largest were reported in the early to mid-1960s, when hunters had a reliable local supply of ammunition, motorized canoes to support summer walrus hunts, and large dog teams to be fed. Subsistence takes were likely lower prior to the introduction of motorized canoes in 1955 and lower still prior to the 1930s due to lack of a reliable local supply of ammunition. The high cost of replacing country foods with those purchased from the store, the market for *igunak*, the wish to obtain ivory to sell or carve, and the perceived benefits of traditional hunting activities are factors acting to maintain walrus catches despite the high costs of hunting (Anderson and Garlich-Miller 1994, Loring 1996, Gustavson et al. 2008).

Hunters from Igloolik and Hall Beach, and visiting sport hunters, kill walruses in northwestern Foxe Basin year-round, but most animals are landed from June through October (Guinn and Stewart 1988). The landed catch data suggest that the total annual kill has declined, rather than increasing in response to the progressive increase in the human population (Fig. 16). Over the same period the area over which walruses are hunted also appears to have contracted (Fig. 18) as the human population has become more concentrated in the Igloolik-Hall Beach area (Crowe 1969, Brody 1976). Catches may be biased toward males, which are larger and have larger tusks; only 31 of 98 landed animals examined between 1982 and 1984 were female (Orr et al. 1986).

The majority of walruses hunted for sport from the eastern Canadian Arctic are taken from the Foxe Basin stock (Fig. 19). This hunt began in 1995 and increased until up to 15 animals were landed annually in the 2003 and 2005 seasons. Sport hunts were suspended in 2007 by Hall

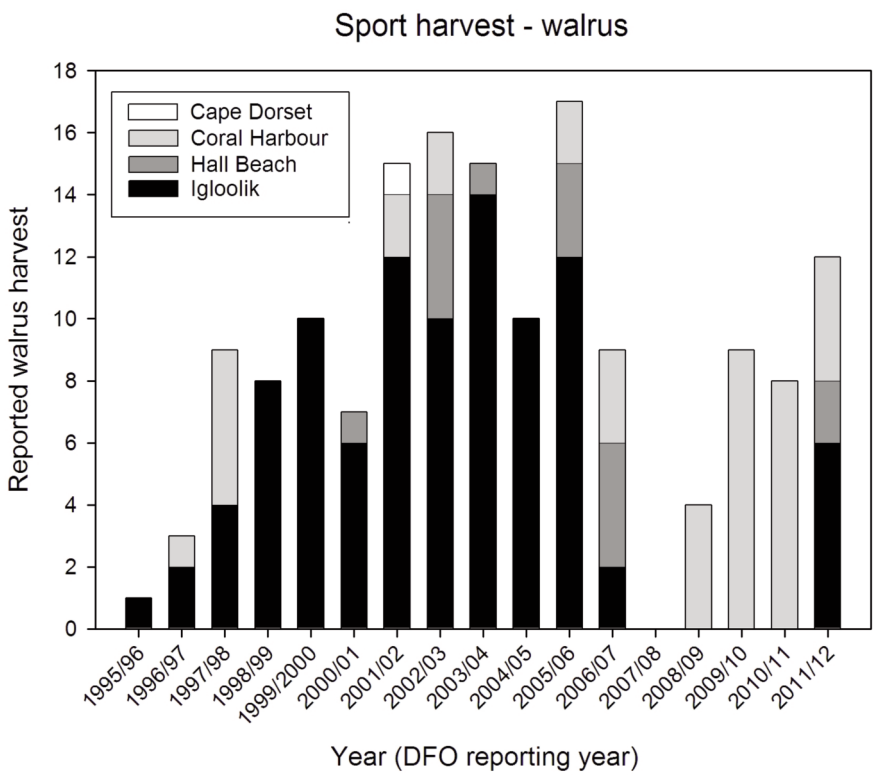


Fig. 19. *Walruses landed in the eastern Canadian Arctic during sport hunts, 1995–2011 (DFO Iqaluit, unpublished data, 2012).*

Beach and 2008 by Igloolik (which suspended other walrus tourism as well) in response to community concerns that human activity was disturbing the walruses, driving them farther from the community and making subsistence hunting more difficult. The 2007 sport hunt may have been underreported as Igloolik did not report results to DFO. Hall Beach resumed licensing of sport hunts in 2009 and Igloolik in 2011, but under more stringent guidelines designed to reduce disturbance.

North and West Hudson Bay stock

Catch data were compiled from 51 whaling voyages to northwestern Hudson Bay between 1863 and 1914 (Table 3). With the exception of several HBC vessels (*Ocean Nymph, Perseverance*), most whalers in the area before 1898 were from Massachusetts, USA. Overwintering was common among the American whalers and sometimes practiced by the HBC vessels (Fig. 6). Marble Island, Depot Island (63°47′N, 89°53′W), Fullerton Harbour and Repulse Bay were the principal wintering sites (Ross 1975). On occasion a vessel remained in Hudson Bay over two consecutive winters. In the case of *Perseverance* the annual catches could be separated and were reported separately. The *Era's* catches could not be separated but relatively few walruses were landed. After 1898, several Scottish vessels from Dundee visited regularly to hunt and to service shore stations.

While the number of ship logs read was small, our sample included the catches of about 25%

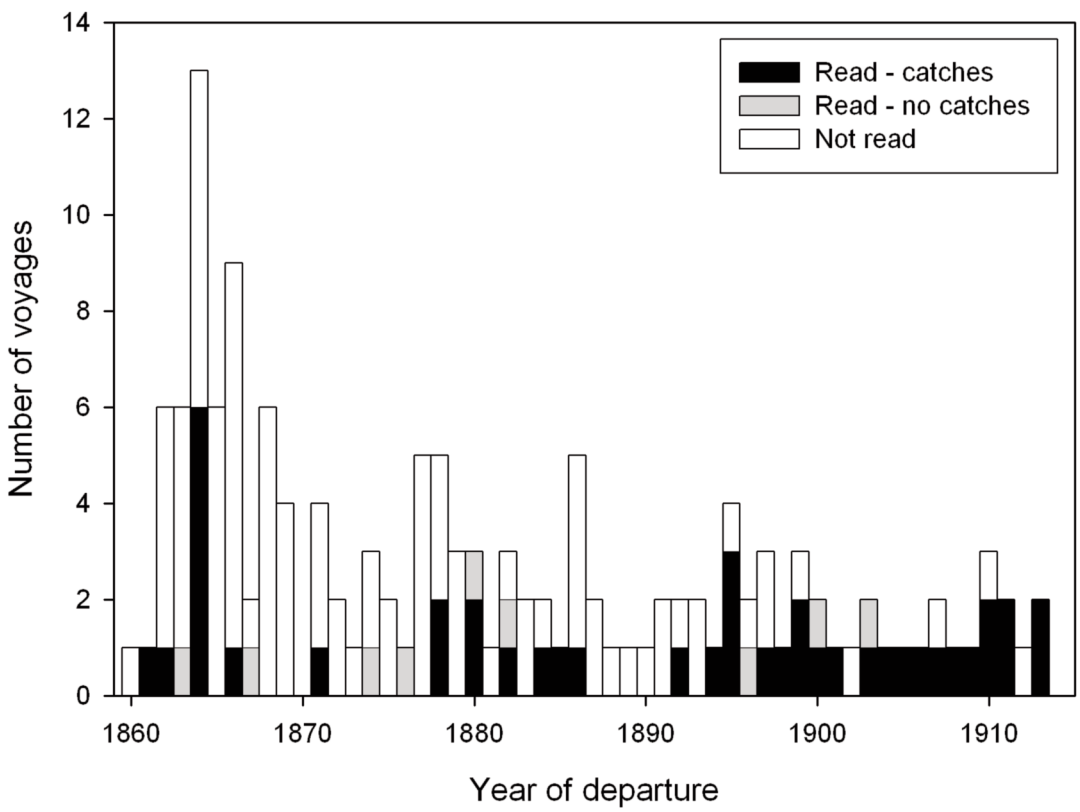


Fig. 20. *Catch data were examined from 51 of the 143 whaling voyages into northwestern Hudson Bay between 1860 and 1915. Records were separated into those with logs that were read and provided walrus data (black shading), those with logs that were read but made no mention of walrus catches (grey), and those for which logs were not read (white).*

(29 of 119) of the American whalers and about 92% (22 of 24) of the British (including HBC) whalers that visited Hudson Bay between 1861 and 1919 (Fig. 20). The reporting rate improved over time although catches varied widely both by vessel and between vessels (Table 3).

Commercial whalers hunted walruses from the beginning of the bowhead whale fishery in Hudson Bay (Fig. 12) but from 1863 until 1897 they concentrated on hunting bowheads, largely ignoring walruses except as a winter food source (Fig. 4). Most of the walruses mentioned in whaling logs from this period were obtained in trade or landed by Inuit associated with a vessel. To avoid double counting, walrus catches reported by the whalers were treated as commercial catches despite the fact that Inuit used some hunt products for subsistence. Catches of walruses by Inuit for their own use during this period were seldom reported.

Most of the catch reports located for this period were from American whaling vessels. The *Glacier* (1873), which spent the winters of 1871–72 and 1872–73 in northwestern Hudson Bay, rendered the oil from 20 walruses taken by the crew. The *Isabella* took 31 walruses while overwintering there in 1882–83 (*Isabella 1873*). Some American whalers obtained large quantities of walrus ivory from the region (Ferguson 1938). In 1878–79, the *Abbie Bradford (1879)* obtained 80 pairs of tusks in trade from Inuit, and took 11 walruses itself; the crew of the *A.J. Ross (1879)*, which was wrecked in August 1878, acquired 800 lbs of ivory either by hunting or trade before returning to New Bedford the following summer. In 1893, the HBC whaling barque obtained 100 tusks in trade from the Inuit (*Perseverance 1893*). The HBC apparently encouraged Inuit in the Hudson Strait–Hudson Bay region to hunt walruses whenever the opportunity arose and sent a small sloop up the coast every year to collect the hides, oil, and tusks (Fox 1893). The carcass from a large walrus was worth between $70 and $100—presumably in terms of products that the HBC could sell.

The hunting pattern changed abruptly in 1898 when the Dundee whaler *Active* owned by Robert Kinnes and Sons began participating in the Hudson Bay bowhead fishery (*Active 1898*). Kinnes established a shore station for whaling and trapping at Cape Low on Southampton Island in ca. 1898 (Southwell 1899). The station was abandoned in 1903 and the small ketch *Ernest William* was towed to Repulse Bay and later to Lyon Inlet to act as a floating base for whaling (Ross 1984:54 note 17). Starting in 1898 and continuing until 1911, the *Active* and other Kinnes vessels (*Polar Star* and *Ernest William*) often landed many walruses, sometimes taking over 500 in a single year (Table 4).

These large catches caused A.P. Low (1906 p.281ff), commander of the Canadian Government scientific expedition to study fisheries and geology in northern Hudson Bay and the Arctic Islands in 1903–1904, to press for the conservation of walruses in Hudson Bay, and to recommend that walruses be reserved for use by the Inuit. He wrote,

> *"There has been a rapid diminution in the number of walrus in the northern part of the bay during the past few years, since the* Active *has been engaged in their capture, and it is only a question of a few years, if the present methods of killing are continued, before the walrus become as rare as the Right [bowhead] whale in the waters of Hudson [B]ay. It is acknowledged that, with present methods of capture and the difficulties of the chase, only one in four or five animals killed is eventually secured…*
>
> *Taking into consideration the value of the animal to the native, the great waste of life in the killing, and the comparative value to civilization, it might be well to pass regulations reserving this animal wholly for the use of the Eskimos."*

The last whaling vessel to hunt walruses in Hudson Bay and return with its catch was the Connecticut schooner *A.T. Gifford* in 1913-1914 (*A.T. Gifford 1914*). The hunt regulation recommended by Low (1906) was implemented in 1928, well after commercial whaling in the region had ended.

Inuit in northwestern Hudson Bay offered visiting HBC traders walrus ivory in trade as early as 1718 (Fossett 2001) and were trading ivory at the HBC post in Churchill by 1822 (HBCA B.42/d/106 [see Supplement 1], see also Fossett 2001). Some of them had travelled there from north of Chesterfield Inlet. The HBC post at Churchill was also carrying out its own walrus hunt in northwestern Hudson Bay by 1882, when the small HBC sloop *Laperouse* travelled north to the Marble Island area to trade. During the trip, the HBC and Inuit killed 70 walruses on a small island about 5 miles from shore (McTavish 1963). The HBC kept most of the tusks and left the rest of the hunt products for the Inuit to use as food and oil. Despite the value of the hides and oil at the time, there seems to have been little interest in these products on the part of whalers and traders in this area (Gordon 1887). In this instance it was due, at least in part, to the limited capacity of the vessel, but in others it may have been interest in larger game, or just poor communication. In the spring of 1902, for example, HBC hunters returning to Churchill from Marble Island killed 100 walruses but left the hides, unaware that they had commercial value (HBCA B.38/b/8, fo. 8d [see Supplement 1]).

In 1911 the HBC established a post at Chesterfield Inlet on the west coast of Hudson Bay (Usher 1971, see also HBC Post Histories). Over the next quarter century the company established posts that would later form the nucleus of settlements at Repulse Bay (1920), Arviat (1921; formerly Eskimo Point), Coral Harbour (1924), and Baker Lake (1925). Shorter-lived coastal posts or outposts were operated at Coats Island (1918–1924), Wager Bay (1926–1947), Mansel Island (ca. 1929–1932), and Tavani (1929–1951). Some of these areas also supported rival companies. Prior to its sale to the HBC in 1936, Révillon Frères operated posts at Tavani (ca. 1928–1931), Baker Lake (1924–1936) and Repulse Bay (1924-1936). Short-lived posts were also operated by F.N. Monjo and Co. at Fullerton Harbour (1913–1919), Henry Toke Munn at Coral Harbour (1916–1918), and Lamson and Hubbard at Chesterfield Inlet (1920–1922).

The HBC archives provide a good record of catches in the Coats Island-Coral Harbour area for 1919 through 1946, and a less comprehensive but still informative record of the Chesterfield Inlet post (Fig. 21, Table 4, Supplement 4). These records often mention the hunting efforts and catches of competitors and other agencies, including the RCMP and Catholic and Anglican missions. In 1913 the HBC post at Chesterfield was salting walrus hides for preservation and sale but the hides were eventually soaked in fresh water to remove the salt so they could be used for dog food (HBCA B.401/a/1, fo. 20-61 [see Supplement 1]). The post continued to gather and export walrus hides until 1929 (HBCA RG3/80/5 p.7 [see Supplement 1]). The HBC post at Coral Harbour purchased walrus hides from the Inuit until at least the summer of 1930 (HBCA B.481/a/1a, fo. 60, 61, 71) and marketed them in 1931(Loughrey 1959). Thereafter the HBC recorded catches by the RCMP, Révillon Frères (Baker Lake), Catholic and Anglican (Baker Lake) missionaries, and local hunters but with little or no HBC involvement in the hunts.

In the mid-1930s a boat from the Révillon Frères post at Baker Lake sometimes travelled to Hudson Bay to hunt walruses for dog food (HBCA B.401/a/9-12 [see Supplement 1]). These catches were reported by the HBC at Chesterfield Inlet and have been included with that post's totals. During the 1930s, Inuit hunters from Baffin Island (Baffinland) occasionally visited Southampton Island. They landed 5 male walruses on 19 May 1932 (HBCA B.481/a/1b, fo. 92 [see Supplement 1]) and "quite a few" on 21 July 1938 (HBCA B.481/a/6, fo. 8 [see Supplement 1]). These catches were reported by the HBC post at Coral Harbour and have been included with its totals.

While the hunting of walruses was reserved for Inuit beginning in 1928, the HBC continued to purchase walrus products for some time. In July 1930 the post at Coral Harbour traded for at least 10 walruses (HBCA B.481/a/1a, fo. 60 [see Supplement 1]), which probably supplied the hides exported in 1931 (Loughrey 1959). The HBC purchased 100 lbs of ivory and 940 lbs of walrus teeth between 1 June 1939 and 31 May 1940 (HBCA RG3/26B). It is not clear whether the "teeth" referred to were tusks or molars, so they have not been included in the catch record. If they were tusks the catch estimate would increase by about 188 walruses, which is many more than the typical annual catch reported by the post at that time. It is possible the "teeth" were traded when the Igloolik post was being established but this has not been confirmed. In any event, walrus conservation continued to be a concern so, in the summer of 1939, the HBC post at Coral Harbour requested gear for catching bowhead whales so the hunting efforts could be shifted away from walruses, stating that "when one consider[s] the enormous slaughter that must take place in this area each year, one cannot but wonder how long the supply can last." (HBCA RG3/26B/27 p.2).

The RCMP game reports provide information on walrus catches by Coral Harbour in most years from 1950 through 1967, with less frequent reporting of catches by the other communities, including Rankin Inlet and Whale Cove (Brack and McIntosh 1963, Outcrop Ltd. 1990). In the late 1950s, Inuit who had survived famines in the interior were relocated to both communities to take advantage of the richer coastal resources and opportunities for employment at the North Rankin Nickel Mine. The modern catch record has been compromised by data gaps from 1968 through 1971, in 1992 and 2001, and from 2008 through 2010.

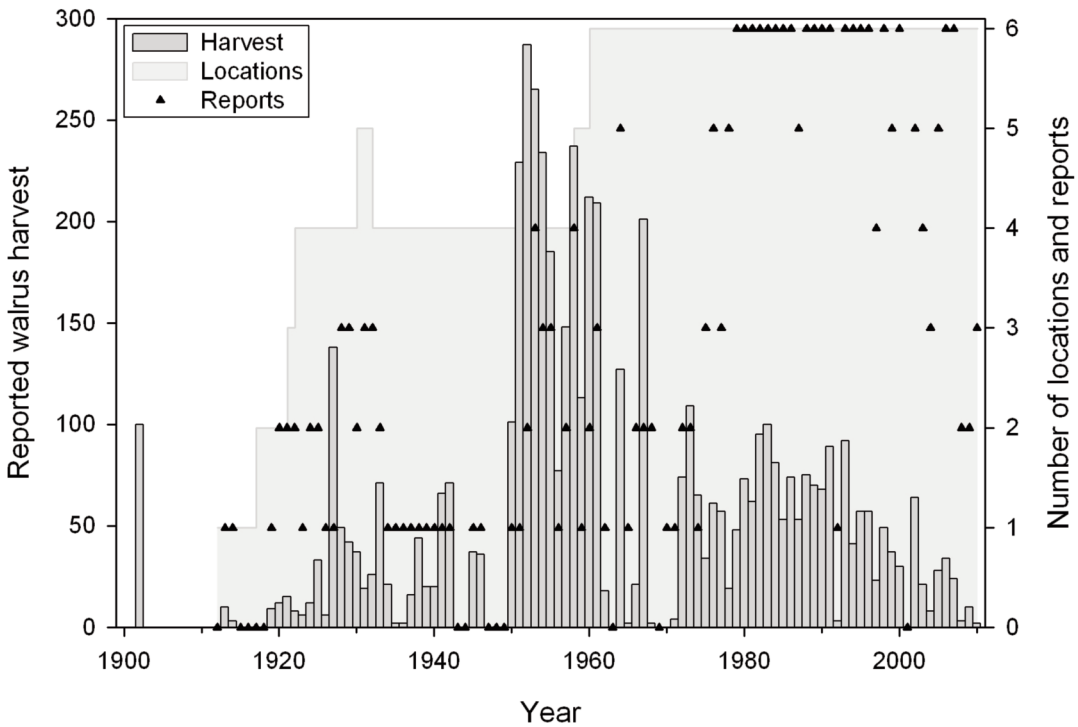


Fig. 21. *Catches by Inuit and shore-based traders, and community reporting rates, from the North and West Hudson Bay (NWHB) stock of the Canadian Central Arctic walrus population, 1900–2010. Recent sport hunts not included.*

Communities along the west coast of Hudson Bay hunt animals from the Central Arctic walrus population (Fig. 1). These catches increase from south to north and hunters from southern communities often must travel north into the Coats Island area to find walrus herds. In 1929 walruses were hunted at least as far south as Walrus Island (61°58′12″N, 92°28′48″W), about 24.6 km northeast of Whale Cove (NWT Archives, Prince of Wales Northern Heritage Centre, Yellowknife, NT: photo N-1987-033: 0838). By 1963 walruses had not been regularly hunted along the Hudson Bay coast in the Arviat area for many years (Brack and McIntosh 1963). People in Arviat travel to Marble Island near Rankin Inlet to hunt walruses, and the people in Kugaaruk (Pelly Bay) travel to Repulse Bay (DFO 2013). [Note: Kugaaruk hunters landed 3 walruses in 2004 and 6 in 2007 (A. Currie, DFO Iqaluit, pers. comm.) but the hunt locations and population affinity are unknown so they have not been included in this catch history.] There are no recent reports of walruses being killed near Churchill. They are rarely taken at Arviat and only irregularly at Whale Cove (Brack and McIntosh 1963, Welland 1976, Gamble 1988, Strong 1989, Fleming and Newton 2003). Timing of the hunts varies among communities. All of the communities hunt animals at the ice edge but the largest catches typically occur during the open water season in the Repulse Bay (September–October) and Coral Harbour–Coats Island (July–September) areas (Gamble 1984, 1987a, 1987b, 1988).

Coral Harbour has the most complete time series of catches from northern and western Hudson Bay (Supplement 4). Annual catches reported by the HBC increased following the regulatory changes in 1928; the largest catches were reported by the RCMP in the 1950s and 1960s. It appears that the landed catch of walruses at Coral Harbour has declined since 1950 even though the Inuit population has increased (Fig. 16). Also, the geographical extent of walrus hunting appears to have contracted toward the community (Fig. 18). From 1972 through 2007, Coral Harbour landed over 60% of the total walruses reported to have been taken in this region (Supplement 4). The reported catch has exceeded 60 walruses only once since 1980 when an annual community catch quota of 60 was established. In the mid-1970s, Welland (1976) reported that fewer walruses had been taken in recent years due to the declining use of dog teams. In 1975 the walrus catch was smaller than in previous years because almost all of the men were employed by the hamlet for the summer and what few occasions they had to hunt walruses were delayed due to mechanical difficulties with the Peterhead boat (A. Helmer, GNWT in litt. to D.H. Dowler, FMS 23 April 1976). Helmer questioned the need for large walrus catches "as there was not one active dog team in the whole of Southampton Island." He believed that some were being taken for their tusks.

Smith and Taylor (1977) reported that there were three years of large catches by Rankin Inlet in the 1960s based on RCMP game reports, and that these catches averaged 127 walruses with a maximum of 200. This average is not included in the catch record, as the data could not be confirmed or accurately dated and may duplicate data from Coral Harbour. Further archival research is needed to verify these data, which may have been related to the establishment of the cannery at Daly Bay in 1964 and its move to Rankin Inlet in 1966, when it became the Issatik Food Plant. Marine mammals were processed at both locations for local consumption but the demand for these products declined steadily and in 1970 the products were discontinued (Carder and Peet 1983, Stewart et al. 1993).

Coral Harbour is the only community that conducts regular sport hunts of walruses in northwestern Hudson Bay (Fig. 19, Supplement 5). Licensing of these hunts began in 1996 and has continued since then with occasional interruptions. The 2007 sport hunt may have been underreported, as Coral Harbour did not report that year's results to DFO. The annual landed catch is typically <5 walruses although 8 were taken in 2009 and 9 in 2010, coincident with suspension of the Igloolik sport hunt. Sport hunts were approved for Repulse (2002) and Arviat (2010) but no Arviat hunts were licensed and no walruses were landed.

South and East Baffin stock (SEB)
Catch data were compiled from 57 vessels that operated between 1827 and 1924 primarily in the area south and east of Baffin Island occupied by the Central Arctic walrus population (Table 3). The earliest of these vessels were English (pre-1830) or Scottish (1856) whalers that operated in Davis Strait, followed by American whalers (1861–1879) that operated in Cumberland Sound. Dundee (Scotland) vessels expanded operations throughout the region (1885–1911) as whalers and later as traders. From 1912 through 1924 trade vessels from London (England) and Peterhead (Scotland) that serviced shore stations predominated, and such vessels typically hunted walruses and other wildlife.

The American and Scottish vessels often overwintered in Cumberland Sound (Sanger 2007). In 1860, a Scottish vessel and up to 10 American vessels overwintered there (Sanger 2007). Over the period 1853 through 1890 there were at least 68 overwinterings by Scottish whalers in Cumberland Sound, while 13 returned early when they had a successful fall fishery or were unable to reach their winter anchorage (Sanger 2007). A number of the whaling companies had well-developed whaling stations and later trading posts that actively hunted walruses in the off-season (Ross 1975, White 1977, Goldring 1986). In addition to stations at Kekerten Island and Blacklead Island in Cumberland Sound, Captain Spicer wintered west of Kimmirut on Spicer Island in 1877 and operated a station there in 1879–80 (Ross 1975). When it closed, Haven and Williams established a station that operated on the island until the early 1890s.

While the HBC was encouraging its supply vessels to trade for "seahorse teeth" as early as 1798, these vessels apparently did not trade with the Inuit annually or obtain much walrus ivory (Ross 1975). The whalers' route to the grounds in northwestern Hudson Bay typically took them south of Resolution Island, along the north shore of Hudson Strait to west of Big Island (now Qikiqtarjuaq 62°43′N, 70°43′W), between Nottingham Island and the Nunavik coast, and then north or south of Coats Island en route to the Marble Island-Cape Fullerton area (Ross 1975). When they returned home in the fall the route was reversed but followed a more direct and central track from Charles Island to Cape Chidley (60°23′N, 64°26′W), thereby limiting whaler contact with Inuit along the Nunavik coast (Ross 1975). Of 16 occasions on which company ships met Inuit in Hudson Strait between 1850 and 1870, only the *Prince Albert* in 1852 and *Prince Arthur* in 1858 obtained substantial quantities of walrus ivory, 204 and 55 lbs, respectively (Ross 1975).

The whalers landed few walruses from this stock until at least 1885, regardless of whether they were successful in catching bowheads (Fig. 12). This was not for lack of walruses. O'Reilly (1818 p.84) described them as being seen "in great numbers" at Resolution Island, but noted that they were seldom hunted, as they were gregarious, ferocious, and came to each other's aid. Barron (1895) took walruses on 5 of his 14 whaling voyages to the eastern Canadian Arctic between 1849 and 1865, landing only 8, all from eastern Baffin Island. During this period Inuit sometimes hunted walruses at the floe edge to feed overwintering whaling crews (Barron 1895). The Dundee whaler *Narwhal* secured 2 walruses in Home Bay (68°45′N, 67°15′W) while en route home at the end of the season in 1859 (*Narwhal 1859*), and the *Perseverance* secured 26 in the Wareham Island (65°15′N, 65°03′W) area of Cumberland Sound in 1878 (*Perseverance 1878*). In the mid-1880s walruses were still plentiful in Frobisher Bay and "on both shores of Davis Straits, owing to the whalers being in too great a hurry to reach the north water to stop to hunt them systematically" (Southwell 1886 p.101ff).

As happened elsewhere when bowhead catches declined, whalers began hunting other species including walruses (Fig. 4). Dundee whalers may have taken their first large catches from this stock in the mid-1880s (*Maud 1885, Chieftain 1885, 1886*) although the hunt locations are uncertain. From 1887 through 1898, whalers occasionally caught a few walruses along the east coast of Baffin Island when they were en route home in the fall (*Maud 1887, Eclipse 1894, 1895*). No

reports were found of concerted commercial hunts for walruses in the region during this period, although walruses were sometimes taken in "considerable numbers" at the ice edge in Cumberland Sound by Inuit engaged in spring whaling (Wakeham 1898 p.73). They sold the hides to the nearest whaling station but kept the ivory to make tools or to carve into ornaments.

The pattern of walrus hunting by whalers changed about 1899, when the small "carrying ship" *Alert* returned home to Peterhead loaded with products from 150 walruses taken around the Cumberland Sound whaling stations (Southwell 1900). In the quarter century that followed, these vessels and their shore stations made very large catches of walruses from the region. Particularly large numbers of walruses were taken along the east and south coasts of Baffin Island by whaler-trader Osbert Forsyth-Grant who operated the motor ketch *Snowdrop* which recorded 200 walruses in 1906 (Fraser and Rannie 1972), 156 in 1907 (*Snowdrop 1907*), and 88 in 1909 (*Snowdrop 1909*) and, after *Snowdrop* sank, the steam auxiliary schooner *Seduisante* which took 433 walruses in 1910 (Table 3; *Seduisante 1910*). In 1910, most of the walruses were taken in the pack ice of Davis Strait southeast of Cape Dyer and from there along the southern coast of Baffin Island west to Frobisher Bay. The *Seduisante* was wrecked in 1911 while pursuing a herd of walruses near Nottingham Island (Fraser and Rannie 1972). Vessels that serviced Kinnes's whaling-trading stations (*St. Hilda*), the Sabellum Trading Company (*Erme, Vera, Rosie*), and the Arctic Gold Exploration Syndicate (*Albert*) also returned large catches. Collectively, these stations were spread from Mingoaktuk in Cumberland Sound east and north to Cape Henry Kater (Usher 1971, White 1977, Goldring 1986). Records of their catches are not complete but those that are available indicate large and consistent catches of walruses from ca. 1906 through 1914, with some walruses taken after World War I until at least 1925.

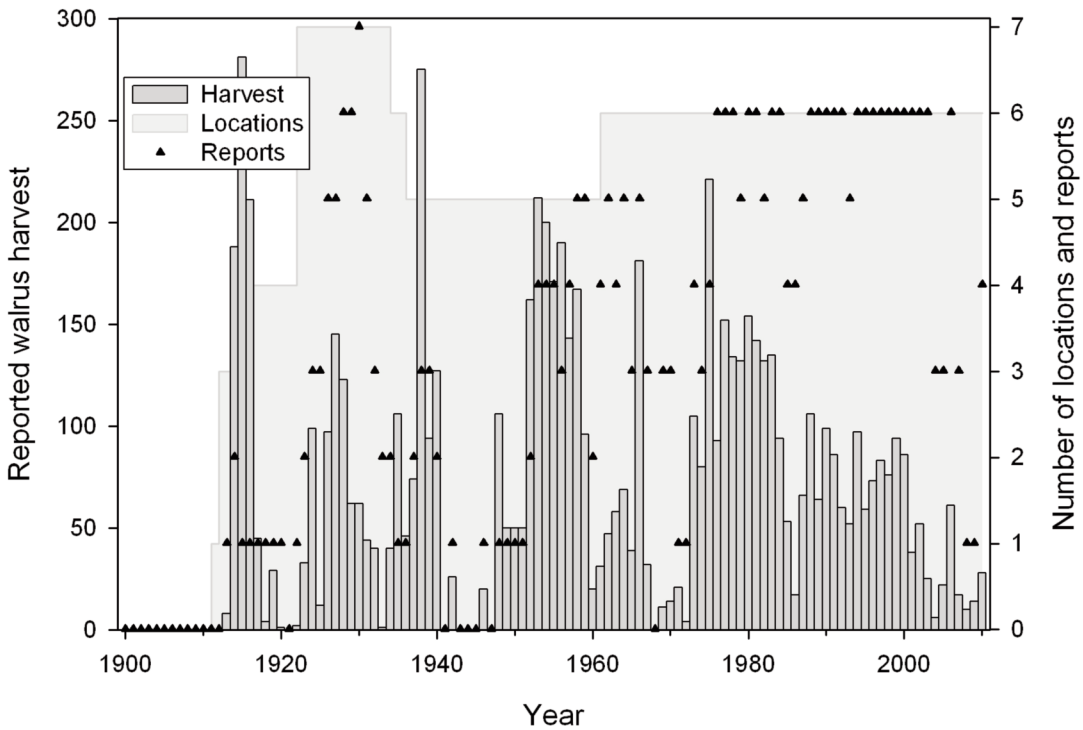


Fig. 22. *Catches by Inuit and shore-based traders, and community reporting rates, from the South and East Baffin (SEB) stock of the Canadian Central Arctic walrus population, 1900–2010. Recent sport hunts not included.*

In the early 1900s the HBC established trading posts at Amadjuak (1921–1934), Blacklead Island (1921–1936), Cape Dorset (est. 1913), Clyde River (1923), Frobisher Bay (Iqaluit; 1911), Kimmirut (Lake Harbour; 1911) and Pangnirtung (1910; HBCA Post Histories [see Supplement 1]). Amadjuak and Blacklead Island landed walruses consistently in the 1920s and early 1930s, but generally in low numbers, before closing in the mid-1930s.

During World War I the HBC post at Cape Dorset, with help from local Inuit, secured many walruses, mostly from the Cape Dorchester (Nuwata) area (Fig. 22). The hunts yielded a minimum of 18 tons of hides in 1914, 18 tons with another 14 tons lost to spoilage when the salt ran out in 1915, and 24 tons with another 11 tons that were thrown overboard en route from Nuwata (Nouwatta) to Cape Dorset in 1916 (HBCA B.397/a/1 [see Supplement 1], Reeves and Mitchell 1986). This represents about 640 walruses landed over 3 years. These wasteful hunts could not be sustained and were not equalled in subsequent years. The post and/or local Inuit continued to take large numbers of walruses at Cape Dorchester or Salisbury Island in most years with catch records until commercial hunting was prohibited. The other HBC posts also secured walruses in most years with records, albeit in smaller numbers.

Since 1928, the communities that formed around the HBC posts at Cape Dorset, Iqaluit, Kimmirut, Pangnirtung, and Qikiqtarjuaq have landed walruses in most years with catch records (Supplement 4). Clyde River walrus catches have typically been smaller although the community reported catches of 40 in 1957 and 38 in 1973. Since 1985, years with no catch reported from Clyde River have been common. Qikiqtarjuaq (formerly Broughton Island) grew up around the Distant Early Warning Line site that was constructed on Broughton Island in 1956–57 (Outcrop Ltd. 1990). Catch reports are not available for Qikiqtarjuaq prior to 1973, but Inuit who relocated there from the Padloping and Kivitoo areas would have hunted walruses previously along the east coast of Baffin Island.

The HBC post, and later community, at Cape Dorset provide the most complete catch record from the region post-1900 although good records are also available for Kimmirut and Pangnirtung. Cape Dorset historically made the largest catches of walruses; in the 1930s and 1940s Cape Dorset sometimes landed over 100 walruses in a year, typically from Cape Dorchester and/or Salisbury, Nottingham, and Mill islands in western Hudson Strait. The walrus meat was distributed to Inuit camps to ensure they had enough dog food to carry them through the trapping season (HBCA B.397/a/9, fo. 51).

Hunters from communities on both sides of Hudson Strait hunted walruses at Salisbury and Nottingham islands (Reeves and Mitchell 1986, D.B. Stewart unpublished data). In 1940, for example, the fleet of Peterheads and other boats hunting at Nottingham Island consisted of vessels from Cape Dorset (2), Salluit (formerly Sugluk; 5), Akulivik (formerly Cape Smith; 2), and Ivujivik (formerly Wolstenholme; at least 2) (HBCA B.368a/18, September 17 to November 2). Boats from Kimmirut (HBC, RCMP, Inuit) also visited Nottingham Island on occasion, and in some years landed many walruses including 31 in 1938 and 100 in 1966 (HBCA B.397/a/8, fo. 36, Higgins 1968, Reeves and Mitchell 1986, D.B. Stewart unpublished data). The RCMP detachment patrolled a large area and hunted walruses from Robinson Sound to Nottingham Island (HBCA B.397/a/8, fo. 36). The HBC auxiliary schooner *Nanuk* was capable of carrying the products from at least 51 walruses (HBCA B.430/a/12 fo. 4), and contributed to many of the larger catches attributed to Kimmirut between 1920 and 1940, taking walruses from the southeastern coast of Baffin Island and Resolution Island areas.

Walruses are typically hunted year-round by Cape Dorset hunters, from February through November or December by Kimmirut and Iqaluit, from May through November or December by Pangnirtung and Qikiqtarjuaq, and in May, July and August by Clyde River (Pattimore 1983a,

1983b, 1985, J. Pattimore, pers. comm. 1986). The hunting patterns of the Cape Dorset people changed around 1970 with the introduction of snowmobiles, which reduced the need to feed dog teams, and with concentration of people at the community (Fig. 18; Kemp 1976). Nottingham and Salisbury islands had been important as hunting areas but they are now seldom visited, and most walruses are taken along the southern coast of Baffin Island (Kemp 1976, Orr and Rebizant 1987, Priest and Usher 2004). Kemp (1976) reported a similar reduction in the hunting range and catch by hunters from Kimmirut and Iqaluit. Fall walrus hunts from Iqaluit have apparently been constrained in recent years by the long distance to the hunting area and the lack of boats of suitable size (DFO 2002). This shrinkage in walrus hunting areas, particularly in the area of Nottingham and Salisbury islands, should reduce overlap of the Nunavut and Nunavik hunting areas although some migrating walruses may still be vulnerable to hunting in both jurisdictions.

A comparison of Inuit populations with the catches reported since 1950 suggests that Cape Dorset (Fig. 16) and Pangnirtung (D.B. Stewart unpublished data) walrus catches have declined despite increasing Inuit populations. Over the same period, the area in which the people of Cape Dorset hunt walruses has contracted toward the community (Fig. 18). These changes probably reflect changes in the desire and need for walrus products, changes in technology, and cost of hunting.

The reported kill of 125 walruses by the people of Pangnirtung in 1975 may have been exceptional but it illustrates how economics can influence walrus catches. Land (1977 p.80) reported that:

> *"the local cooperative began to purchase walrus tusks, and in a period of a few short weeks the kill had reached in excess of 120…Almost all of the meat was wasted."*

It was only through serious discussions with the co-op manager that purchasing was stopped and hunting ended.

While the reported annual catches from this region between 1913 and 1975 were sometimes large, reporting is incomplete (Fig. 22, Table 4). For example, all 281 walruses (estimate based on hides) reported in 1915 were taken by Cape Dorset, although a number of other posts were operating at that time (Supplement 4). The 1938 total of 275 walruses likewise does not include data from Clyde River and Pangnirtung, so many catches during this period may have been underreported by 50%. Reporting rates dropped sharply in 1941 due to World War II and remained low through 1952. They were fairly consistent from 1953 through 1966 but catches in those years may have been underreported by 30% due to missing values from one or more key walrus hunting communities. Reporting rates were inconsistent and often low from 1967 to 1975, such that catches during this period may have been under-reported by 66%. In contrast, the reporting rates were consistently high (83–100%) between 1976 and 2003, suggesting that declines in the reported catches over that period are real. Unfortunately, reporting has been inconsistent and often low since then, such that the catches in 2004, 2005, and 2007 to 2010 have been under-reported. These missing data weaken management understanding of hunting removals and current recovery status of this walrus stock. This is a particular concern given recent development initiatives in the region. For example, the recently approved Mary River Iron Mine project which may greatly increase ship traffic in Hudson Strait and southern Foxe Basin year-round, with serious potential impacts on walruses (http://www.nirb.ca/).

Sport hunts from this walrus stock have been approved sporadically, starting in 1999, for Cape Dorset, Kimmirut, Pangnirtung, and Qikiqtarjuaq (Supplement 5). No hunts have been licensed for these communities since at least 2003. The only walrus secured to date by a sport hunter was taken in 2001 during a Cape Dorset hunt.

Southern Hudson Strait, Ungava Bay, and Labrador stock (SHSUBL)
This region was seldom visited by commercial whalers as their prey were elsewhere and the currents en route to the Hudson Bay whale fishery were more favourable to the north (Ross 1975). Their route homeward in the fall typically remained offshore from Charles Island to Cape Chidley, only far enough south to avoid icebergs and benefit from the favourable currents (Ross 1975). Most of the whalers were anxious to return home and made little attempt to hunt marine mammals or trade with Inuit.

Year-round trading posts were established earlier in Ungava Bay than in the Arctic Archipelago. In 1830 the HBC established a post at Fort Chimo near the present-day settlement of Kuujjuaq (www.nvkuujjuaq.ca/kuujjuaq.html). It closed in 1842 but reopened in 1866. Fort Siveright, which was built in 1838 on the George River about 20 km south of Kangiqsualujjuaq, operated intermittently until ca. 1952 but the present village did not develop until the early 1960s (HBCA Post Histories: George River [see Supplement 1]). The HBC post at Nachvak, Labrador operated from 1868 to 1905.

From 1898 through ca. 1904, Job Brothers & Co. Ltd., a Newfoundland-based mercantile and trading company, operated a fishing station at Port Burwell on Killiniq Island in Nunavut (Richling 2000, HBCA Post Histories: Port Burwell). The station was taken over by the Moravian Brethren in 1904 and operated as a mission and trading post. The HBC established a post at Port Burwell in 1916 and acquired the property of the Moravian mission in 1924–25. In 1884 the government of Canada established weather stations at Port Burwell (Killiniq), Stupart's Bay (Kangiqsujuaq), Port de Laperrière on Digges Island (62°34′N, 78°04′W), and Port de Boucherville on Nottingham Island (63°12′N, 77°33′W) (Gordon 1885). The community of Killiniq closed in 1978.

Despite the longevity of these posts or stations, few catch records were found. From 1832 through 1837, the post at Fort Chimo traded with Inuit for at least 510 lbs of ivory (HBCA B.38/a/2, fo.33 and a/7, fo. 29d, see also Davies 1963 p.147 and 225-footnote 4). In the 1890s the Moravian missionaries in Labrador collected ivory for the Inuit to carve during the winter, and sent the carvings to Europe for sale (Wakeham 1898). There are some reports of catches by government vessels (e.g., Wakeham 1898, Low 1906), the largest in 1903, when the government expedition aboard the D.G.S. *Neptune* secured 7 walruses at the west end of Charles Island with twice as many killed and lost (Low 1906). The walruses were used for dog food. While walruses were once common on the Atlantic coast of Labrador, by 1906 they were "only killed rarely at Cape Chidley, the northern-most point of that coast" (Low 1906 p.281). But in the winter of 1907 a party from the Koksoak area (i.e., near Kuujjuaq) reportedly killed 14 walruses at the Button Islands north of Killiniq (McGregor 1910 cited in Richling 2000).

Révillon Frères (RF) or the HBC established trading posts at the sites of most of the present communities prior to regulation of commercial walrus hunts. Posts were established at Tasiujaq (Leaf Bay; RF 1905, HBC 1907—both closed in 1935), Ivujivik (formerly Wolstenholme, HBC 1909), Kangiqsujuaq (Wakeham Bay; RF 1910, HBC 1914), Kangirsuk (RF ca. 1921, HBC ca. 1927) and Puvirnituq (RF 1921, HBC 1923), Akulivik (Cape Smith; HBC 1922-1952, community built 1973), Salluit (Sugluk West, HBC 1929), and Quaqtaq (Diana Bay; RF 1929, HBC 1936) (Usher 1971, HBCA Post Histories). Independent ("free") trader Herbert Hall established posts at Diana Bay and Sugluk Bay (1925) and existing HBC records suggest that prior to commercial hunt regulation these trading posts all hunted walruses in most years, with varying success (Table 4, Supplement 4).

The most complete catch records are from Ivujivik and Kangisujuaq. Gaps in the records mean that walrus catches by commercial traders during this period are significantly under-reported. The largest catches were made by Ivujivik, from Salisbury and Digges islands (91 in 1924; HBCA

B.368/a/9 fo.8, 13, 39), and by Kuujjuaq, probably from Akpatok Island (140 in 1924; HBCA B.38/a/38, fo. 70 and 73).

Prior to 1928, the most complete records of annual catches are available from the journals of the HBC post at Ivujivk (Fig. 23). The HBC records also document significant catches by the posts at Wakeham Bay (Kangiqsujuaq), Payne Bay (Kangirsuk), Fort Chimo (Kuujuaq), and Leaf Bay (Tasiujaq).

Catch reporting from Nunavik communities was sporadic at best between 1928 and 1973 and lacking for many of the years between 1936 and 1973 (Fig. 23). Most of the pre-1950 data are from the HBC, although Révillon Frères, Herbert H. Hall and the Baffin Trading Company, which operated at Diana Bay (1946-49; HBCA Post Histories: Diana Bay), also hunted or traded walruses. Some of their catches were reported in the HBC post journals. The most consistent records, albeit with large gaps, are from Ivujivik, Kangiqsujuaq, and Salluit. From 1926 through 1953, all Ivujivik catches of >15 walruses, for which location data are available, were made at Nottingham Island (D.B. Stewart unpublished data). Few catch records were found for the community of Killinq in Nunavut prior to its closure in 1978; there are several reports from the area post-closure (Supplement 4).

In other areas RCMP detachments and church missions hunted walruses for dog food and sometimes purchased or traded for walrus products such as ivory carvings. These groups probably were more active as participants in the hunts than the records suggest particularly prior to ca. 1960. In 1953, for example, people from Salluit and Ivujivik took a total of 117 walruses at Nottingham Island in organized hunts using boats supplied by the RCMP and Roman Catholic Mission, respectively (Born et al. 1995). There are few reports of government or scientific catch-

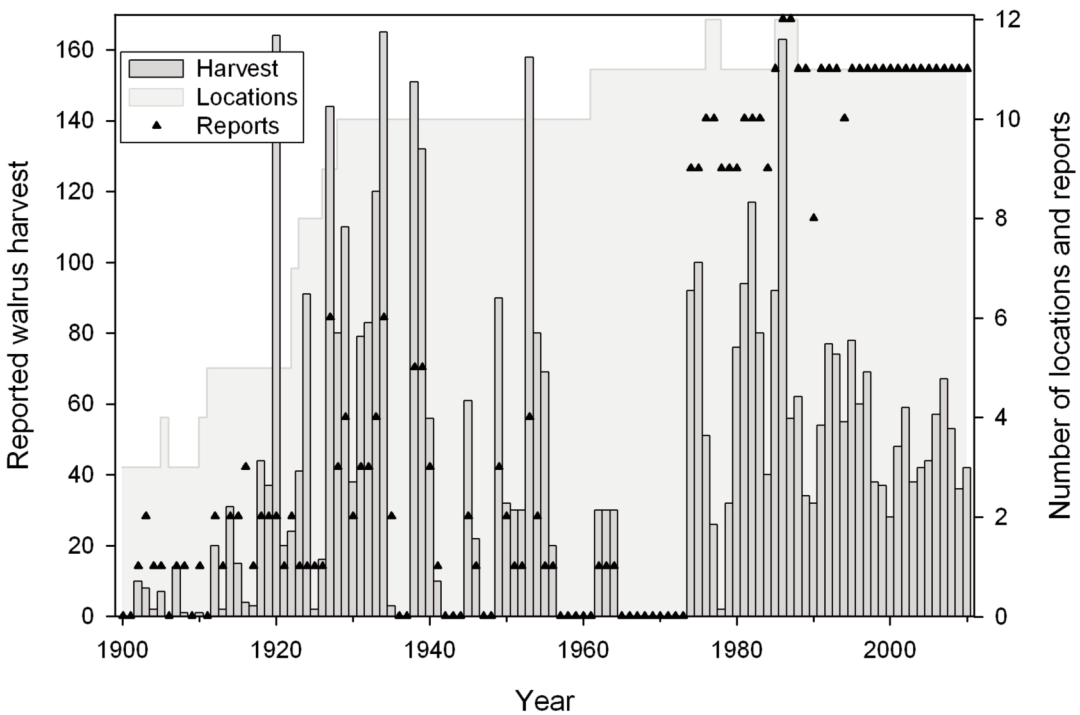


Fig. 23. *Catches by Inuit and shore-based traders, and community reporting rates, from the South and East Baffin (SEB) stock of the Canadian Central Arctic walrus population, 1900–2010. Recent sport hunts not included.*

es of walruses from this region (e.g., Grainger 1950). These gaps in hunt reporting mean that catches are under-reported, possibly significantly, especially between 1940 and 1974. In 1930 walrus meat was being used to feed foxes on a fox farm near the HBC post at Wakeham Bay (Kangiqsujuaq; HBCA B.484/a/7 and 8).

> *"Prior to the 1950s well-organized hunts by Eskimos in Peterheads were carried out from Payne Bay [Kangirsuk]. These have yielded 800 walrus in one season (Jim Ford pers. comm.). During the 1950s a few expeditions were carried out with fewer boats and fewer hunters and these averaged from 150 to 200 walrus a season. …In recent years [early 1960s] there have been no organized hunts owing to the unseaworthiness of most of the old Peterheads" (Currie 1963 p.21).*

Catch data from 1974 onward are mostly from Makivik or DFO studies or summaries (D.B. Stewart unpublished data). The reporting rates improved from 1975 through 1994, although catch data were not always obtained from Ivujivik, Puvirnituq, and Kangirsuk. These communities land some walruses in most years, so their catches are under-reported at least somewhat. Reporting rates have been consistently high since 1994, when the program to test walruses for *Trichinella* began providing catch data. There is still under-reporting, however, as young walruses and those not intended for human consumption are not always tested (DFO 2013). Catch records for the recently created communities of Tasiujaq (ca. 1971) and Aupaluk (ca. 1975), which take few walruses, are assumed to be nearly complete.

In Nunavik,

> *"walrus were usually harvested as a source of dog food, therefore, with the shift from dog teams to motorized transport by the 1960s, Inuit say that the harvest dropped. This was also the period* [when] *the last of the old Peterhead boats, which were the main mode of transport to the distant offshore island*[s] *disappeared. Interest in walrus harvesting had a resurgence in the 1980s when larger sea-going boats* [longliners- Brooke and Kemp 1986 p.25] *were introduced to Nunavik through government sponsored vessel acquisition programs."* (Brooke 1992 p.6; see also DFO 2013).

Other factors that may have contributed to reducing the catch include outbreaks of trichinosis associated with eating walrus meat and a lesser appreciation of walrus meat by younger Inuit due to its strong gamey flavour (Olpinski 1991, Brooke 1992, Larrat et al. 2012).

Residents of Puvirnituq, Akulivik, Ivujivik, and Salluit regularly take walruses from the southern Hudson Strait–Ungava Bay–Labrador area occupied by the Central Arctic walrus population (Roy 1971, Olpinski 1990, 1993, Portnoff 1994, Brooke 1997). Most animals are killed during the open water season, often in September and October near Nottingham and Salisbury islands. However, hunters from Ivujivik, Puvirnituq and Inukjuak have taken walruses occasionally at Mansel Island. Hunters from Kangiqsujuaq and communities around Ungava Bay take most of their walruses from August through October at Akpatok Island, although boats from Kangiqsujuaq have also taken them from Salisbury Island (D.B. Stewart unpublished data).

Over the past decade (2001–2010) most Nunavik communities on Hudson Strait and Ungava Bay have taken walruses in low numbers (DFO 2013). Salluit is the main walrus-hunting community, followed by Puvirnituq, Ivujivik and Akulivik (Supplement 4). Quaqtaq typically catches fewer walruses on average, mostly for *igunak* (DFO 2013). None of the Nunavik communities lands walruses in significant numbers for dog food.

Only a few Nunavik communities are able to hunt walruses nearby, so their annual hunts can be affected and even precluded by equipment failures (DFO 2013). In Kangiqsujuaq, for example, the local Peterhead boat was inoperable for a number of years prior to 1985 and catches were low (Brooke and Kemp 1986). The catches rebounded after the acquisition of a longliner in ca. 1985 re-established large-boat access to walruses on the offshore islands. Salluit had Peterheads operating when it acquired a longliner in ca. 1985 (Brooke and Kemp 1986) and walrus catches by the community reportedly spiked the following year (Olpinski 1990).

In the past some walrus hunts by boat lasted up to a month (DFO 2013). Now the hunters travel faster. The walrus hunt is more efficient but fewer animals are taken because Nunavik Inuit (*Nunavimmiut*) no longer use dog teams. Younger hunters are more likely to hunt male walruses with large tusks while the older generation tends to hunt females, which have smaller tusks but suppler skin and tenderer flesh (DFO 2013). The Salluit walrus catches do not appear to be increasing despite the increasing Inuit population (D.B. Stewart unpublished data).

The community first received approval to conduct sport hunts for walruses in 1995 (Supplement 5). Despite fairly regular approval of hunt requests, no licenses have been issued since at least 2003 and there are no reports of walruses having been taken under a sport license. None of the other Nunavik or Labrador communities has received approval to conduct sport hunts.

At present, walruses are rare south of the Hebron-Okak Bay (ca. 57.5°N, 62.3°W) area of the Labrador coast (Mercer 1967, Born et al. 1995). There are sporadic recent sightings of individuals and small groups south to Nova Scotia and the Gulf of St. Lawrence (Kingsley 1998, Camus 2003, Richer 2003), but they are not considered to be indications of population re-establishment (Reeves 1978, COSEWIC 2006).

Low Arctic Population

At least 782 walruses were landed from the Low Arctic population over the period from 1820 through 2010 (Fig. 3). Commercial hunts by land-based traders and subsistence hunts by Inuit took walruses from 1924 through 2010, with peak catches in the mid-1920s and late 1970s. Accounting for gaps in the catch record and for animals that were removed from the population but not landed (i.e., hunting loss) would increase estimates of total removals and might also shift the timing of the peaks.

This walrus population also was spared from hunting by commercial whalers, few of whom ventured into southeastern Hudson Bay. The Dundee whaler *Active* visited the Ottawa Islands between 1912 and 1914, established a small station, and overwintered in 1912 (Newspaper clipping, PAC MG29, A58, Vo. 8, File 5—cited in Reeves and Mitchell 1987, Eber 1989, Christopher 2005). Whales were apparently abundant in the spring, up to July, and then again in late fall and winter at the ice edge, but whaling was not economically feasible as the Inuit would not overwinter (Christopher 2005). This limited the presence of whalers and thereby commercial walrus catches.

Few reports were found of walrus catches by shore-based traders, and all were from Inukjuak (D.B. Stewart unpublished data). Walruses were apparently present south to the Paint Hills Islands in eastern James Bay at some time prior to 1906 (Low 1906) but are now uncommon south of Cape Henrietta Maria (55° 09′ 01′′ N, 82° 19′ 59′′ W; COSEWIC 2006). Révillon Frères established a trading post at Port Harrison in 1909, followed by the HBC in 1920 (HBCA Post Histories: Port Harrison). The two companies were in active competition in the 1920s and early 1930s, but sometimes cooperated on walrus hunts in company with personnel from the Mission—all with the assistance of Inuit hunters. The catch records are largely from the HBC. Until 1928 these hunts were conducted using a variety of motor vessels at "Walrus Island," which appears to be

the unofficial name for an island within perhaps 40 km of the community. Their main purpose was to obtain dog food for the winter.

Subsistence hunts in the early 1930s were conducted in the Ottawa Islands and King George Islands, for the same purpose by the same participants (HBCA B.467/a/10-a15). By 1938 Inuit hunters at Inukjuak had their own Peterhead, the *Seal*, which they used to catch a full load of 23 walruses from the Sleeper Islands (Twomey and Herrick 1942 p.302, see also Twomey 1939). An expedition from Sanikiluaq was there at the same time.

> *"During the fall it is always possible to procure walrus, sometimes quite near the post, and again as far away as the North Sleepers, but the point is that they can be depended upon. At present the method of hunting is very extravagant, but this is being curtailed gradually."* (HBCA RG3/26B/10).

There is a large gap in the subsistence catch record from the time the HBC records ended in 1938 until 1973 (Fig. 24).

The communities of Inukjuak, Kuujjuarapik, and Umiujaq in Nunavik, and Sanikiluaq in Nunavut currently catch walruses from the Low Arctic population (Table 4). Since 1973, there has been consistent catch reporting by the Nunavik communities but Sanikiluaq has missed 8 years. Sanikiluaq takes walruses in most years but the number taken varies. The community catch quota of 10 walruses was exceeded in 1998 and again in 2002. The data gaps and large catches obscure any trends in catches relative to the Inuit population size for Sanikiluaq (Fig. 16), but the Inukjuak walrus catch does not appear to be increasing with the increase in Inuit population there (D.B. Stewart unpublished data).

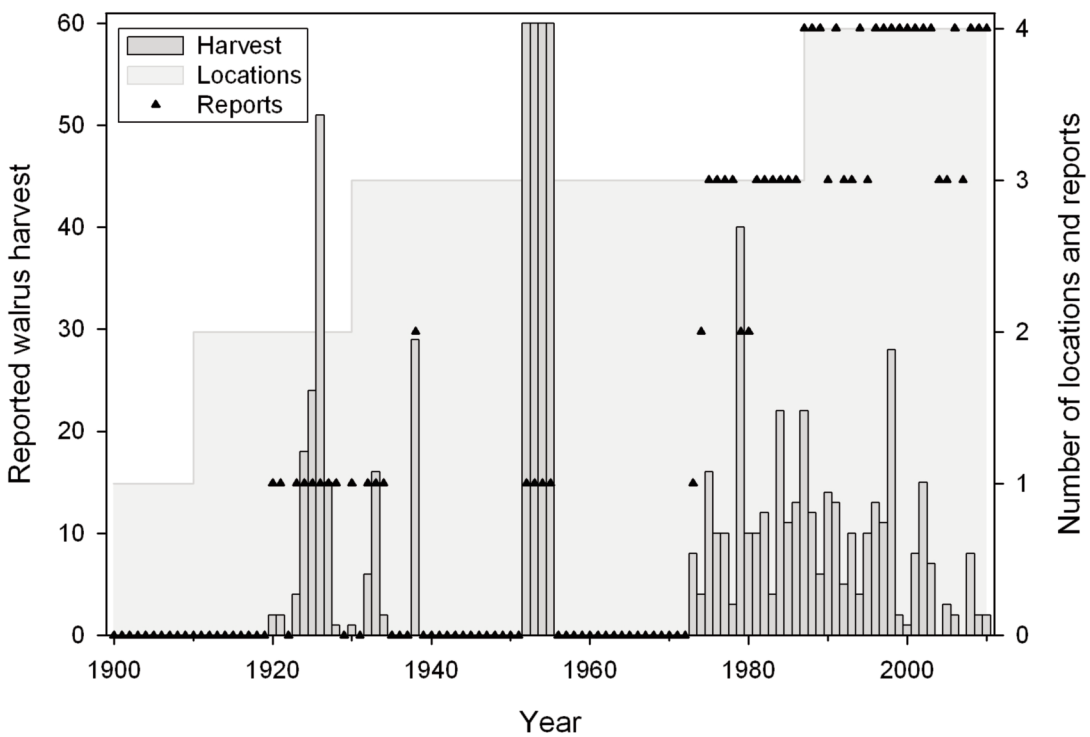


Fig. 24. *Catches by Inuit and shore-based traders, and community reporting rates, from the Canadian Low Arctic walrus population, 1900–2010.*

Hunters from Kuujjuarapik and Umiujaq take a walrus in some years, typically in the Sleeper Islands or along the coast of the Hudson Bay Arc, while those from Sanikiluaq and Inukjuak land a few on average each year, mostly from the offshore islands (JBNQNHRC 1988, Strong 1989, Olpinski 1990, 1993, Portnoff 1994, Brooke 1997). Historically, walruses in southeastern Hudson Bay and James Bay were hunted mainly in the open water season at terrestrial haulouts (*uglit*; Twomey 1939, May 1942, Manning 1946, 1976, Freeman 1964, Olpinski 1990, Reeves 1995, Fleming and Newton 2003). They were also killed in winter and spring at the floe edge or in spring on floating ice pans. Most recent hunting in this region has taken place in late summer and fall (September and October) at the Sleeper Islands (Manning 1976, Schwartz 1976, Olpinski 1990, 1993, Portnoff 1994, Brooke 1997, Fleming and Newton 2003). Cree living along the coasts of James Bay and southern Hudson Bay seldom travel offshore to hunt walruses (Johnston 1961) but they did hunt them occasionally in the past (Fleming and Newton 2003).

Sources of Uncertainty

Uncertainties related to the location, timing, and magnitude of the reported walrus catches have been discussed above and this sort of variation needs to be considered in future population trajectory models (e.g., Reeves and Smith 2010). Moreover, these reported catches only represent a portion of the overall removals. They are useful indicators of minimum removal levels but do not account for the effects of under-reporting, losses of animals that were killed or were seriously injured but were not landed (hunting loss), or catches that could not be confirmed. The unreported components represent a significant fraction of the total numbers of walruses removed from the populations by hunting and therefore these components must be considered in population management and future modelling (e.g., Reeves and Smith 2010). Measures of catch effort are also needed to understand and interpret trends in catch levels.

Under and over reporting

It is difficult to quantify how differences in data collection methods have affected the accuracy of catch reporting over the past 40 years. Some over- or under-reporting will be artefacts of the methods used to gather or extrapolate the data; others may stem from concern that reporting the catch of small animals might reduce the number of large animals that could be taken, or that large catches might cause stricter limits to be placed on hunts. Under-reporting may be greater for walrus calves than for adults.

The capture of live calves for sale to zoos was often described in ships log books or journals but under-reporting of products from calves that were killed was common. Their yield of edible products is low relative to that obtained from adult walruses, their hides are too small to retain for tanning, and they lack tusks. In 1961 in the Southampton Island area, calves constituted about 20% of the animals killed but were "not reported even when utilized", so the landed catch (i.e., animals utilized) of 153 walruses was revised upward to 180 animals by Freeman (1969/1970 p.168). Since 1997, Nunavik walrus reports have been based largely on the *Trichinella* testing program and therefore under-represent the actual catches because young animals and those not intended for human consumption are not always tested (DFO 2013). Community feedback to the Nunavut Harvesting Study from Arviat and Qikiqtarjuak noted that these communities land walruses every year, so that under-reporting of young and/or adult walruses likely occurred in years without a reported catch (Priest and Usher 2004). Walruses of all ages were almost certainly under-reported prior to ca. 1885, as before that time they were a generally inconsequential element of the whaling industry in the Canadian Arctic. Hunts by whalers at large haulouts likely resulted in stampedes that trampled many calves.

The Marine Mammal Regulations and Nunavut Land Claims Agreement both require hunters to report their catches but not all hunters do so (DFO 2013). Some have difficulty completing the catch form or consider the remuneration they receive for providing walrus catch information and

samples to DFO to be inadequate. Others do not report their catches due to concern that it might lead to greater regulation of the hunts. Efforts are under way to educate hunters about the importance of reporting both landed and lost animals, and DFO and its co-management partners are working with the communities to improve the reporting system.

Loss rates during and following hunts

Uncertainties in the reported landed catch are compounded by uncertainty in loss rates, which makes estimating removal rates and modelling populations even more difficult (COSEWIC 2006). Walruses taken by vessels that were lost, such as the *Arctic* in 1874, were not reported in catch summaries such as the Dundee Year Books. Animals that were landed and then lost (for any of a variety of reasons, see below) were also missed. The Dundee Year Book for 1899 (Dundee Advertiser 1900), for example, reported that the whaler *Active* delivered 170 walruses to Dundee but this did not include 182 carcasses that had been lost in a storm (Southwell 1900). Between ca. 1916 and 1940, Inuit hunters experienced substantial weather-related losses on numerous occasions when boats loaded with walrus products met bad weather and were forced to jettison their cargo or sank (HBCA RG3/26B/12 p.6). In 1916, for example, a great number of hides were thrown overboard en route from Nuwata (=Nouwatta), near Cape Dorchester, to the HBC Post at Cape Dorset (HBCA B.397/a/1, fo.128) and in the fall of 1934 Inuit from Nuwata (=Nuwatta) threw most of their load of walrus meat overboard to keep the boats afloat (HBCA B.397/a/4, fo. 9); on 21 October 1940 a Peterhead boat from Salluit (Sugluk) was wrecked in a violent storm and lost 70% of its walruses while returning from Nottingham Island (HBCA B.368a/18); and in 1939 two Inuit boats were wrecked while walrus hunting along a dangerous coast of Southampton Island (HBCA RG3/26B/27 p.5).

Walruses sink quickly when killed in the water, so experienced Inuit hunters prefer to kill them on land or ice where they are easier to retrieve and butcher (Beaubier 1970, Orr et al. 1986). Few estimates of loss rates exist for walrus hunts but some whalers, scientists, sportsmen, and traders who lacked walrus hunting experience had high loss rates. For example, in 1896 sailors and Inuit associated with the whaling bark *Canton* of New Bedford landed 8 walruses and struck and lost 6 more at the floe edge (*Canton 1896*). Low (1906) estimated that whalers using the methods in practice in the early 1900s secured only one in four or five of the animals they killed, and he reported that his scientific expedition killed and lost two walruses for each of the seven they landed. In 1861 near the east side of Smith Sound, American explorer Isaac Hayes and his crew killed at least a dozen walruses and mortally wounded as many more but only landed two (Fig. 4; Hayes 1867). British "sportsman" Barclay Walker chartered the whaler *Esquimeaux* in 1899 to hunt Arctic game (Walker 1900). In all, 38 walruses were landed, including 4 live calves. At least 16 additional walruses (likely many more than that) were struck and lost. Between 29 and 31 July 1920 the HBC killed 27 walruses in the water at the cape on Coats Island but landed only 3 (HBCA B.404/a/1).

To reduce losses, animals in the water may be harpooned before they are shot, wounded so they can be harpooned before being killed, or killed in shallow water where they can be retrieved with grappling hooks or at low tide. Harpooning a walrus is dangerous, since animals must be approached to within about 7.5 m, and wounded walruses become very aggressive and can sink or capsize canoes or small boats. Perey (1961) observed that hunting loss was greatest when there was heavy pack ice or fog, and it was always substantial when there were more animals than harpoons or hunters.

The overall loss rate for "modern" walrus hunts in the Canadian Arctic has been estimated at about 30% (Mansfield 1973) meaning that 3 of every 10 animals killed or wounded sink and cannot be secured. In summer Foxe Basin hunts, Perey (1961) observed a loss rate of 24% (18 walruses sank of 76 killed), while Orr et al. (1986) observed a loss rate of 32% (40 lost of 124 shot). In northern Hudson Bay, Loughrey (1959) observed no losses during open water hunting,

when Inuit retrieved all 27 animals killed over deep and shallow water, but a 50% loss rate in ice floes (3 of 6 walruses killed were lost). Freeman observed a loss rate of about 30% in two summer (late August) hunts near Walrus Island (Freeman 1974/75) and of 38% in the spring when ice was present and the hunts were conducted in deep water near Southampton Island (lost 5 of 13; Freeman 1969/1970). In 1942, the RCMP at Lake Harbour (Kimmirut) landed 26 walruses but killed and lost at least another 8 due to bad weather (24%; Public Archives of Canada, RG85, Vol. 1045, file 540-3, part 3-C cited in Born et al. 1995). During an August hunt at Padloping Island, Inuit landed 2 walruses and killed and lost at least 6 (Wynne-Edwards 1952). Tuck (1954 cited in Loughrey 1959) observed that only 5 walruses were secured out of a certain kill of 9 plus 4 probable and a number wounded at Akpatok Island in Ungava Bay.

These loss rates are often higher than those observed and reported for open water hunts in the Avanersuaq (Thule) area of northwestern Greenland (15-25%; Born and Kristensen 1981 cited in Born et al. 1995) and lower than those of Alaskan walrus hunts, which averaged 42% over the period 1952 to 1972 (Fay et al. 1994). About 55% of the animals struck and lost in Alaska died immediately and most of the wounded died shortly after being struck (Fay et al. 1994). Improvements in the weapons used for the hunts over the period did not alter loss rates but increased the proportion of outright kills among the lost animals. Inuit hunters believe loss rates to be lower (~5%; DFO 2013). In Greenland it has been difficult to obtain information about struck-and-lost rates because hunters are reluctant to talk about the issue, so the government manages the hunt on the assumption that boat and ice hunts involve struck-and-lost rates of about 15% and 0%, respectively (Ugarte cited in DFO 2013, see also Greenland Institute of Natural Resources 2011). None of these loss rates considers the indirect mortality of calves that are orphaned while still dependent on their mother's milk. Aside from those presented by Orr et al. (1986), all Canadian data are over 40 years old and may not reflect current hunting practices.

Struck-and-lost rates during walrus sport hunts are believed to be low. DFO has not reported any losses to date although at least one is known to have occurred (J.W. Higdon pers. obs.).

Unverified reports
Some reports of large catches could not be verified and have not been included, as follows:

1) the report of 800 walruses caught in one season at Akpatok Island by hunters from Payne Bay, QC prior to the 1950s (Currie 1963 citing p.c. by Jim Ford). This catch is much larger than any others reported from the island, which has been an important area for walrus hunting by communities around Ungava Bay. A catch of this magnitude is possible but it is unlikely to be taken in one year by one community. Further archival searches could be conducted for ancillary evidence of this hunt in the form of unusually large quantities of meat or ivory.
2) a report that one company took over 4000 walrus hides per year (Anderson 1934) is based on a second-hand report from Major Burwash. Unfortunately, the catch locality (or localities), period, or number of years involved, were not clearly stated (Born et al. 1995). Between 1900 and 1914, many walruses were landed from southeastern Baffin Island. Given the loss of contact during World War I and lack of catch records for some of the small companies operating in the region during that period, such a catch could have been spread over a few years but not reported in Canadian archives. Further work is required in Canada and the United Kingdom to investigate catches by small companies from southeastern Baffin Island in the early 1900s.
3) catches of 623 and 1159 walruses in 1949 and 1951, respectively, by a Norwegian sealer (Born et al. 1994, 1995). The locations are uncertain but they are believed to have come from northern Baffin Bay. These catches prompted Norway to ban the take of walruses by Norwegians anywhere (see also Wiig et al. 2014). Further information might be available in Norwegian archives.

Until these large catches are verified or refuted any population modelling should be run with and without them to better understand the uncertainty they represent.

Catch effort

The effort hunters expend to catch walruses provides important information on the animals' availability. Knowing how many hunters were actively pursuing the species in a particular area and how much time and effort (e.g., distance traveled by boat or snowmobile) they spent provides a context for interpreting trends in catch levels. A declining catch can indicate a population at risk or simply a change in hunter effort. Measures of hunter effort in the catch history are crude, typically at the level of the number of vessels involved or the population size of the relevant human communities. There are no consistent measures that can be applied over time to correlate with catch data. Catch effort data should be provided either on an ongoing basis by hunters or collected by management agencies at regular intervals of perhaps 3 years. Gaps in catch reporting should not be allowed to continue as they will weaken population management and may increase the risk of damage to regional stocks.

Modelling potential

Relative completeness of the catch record for walruses in Canada has varied widely over time. Data on prehistoric catch patterns were gleaned from zooarchaeological studies at a few locations; information on historical Inuit catches was compiled from ethnographies and oral histories; whaler catches came from documents covering a small subset of the actual voyages; and land-based commercial catches were compiled mainly from HBC records, which have large gaps. There are also significant gaps in the reporting of recent catches. The numerous gaps limit our ability to interpret the catch record and increase the uncertainty associated with any extrapolation to estimate removals, particularly for Inuit subsistence catches prior to ca. 1928. Any extrapolation of whaler catches based on number of vessels involved in the fishery must consider the clumping of walrus hunting activities, high inter-annual variability in catches by individual vessels, and the temporal changes in hunting patterns. For the most part, reported catch data are uncorrected for hunting loss and do not include information on age or sex composition.

To avoid double counting of walrus removals, modeled estimates of historical Inuit (pre-1928) subsistence catches must consider how walrus products were divided among the hunters. Some walruses taken by Inuit during this period have been reported with commercial catches because their ivory or hides were traded. The Inuit would retain meat or other products from these animals for subsistence use. Estimates of the subsistence needs of historical Inuit for walruses should consider what products would have been available for use, and their alternatives.

Loss rates by hunts conducted in different areas at different seasons are uncertain. This limits estimation of the total removals, by sex and age, from the various walrus stocks. Few estimates of hunter effort are available. This limits understanding of how sensitive the landed catches are to hunter participation and effort, and thereby estimates of removals.

To assess the effects of hunting and interpret modelling results, a better understanding is required of the movements of walruses within and between populations or stocks. In the short term, it will be particularly important to improve understanding of the movements of walruses to and from Foxe Basin, and of the relationship between the Central Arctic and Low Arctic populations. Walrus harvests from northwestern and western Greenland (High Arctic and Central Arctic walrus populations, respectively) also need to be considered in any modelling (e.g., over 31,000 reported [and sometimes estimated] walruses from 1900-1999, not including struck-lost animals, Witting and Born 2005).

Further archival searches of period accounts could strengthen the catch record by providing a better understanding of the early whaler catches in the High Arctic and Central Arctic (South and East Baffin), and of the catches by, or traded to, small shore-based trading companies. Searches of library collections and period newspapers in Canada (Ottawa, Winnipeg), England (Hull, London), Scotland (Dundee, Peterhead), the United States (New Bedford, MA) might provide information on walrus catches and/or product use that is not found in other catch summaries, especially for smaller companies. Reading more ships logs would be useful, particularly those that fill temporal gaps in the catch record or extend records by individual vessels. In many instances these searches will require visits to the institutions holding these materials.

Proviso

While catch data compiled here may form a useful basis for modelling walrus populations, hunting is not the only stressor affecting them in the eastern Canadian Arctic. The region has been experiencing major changes in ice conditions (Parkinson and Cavalieri 2008, Sahanatien and Derocher 2012) that are bound to affect walrus ecology. Tourism and interest in non-renewable resource development are both increasing, and the related shipping and other activities may significantly affect walrus populations locally and regionally.

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[Note: Reference citations for ship logs and other archival sources are provided in Supplements 1 and 2, respectively.]

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SUPPLEMENTARY MATERIAL

These files can be accessed via the links in the text of this paper and the titles below, or by emailing the corresponding author.

Supplement 1. Hudson's Bay Company post journals and other archival materials examined for walrus data. doi: http://septentrio.uit.no/index.php/NAMMCOSP/editor/downloadFile/3065/11807

Supplement 2. Ship's logbooks and journals examined for walrus data. doi: http://septentrio.uit.no/index.php/NAMMCOSP/editor/downloadFile/3065/11808

Supplement 3. Oil yields from walruses. doi: http://septentrio.uit.no/index.php/NAMMCOSP/editor/downloadFile/3065/11809

Supplement 4. Subsistence and land-based commercial catches of walruses from the eastern Canadian Arctic. Worksheets: High Arctic (WJS-BB, PS-LS), Central Arctic (FB, NWHB, SEB, SHSUBL), and Low Arctic. doi: http://septentrio.uit.no/index.php/NAMMCOSP/editor/downloadFile/3065/11810

Supplement 5. Sport catches of walruses from the eastern Canadian Arctic in 1995 through 2011. doi: http://septentrio.uit.no/index.php/NAMMCOSP/editor/downloadFile/3065/11811