

THE PREHISTORY OF INUIT AND YUPIK WHALE USE

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Abstract

Bowheads (*Balaena mysticetus*) and other large baleen whales have been part of Inuit and Yupik maritime harvesting economies for over 1000 years. The potential for past utilization of naturally stranded whales has led to much disagreement over the antiquity of whale hunting and its relative economic contribution at various times and places. Archaeological indications of whale use are reevaluated here, focussing on the whaling tradition that arose in the Bering-Chukchi Sea region and eventually spread into the Eastern Arctic. The evidence suggests a 3000 or more year continuum of whale use that likely always involved sporadic hunting. The expansion of whaling activity during the first millennium A.D. was a form of economic intensification that was driven by socioeconomic demand, rather than purely ecological or technological factors, in the context of population growth and an increasing long distance trade in prestige goods that promoted the integration of regions with disparate economic foci.

Resumen

La prehistoria del uso de la ballena de los Inuit y Yupik. Las ballenas Arco (*Balaena mysticetus*) y otras grandes ballenas han sido parte de las economías recolectoras de los Inuit y Yupik por más de 1000 años. El potencial para la utilización pasada de ballenas baradas ha llevado a fuerte desacuerdo sobre la antigüedad de la caza de la ballena y su contribución económicamente relativa en diferentes tiempos y lugares. Indicios arqueológicos del uso de ballena se re-evalúan en este trabajo, enfocándose en la tradición ballenera que llegó a la región del Mar de Bering-Chukchi y que, eventualmente, se extendió al Ártico este. La evidencia sugiere un continuo de más de 3000 años de uso de ballena que probablemente siempre implicó cacería esporádica. La expansión de la actividad ballenera durante el primer milenio d.C. fue una forma de intensificación

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económica, que fue impulsada por la demanda socioeconómica, antes que por facturas puramente ecológicas o tecnológicas, en el contexto del crecimiento poblacional y de un aumento en el comercio de larga distancia de bienes de prestigio que promovió la integración de regiones con focos económicos disímiles.

Résumé

La préhistoire de l'exploitation de la baleine par les groupes Inuit et Yupik. La baleine boréale (*Balaena mysticetus*) et d'autres espèces de grandes baleines ont constitué des éléments importants de l'économie maritime des Inuit et des Yupik depuis plus de 1000 ans. La possibilité dans le passé d'exploiter des baleines échouées a été utilisée par certains pour contrer les arguments qui accordent une importance et une antiquité à la chasse à la baleine à divers endroits et à différents moments. Cet article revoit les données archéologiques ayant trait à l'utilisation de la baleine en examinant de près la tradition baleinière qui s'est développée dans la région du détroit de Béring et de la mer Chukchi pour ensuite s'étendre à travers l'Arctique oriental. Les données que nous disposons suggèrent une utilisation de ce mammifère marin pendant au moins 3000 ans qui a probablement toujours inclue la chasse sporadique. L'expansion de cette activité économique pendant le premier millénaire après Jésus-Christ était une forme d'intensification économique liée à des exigences socio-économiques plutôt qu'à des facteurs purement écologiques ou technologiques. L'expansion eu lieu dans le contexte de l'accroissement démographique et de l'augmentation de l'échange de biens prestigieux sur des longues distances ce qui encourageait l'intégration de régions avec des emphases économiques différents.

Resumo

A pré-história do uso da Baleia pelos grupos Inuit e Yupik. A baleia boreal (*Balena mysticetus*) e outras espécies de baleias tem sido parte dos recursos econômicos marítimos dos Inuit e Yupik por 1000 anos. O potencial para a utilização passada de baleias naturalmente encalhadas, tem conduzido a muitas discordancias sobre a antiguidade da caça à baleia e sua relativa contribuição econômica em vários tempos e lugares. Indicações arqueológicas do uso da baleia são reavaliados aqui, focalizando a tradição baleeira levantada na região Bering-Chukchi Sea e que eventualmente se estendeu até o leste do Ártico. A evidência sugere 3000 anos ou mais de continuidade no uso da baleia que provavelmente envolve a caça esporádica. A expansão da atividade baleeira durante o primeiro milênio foi a forma de intensificação econômica que foi direcionada pela demanda socio-econômica, ao invés de fatores puramente ecológicos e tecnológicos, no contexto de crescimento populacional e aumento de comércio de longa distância e bens de prestígio que promoveram a integração de regiões com diferentes focos econômicos.

Introduction

The closely related Inuit and Yupik peoples of the North American Arctic and adjacent Chukotka (collectively, in traditional anthropological usage, the Eskimo peoples) have long been among the world's most heavily maritime-oriented hunter-gatherers (Figure 1). Beginning some five millennia ago, these occupants of predominantly ice-choked tundra coasts adjusted to the relative impoverishment of the terrestrial ecosystem by acquiring the technologies and modes of socioeconomic organization for hunting a wide variety of marine mammals in open water and from the sea ice. One of the more spectacular expressions of this maritime hunting tradition was the intensive harvesting of bowhead (*Balaena mysticetus*) and other large baleen whales (Table 1; Figure 2), in which some of the most elaborate hunting technologies ever devised were deployed in pursuit of the largest hunter-gatherer prey.

In varying proportions, pinnipeds (true seals or phocids, eared seals or otariids, and walrus), and cetaceans (baleen whales or mysticetes, and toothed whales or odontocetes), were critical sources of food, fuel, hides, and other raw materials for all Eskimo populations. Even the few groups that spent the bulk of their annual round on the interior tundra, such as the caribou hunters of North Alaska (Gubser 1965) and the Canadian Barren grounds (Birket-Smith 1929), appear to have been reliant on sea mammal oil obtained in trade from coastal

Table 1
Major cetacean game species utilized by Inuit,
Yupik, and closely related prehistoric whalers

Common name	Latin name	Maximum length (m)
fin whale	<i>Balaenoptera physalus</i>	21.5
bowhead whale	<i>Balaena mysticetus</i>	20.0
gray whale	<i>Eschrichtius robustus</i>	15.0
humpback whale	<i>Megaptera novaeangliae</i>	14.5
Cuvier's beaked whale	<i>Ziphius cavirostris</i>	8.0
Atlantic pilot whale	<i>Globicephala melaena</i>	6.2
beluga	<i>Delphinapterus leucas</i>	6.0
narwhal	<i>Monodon monoceros</i>	6.0
Pacific pilot whale	<i>Globicephala macrorhynca</i>	5.5
Dall's porpoise	<i>Phocoenoides dalli</i>	2.0
harbour porpoise	<i>Phocoena phocoena</i>	1.9

Source: Banfield 1974.

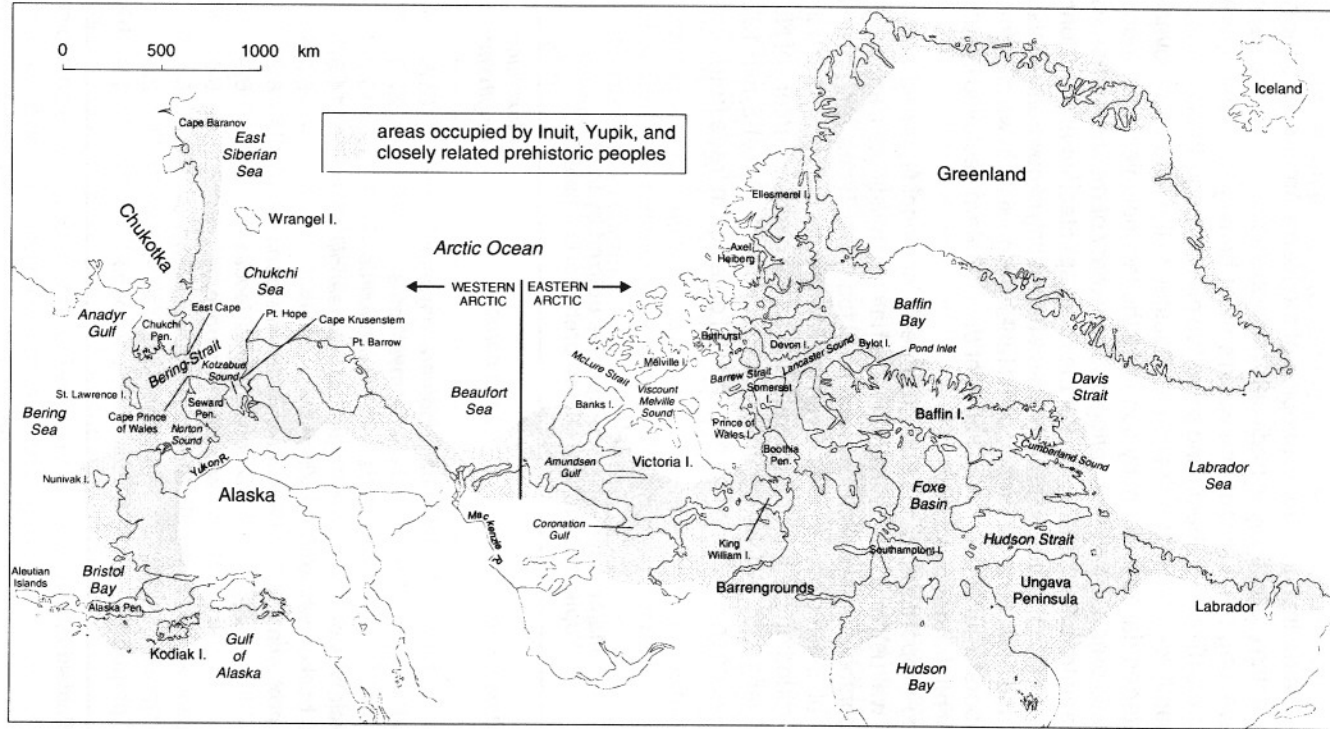


Figure 1. Areas occupied by Inuit, Yupik, and closely related prehistoric groups.

people, or through seasonal hunting forays to the coast. This is due to the difficulty of satisfying both fuel needs and dietary requirements for fat, given the scarcity of wood above the treeline, and the relatively lean terrestrial game species available (Table 2). The other side of this basic dilemma of arctic human ecology is the necessity that coastal groups obtain from the interior an adequate supply of caribou (termed reindeer in Eurasia) hides, which were widely recognized throughout the circumpolar world as the best material for manufacturing durable and highly insulating winter clothing (Hatt 1969; Stenton 1991). Although substitutes such as arctic fox and polar bear were utilized to varying degrees, these were functionally inferior, and were not available in sufficient numbers to clothe whole communities at a reasonable economic cost.

Table 2
Percentage fat composition by body weight of
some arctic game species

<i>Common name</i>	<i>Latin name</i>	<i>% fat</i>
Marine		
bowhead whale	<i>Balaena mysticetus</i>	40.3
polar bear	<i>Ursus maritimus</i>	38.3
harbour seal	<i>Phoca vitulina</i>	32.5
ringed seal	<i>Phoca hispida</i>	32.5
bearded seal	<i>Erignathus barbatus</i>	27.1
beluga	<i>Delphinapterus leucas</i>	25.2
walrus	<i>Odobenus rosmarus</i>	20.9
Terrestrial		
grizzly bear	<i>Ursus arctos</i>	16.7
caribou	<i>Rangifer tarandus</i>	10.4
arctic hare	<i>Lepus arcticus</i>	8.0

Sources: Foote 1965; Keene 1985.

The prehistoric intensification of sea mammal hunting by growing arctic populations was thus a complex process that involved, among other things, the development of either an intra-community division of harvesting labour between the coast and interior, or stable external exchange relationships with groups that were well-supplied with interior resources. While technological innovation and environmental change are vitally important to the prehistory of whaling, and are critically evaluated where appropriate in the following sections, the review of recent research on prehistoric Eskimo whale use that forms the

bulk of this paper emphasizes the larger socioeconomic context in which archaeological indications of whaling appear. The discussions of individual archaeological cultures are preceded by summaries of recent Inuit and Yupik whaling practises and whale utilization, and a consideration of some inadequacies of past approaches to the identification of prehistoric whaling.

Inuit and Yupik Whaling

Within the overall economic emphasis on sea mammals, the nature and degree of Eskimo whale use varied greatly across time and space. Belugas (Figure 2A) were widely utilized historically in the Western Arctic, especially by groups occupying the deltas and sounds of the shallow eastern Bering Sea, and the Mackenzie Delta (see, e.g., Friesen and Arnold 1995; Lucier and VanStone 1995; McGhee 1974; Morseth 1997) (note that the hunting of smaller toothed whales is often not embraced by the term 'whaling'). They were harvested with a variety of techniques that emphasized the use of harpoon darts and lances from fast, manoeuvrable *kayaks* (small skin boats), either individually or in large flotillas where beluga pods could be trapped and killed in enclosed bays or estuaries. Other toothed whales, especially porpoises, were utilized by Pacific Eskimo groups occupying the subarctic coasts of the Gulf of Alaska region (Yarborough 1995; Yarborough and Yarborough 1998). In the Eastern Arctic, beluga and narwhal (Figure 2B) were widely harvested on a small scale prehistorically, with an apparent increase in their use following such historic introductions as rifles, nets, and outboard motors, and the decline of bowhead whaling (Kemper 1980; Savelle 1994, 1995). While at least some Western Arctic groups made intensive use of belugas prehistorically (e.g., Friesen and Arnold 1995), the extent of small whale hunting may have increased historically in that region for some of the same reasons adduced by Savelle for the east. Other toothed whales (pilot whale, harbor porpoise) were utilized to varying degrees in southwestern Greenland (Freeman *et al.* 1998; Gulløv 1997).

In an unusual variant of *kayak*-dart whaling of uncertain antiquity (Clark 1998), Pacific Eskimo and neighbouring groups also hunted the larger baleen whales from *kayaks* (Crowell 1994; Heizer 1943; Yarborough 1995). Young fin and humpback whales (Figures 2C and 2D) were intercepted during their northward migrations by one or more *kayakers*, and struck with an atlatl-launched dart tipped with a poisoned slate blade. The poison, derived from the monkshood plant (*Aconitum* sp.), apparently caused local paralysis, such that animals wounded in an area critical to their locomotion (flipper or tail) would eventually drown (Crowell 1994). In a reasonable proportion (10-50%) of cases, the carcass drifted ashore within a few days and was claimed on the basis of the ownership mark inscribed on the detachable dart head. Poisoned-dart whaling was practised by particular elite lineages within these stratified societies, and the requisite bodies of technical and ritual knowledge were carefully guarded.

These relatively individualistic forms of *kayak*-dart whaling contrast with the style of whaling usually employed by more northerly groups for procuring gray (Figure 2E), bowhead (Figure 2F) and, more rarely, humpback and fin whales (Stoker and Krupnik 1993). From St. Lawrence Island northwards, and from Chukotka to Greenland, baleen whales were typically hunted from large, open skin boats, or *umiaks*, with 6-10 person crews (Kleivan 1984; Rainey 1947; Spencer 1959; Stoker and Krupnik 1993; Taylor 1988). In the Eastern Arctic kayakers often assisted the *umiaks*, and in a few instances bowheads were hunted solely from *kayaks* (Freeman *et al.* 1998; Stoker and Krupnik 1993). The principal hunting weapon was a thrusting harpoon with a large toggling head to which was attached one or more inflated sealskin floats, and sometimes a drag. When an animal was struck, the harpoon head detached from the foreshaft and tension on the line caused the head to rotate (toggle) within the wound, providing a secure anchor for the floats. The whales were pursued in spring as they migrated through narrow shore leads that form as the sea ice breaks up, in summer where they could be found feeding in inshore waters, and in fall during their coastal migrations to wintering grounds. When whales were sighted, anywhere from one or two to a dozen *umiaks*, and perhaps *kayaks*, were launched in pursuit, with as many boats as possible attempting to attach floats to the preferred smaller individuals. When the animal tired, it was killed with lances and then towed to shore or to the ice edge for flensing. The whale was partitioned among boat crews according to priority in attaching floats and helping tow the animal, and within crews according to role and seniority (Foote 1992; Lowenstein 1993; VanStone 1962; Worl 1980). Although the food was ultimately distributed widely within the village, the boat owners or *umialiks* (who were normally also the crew captains and helmsmen) received the largest shares of the harvest, and emerged as the wealthiest and most influential members of their communities.

A variety of northern baleen whales were hunted in this general fashion by Eskimo groups, as reviewed by Stoker and Krupnik (1993). Traditionally, gray whales were hunted intensively by the *umiak*-float method at a few locations along the southeastern Chukchi Peninsula coast (Krupnik 1984, 1987, 1993a; Krupnik *et al.* 1983). Along with the occasional fin and humpback, grays were also sometimes taken by St. Lawrence Island groups (McCartney 1995b) and, at least during this century, small numbers were landed on the Northwest Alaska mainland (Marquette and Braham 1982). Humpbacks and fins were being harvested in Greenland, and perhaps also in Labrador, in the early historic period (Freeman *et al.* 1998; Gulløv 1997; Stoker and Krupnik 1993). However, in most of these areas, as well as in parts of the central Canadian Arctic, the bowhead whale was the most highly prized game species, and traditionally accounted for the vast majority of the large cetacean harvest (see, e.g., papers in McCartney 1995a; Stoker and Krupnik 1993; Taylor 1988). Only as bowhead stocks were driven close to extinction by commercial whaling, during

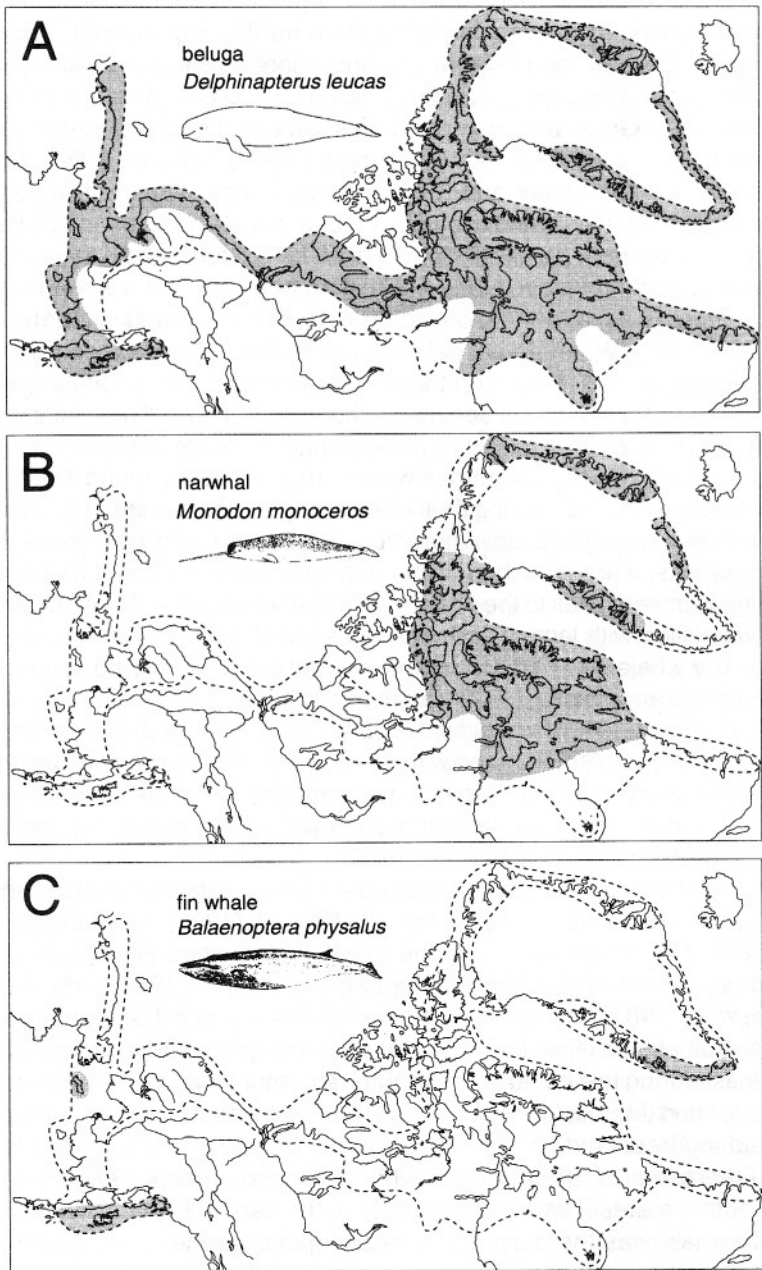


Figure 2.

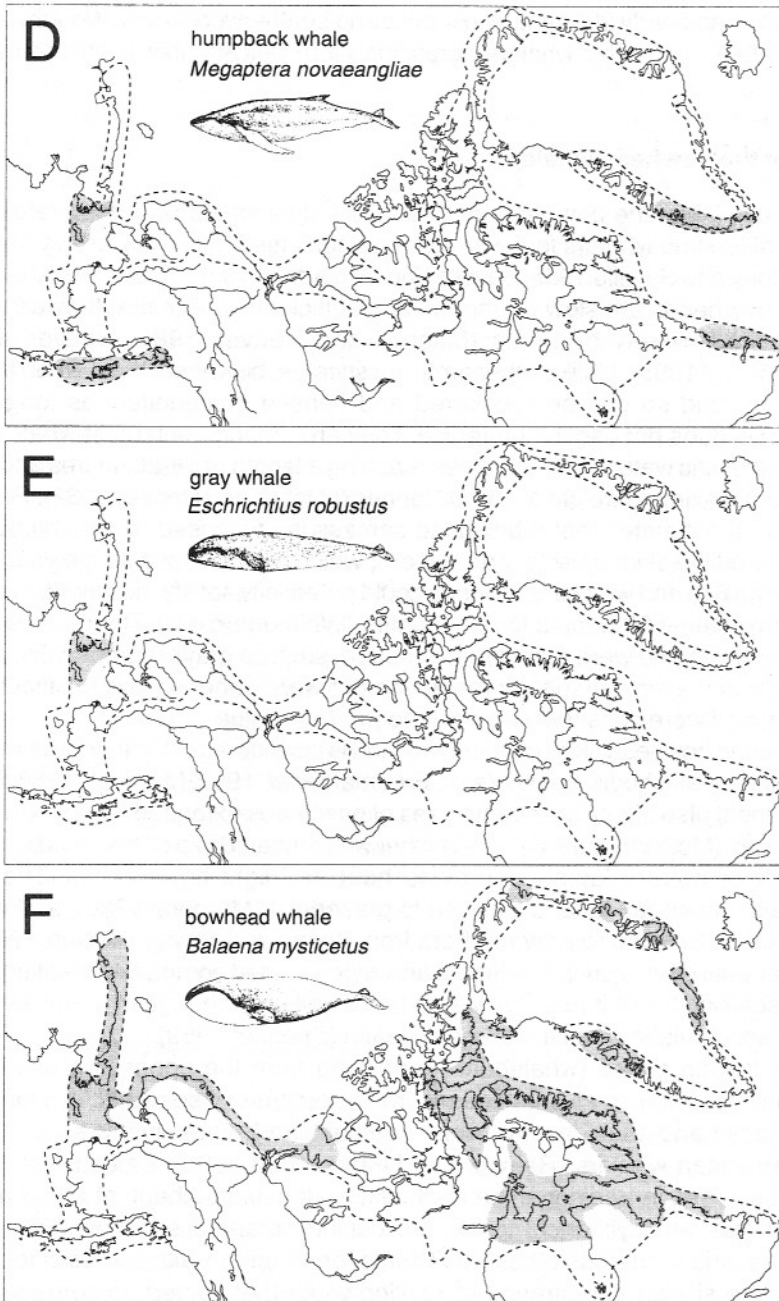


Figure 2. Areas in which some of the major cetacean game species were harvested by Inuit and Yupik groups. A: beluga; B: narwhal; C: fin whale; D: humpback whale; E: gray whale; F: bowhead whale.

the late 19th and early 20th century (Reeves and Leatherwood 1985; Woodby and Botkin 1993), did Eskimo whalers increasingly turn their attention to other baleen whales.

Uses of the bowhead whale

Where available, the bowhead, or Greenland right whale, was the preferred quarry of Eskimo whalers for a variety of reasons (see, e.g., McCartney 1980; McCartney and Savelle 1985; Savelle and McCartney 1990; Stoker and Krupnik 1993). Bowheads are slow swimmers and sufficiently docile that they can be approached closely by boats (Mitchell and Reeves 1982; Reeves and Leatherwood 1985). Unlike other arctic mysticetes, bowheads float when they are killed, and so can be recovered and flensed immediately as long as the animal does not escape under ice. They are among the largest whales to penetrate arctic waters, adult females reaching a length of 18-20 metres and an estimated maximum weight of 75-100 tonnes (Mitchell and Reeves 1982). Foote (1965:350) estimates that a bowhead carcass is composed of 40% blubber, and 46% edible skin, muscle, and viscera, which means that a single yearling measuring 8 m and weighing 7 tonnes could potentially satisfy the caloric needs of approximately 60 people for six months (Whitridge n.d.b). The other large baleen whales that were sometimes pursued, such as grays, humpbacks, and fins, provided a similar suite of resources but were generally more difficult to harvest, and were considered to have poorer food value.

Although bowhead skin (*muktuk*) was and is considered the greatest delicacy by most Inuit and Yupik groups (e.g., Freeman *et al.* 1992; Murdoch 1988:62), and its meat also highly prized, the uses of bowheads extended far beyond the cooking pot (McCartney 1980). The blubber was rendered into oil that was burned in stone or pottery lamps to provide heat and light in dwellings. The oil could also be added to food, or used to preserve it (Murdoch 1988), and was applied to boat skins to prevent them from drying and rotting (Nelson 1983). Sea mammal oil was such a valuable and widely traded commodity traditionally that a sealskin full of it (a poke) was a basic unit of exchange in many areas, and its accumulation was a marker of wealth (Spencer 1959).

The baleen plates (whalebone) that hang from the upper jaw, used by the whale to strain small crustaceans from mouthfuls of seawater, are longer in the bowhead than in any other species, and were avidly sought by Euro-American whalers (Reeves and Leatherwood 1985). Baleen also had numerous uses in traditional material culture. It could be bent into boat ribs, drum frames, and cylindrical containers, cut into scrapers, snow beaters, bow backings, and numerous other small items, or shredded with a special tool (a whalebone shave) into strands of varying width that served as cordage for handle whippings, fishing line, nets, snares, and tying up the whale bone framework of a house (see, e.g., Mathiassen 1927).

Whale bone itself was equally useful. Particularly in the Eastern Arctic, where driftwood is frequently scarce, large bowhead skeletal elements were prized construction materials for roof frameworks, scaffoldings, and other structural components and furnishings of dwellings (McCartney 1979a; 1980; Savelle 1997). Bowhead mandibles were the preferred material for sled runners, and for centuries after the cessation of whaling, they were salvaged in some areas for this purpose (McCartney 1979b). Ribs and scapulae were utilized for dozens of everyday implements, such as knife handles, harpoon heads, stools, and snow shovels. Although seldom recorded in detail, the waste material from manufacturing such whale bone artifacts may dominate the excavated artifact assemblage from prehistoric whaling settlements (Whitridge 1999). Other parts of the bowhead carcass, such as various internal membranes, were also used by some groups.

Bowheads represent such an enormous package of useful resources that the ability to harvest them at a reasonable economic cost would seem to confer a significant advantage on whaling groups. However, since bowheads (and other arctic sea mammals) are adapted to a particular suite of sea ice conditions, climatic oscillations have resulted in shifts in local bowhead abundance and accessibility over the course of the Holocene, as reflected in the incidence of dated natural strandings (Dyke *et al.* 1996). Although there is some correspondence between climate change and patterns of Eskimo sea mammal harvesting over the last several millennia in both the Western (Krupnik 1993a; Mason and Gerlach 1995b) and Eastern Arctic (Barry *et al.* 1977; Dekin 1972; Fitzhugh 1997; McGhee 1972), it appears that maritime hunters occupied shores frequented by bowheads for millennia before abundant evidence of whaling appears in the archaeological record, and they even abandoned whaling in areas where bowheads continued to occur. Variability in the prehistoric occurrence of intensive bowhead whaling thus cannot be reduced to purely ecological determinants. It seems rather that some combination of environmental circumstances, available technology, and various demographic and socioeconomic factors were critical to the emergence and survival of whaling economies.

The evidential basis for the origins of whaling

The recent literature reveals a widespread skepticism amongst arctic archaeologists about the prehistoric occurrence of whaling outside a narrow range of well-established instances. While it is generally recognized that a case for whaling should be evaluated according to multiple lines of evidence, in recent practise a marked abundance of whale bone has tended to serve as the necessary criterion for assessing "active whaling". This skepticism about the extent of past whaling is due mainly to the possibility that small amounts of archaeological whale bone could derive from scavenging of naturally stranded whale carcasses (e.g., Ackerman 1998; Arnold 1981; Collins 1937; Freeman

1979; Mason and Gerlach 1995a; McGhee 1981). However, one corollary of this is that useable whale bone will likely have been scavenged from *cultural* contexts as well (McCartney 1979a, 1979b; Park 1997), given that the bulk of the bone transported to residential sites by later prehistoric whalers consisted precisely of the architecturally most useful elements, with most of the rest discarded at the ice edge or beach where the animal was butchered (Savelle 1997; Whitridge n.d.a). While prehistoric architectural whale bone is readily visible in some relatively undisturbed contexts (McCartney 1979b), it can be relatively scarce where there was intensive human occupancy subsequent to a period of whale bone accumulation, particularly if whale hunting declined. This accounts in part for the scarcity of surface whale bone at probable Thule whaling sites on the north and east coasts of Baffin Island (Hunston 1979:156; Sabo 1979:199). Unless accompanied by thorough taphonomic and settlement-system analyses, the simple abundance of whale bone in a residential site assemblage cannot be considered an accurate index of whaling intensity.

However, Savelle and McCartney have demonstrated that whale bone assemblages accumulated by hunting during the past thousand years can be readily distinguished from assemblages composed of natural strandings, on the basis of the heavy selection for young animals by Thule and later hunters (McCartney 1995b; McCartney and Savelle 1993; Savelle 1996; Savelle and McCartney 1990, 1991, 1994, 1999). This pattern appears to extend back into the early first millennium A.D. in Chukotka (Krupnik 1987, 1993b; see also Mason 1998 for discussion of some of the recent Russian literature), and to characterize poison dart whaling by Pacific Eskimo groups (Yarborough 1995), even lacking the logistical hurdle of towing the animal to shore. These data have not yet been thoroughly assembled for most regions, but promise to shed much light on early prehistoric whaling as Savelle and McCartney's research program is extended to the Western Arctic.

Less vulnerable to later scavenging, access to fresh carcasses might also be revealed in the distribution of small elements or riders that were embedded in transported butchery units (Whitridge n.d.a). Phalanges (flipper bones) may be among the stronger zooarchaeological indicators of fresh whale procurement, since flippers have little food value (Savelle and Friesen 1996) and the bones have little utility as a raw material. Unfortunately, phalanges tend to be poorly ossified and appear not to survive well under adverse preservational conditions. Only one was identified among 3363 bowhead bones recorded in a surface survey of the Classic Thule site of Qariaraqyuk, although they were well represented in excavated assemblages (Whitridge 1999).

Eskimo utilization of a carcass that was discovered with the flesh decomposing from the inside, and the skin partially consumed by various scavengers, might well exclude not only the flipper portion, but the bulk of the organs and musculature, and hence leave no defleshing and few disarticulation marks. Heizer (1943:427) quotes Steller's report of the latter practise among

the Maritime Chukchi of Chukotka, who appear to have adopted whaling through emulation of the indigenous Eskimo pattern: "The Tschuktschi catch so many whales, and rely upon their skill therein to such an extent, that they touch none which are cast dead upon the shore, except that they use fat from them to burn". Cut marks of any kind on whale bone are not typically reported in the literature, although they occur frequently on well-preserved surfaces in Thule whale bone assemblages. Access to a fresh whale carcass with palatable soft tissue can also be indicated by the occurrence of whale barnacles (*Coronula* sp.) at residential sites, implying transport of skin, but these have rarely been noted archaeologically (e.g., Collins 1937:250).

An important category of evidence for access to whale products is the use of whale bone and baleen as raw materials for artifacts. Baleen only survives under excellent archaeological conditions, but artifactual whale bone should survive wherever other hard organic materials (non-cetacean bone, antler, ivory) are present. Choices of raw materials were informed by their symbolic qualities (McGhee 1977) and prestige value (Whitridge 1999), but in functional terms at least whale bone appears to have been equivalent to antler, ivory and other dense bone. Since small artifacts made of whale bone do not appear to have been recycled at a greater rate than those made from other materials, the relative frequency of whale bone artifacts may provide a more sensitive index of whale use than relative abundance within the more severely altered faunal assemblages. While the occasional occurrence might be attributed to scavenging, an increase in the artifactual use of whale bone should accompany an increase in whale hunting. The particular utility of this measure is that the data can be obtained from existing collections, whereas the failure to collect unworked whale bone in the past cannot be rectified.

Besides these key categories of zooarchaeological evidence, few of which have been systematically examined at sites where the nature of whale use is in question, the molecular speciation of whale remains and organic residues is theoretically possible, and could establish the presence and nature of whale use in some contexts. However, important as these methodological advances will likely prove to be, there is a great deal of existing contextual evidence relating to settlement systems, site structure, subsistence economy, exchange, palaeoecology, and material culture that can contribute greatly to the whaling debate. Many of these lines of evidence have been mustered in the past to account for the presence or apparent absence of whale hunting (e.g., Ackerman 1988, 1998; Bockstoce 1976; Freeman 1979; Giddings and Anderson 1986; Harritt 1995; Mason and Gerlach 1995a; McCartney 1980; Savelle 1996; Savelle and McCartney 1988, 1990). A frequent unstated assumption in these investigations of whaling origins is that past harvesting patterns will have conformed to the intensive forms of *umiak*-float whaling from large villages practised so conspicuously in the Bering-Chukchi Sea region. However, even in historic times the intensity and technological foundation of baleen whaling

varied enormously from Siberia to Greenland. Researchers seem to be inordinately averse to the notion of low level prehistoric whaling. One would suppose, however, that the first attempts to incorporate baleen whales into the annual subsistence round were more tentative than later ones, and would have left a correlatively sparse and problematic archaeological record.

The position that whaling is absent except where abundantly demonstrated leads to the possibly spurious impression that whaling appeared suddenly at various times and places. While it is important to be alert to the possibility that elements of whaling, like other cultural traits, may have been rapidly developed *in situ*, or introduced from neighbouring areas, gradualist models of whaling development are inherently just as plausible as catastrophist ones. The sporadic early occurrences of large whale bone and elements of whaling technology along the Bering and Chukchi Sea shores assume considerable archaeological interest if they are viewed as occupying one end of a spectrum of whale use that culminated in the emergence of intensive whaling economies throughout the region in later prehistory. From this perspective, the key problem then becomes one of sorting out taphonomic and processual explanations for why, after centuries or millennia, indigenous whaling crossed the threshold from archaeological ambiguity to visibility.

Stoker and Krupnik (1993) note that large baleen whaling appears to have arisen independently at several times and places along the coasts of the Arctic, north Pacific and north Atlantic Oceans during the latter part of the Holocene. This observation has two potentially important implications. One is that the various logistical difficulties associated with harvesting large whales may sometimes have been resolved in substantially different fashions by different groups, as reflected in the contrast between poison dart and *umiak*-float whaling. This should caution us against summary rejections of prehistoric whale hunting on purely technological or organizational grounds. Secondly, the existence of multiple centres of whaling innovation in relatively close proximity in the North Pacific basin may be one ingredient in the development of the highly effective whaling practises widely in evidence from the late first millennium A.D. Over time, various whaling technologies, techniques, and organizational modes likely circulated between many of these centres, with groups around Bering Strait, at the middle of this farflung interaction network, best positioned to assimilate useful elements from multiple neighbours.

While the prehistory of invention and diffusion of whaling-related technologies is a potentially fruitful area of study, it is seriously hampered by incomplete archaeological coverage, unreliable ^{14}C dates, and the consequently shaky chronological frameworks that exist for most regions (see, e.g., Gerlach and Mason 1992; Mason 1998; Morrison 1989). However, given the general antiquity of seafaring and large sea mammal hunting in the North Pacific region, and the wide range of harvesting tactics deployed historically, technology may not represent an insuperable barrier to whaling intensification. The solutions adopted

by groups that can be characterized as heavily reliant on large whales (toggling harpoons, floats, large skin boats), were employed, or available for emulation, by all groups in the Bering-Chukchi Sea region for at least the past 2000 years, and perhaps much longer. If, as further argued below, purely ecological and technological criteria are insufficient to chart the prehistoric development of Eskimo whaling, then it seems worthwhile to devote more attention to the social and economic dimensions of whale use, as many have begun to do (e.g., Cassell 1988; Krupnik 1993a; Mason 1998; McCartney 1991; Savelle 1996; Sheehan 1985, 1997).

Bockstoe (1976:43) influentially identified five factors that contribute to the emergence of whaling: economic security sufficient to allow the diversion of labour to the risky procurement of large whales; presence of whales within hunting range; adequate whaling technology; a large population; and the capacity for cooperative harvesting. While the material complements of these factors can all be considered important evidential criteria in any archaeological investigation of the nature of whaling, they cannot be considered preconditions for determining the simple presence or absence of whale hunting. To monitor the progressive intensification of whale use, these and other lines of evidence need to be built into models of the larger ecological, economic, technological, and social contexts in which whale bone (and other equivocal whaling signs) appears prehistorically, with attention to the possibility of encountering variant, low level modes of whaling. Because the requisite datasets are moderately complete for few times and places, and are particularly incomplete where whale use has the greatest apparent antiquity, the origins of whaling remain the subject of much speculation.

Early Whale Use

North Pacific

The earliest indications of baleen whale use appear along the long-settled subarctic coasts of the North Pacific, outside the zone of winter sea ice. Whale bone occurs at sites on Hokkaido (Dumond and Bland 1995; Hiraguchi 1992), Kodiak Island (Clark 1998; Yarborough 1995) and the Alaska Peninsula (Dumond 1998c; Yesner 1998) by 6000 B.P. (B.P. dates are uncalibrated ¹⁴C years, B.C./A.D. dates are calibrated calendar years), and perhaps in the Aleutian Islands as early as 8000 B.P. (Aigner 1976:42). Toggling harpoon heads, often considered an essential piece of whaling technology, likely reached the coastal sea mammal hunters of the northwest Pacific from the Lower Amur basin before 7000 B.P. (Vasil'evskiy 1987; Yamaura 1998). However, it is possible that alternate procurement techniques were also utilized from an early date. Harpoons are not in evidence at the 5000 B.P. Mawaki site on the Sea of

Japan, so the baleen and large toothed whales present in that assemblage may have been harvested with the same techniques —nets and lances— inferred for the abundant dolphin remains (Hiraguchi 1992; see also Krupnik 1984:114, 116 on Koryak versions of this approach for taking young gray whales). Harpoons are similarly absent from early Lakhtin culture sites on the northwest Bering Sea coast, although whale bone is abundant in house assemblages by about 1900 B.P., prompting Orekhov (1998) to posit the use of poisoned whale arrows or darts, analogous to those utilized historically by Koryak, Aleut, and Pacific Eskimo groups. Slender ground slate points similar to historic whaling dart heads may indicate whaling without toggling harpoons as early as 6000 B.P. on Kodiak Island (Clark 1998:176).

Arctic Small Tool tradition

Within the zone of Eskimo settlement, toggling harpoon heads and skin boat parts first appear on Independence I, Pre-Dorset and Saqqaq sites belonging to the Arctic Small Tool tradition (ASTt) by about 4000 B.P. (Grønnow 1996; Maxwell 1985; McGhee 1976, 1979). Since eastern ASTt originated in a migration from the Western Arctic, this suggests that skin boats and toggling harpoons were part of the technological inventory of ASTt groups belonging to the Denbigh Flint Complex in Alaska by 4500-4000 B.P. (Figure 3). However, the only support for active sea mammal hunting in Alaskan ASTt is settlement location, occasional seal bones, and chipped stone end blades believed to have tipped toggling harpoon heads (Giddings 1964). The relatively meagre evidence for ASTt coastal settlement and resource use in the west may be due to the inundation of pre-4000 B.P. shorelines by rising sea levels (Anderson 1984; Ackerman 1988; Mason and Jordan 1993), and relative inattention to sites of this period in the critical region of Chukotka, through which Siberian groups ancestral to ASTt presumably passed (Ackerman 1998). An equally speculative alternative for the origin of ASTt maritime hunting is adoption of the associated technologies from Maritime Archaic groups in Labrador (Fitzhugh 1976; Tuck 1975), among whom toggling harpoon heads, seafaring, and whale use have an antiquity comparable to that in northeast Asia (Tuck and McGhee 1975).

There are scattered indications of whale use by some early ASTt (Independence I, Pre-Dorset, Saqqaq) and descendant groups (Independence II, Dorset) over the course of their 3500 year tenure in the Eastern Arctic. Although bowhead remains are frequently absent on eastern Palaeoeskimo sites (e.g., LeBlanc 1994; McCartney 1989; Murray 1996; Schleder mann 1989), small amounts of whale bone do turn up occasionally in faunal assemblages (Mary-Rousselière 1976:56; McCartney 1989:112; McGhee 1981:31), and both bone and baleen are found in artifact assemblages (McCartney 1989:112; Arnold

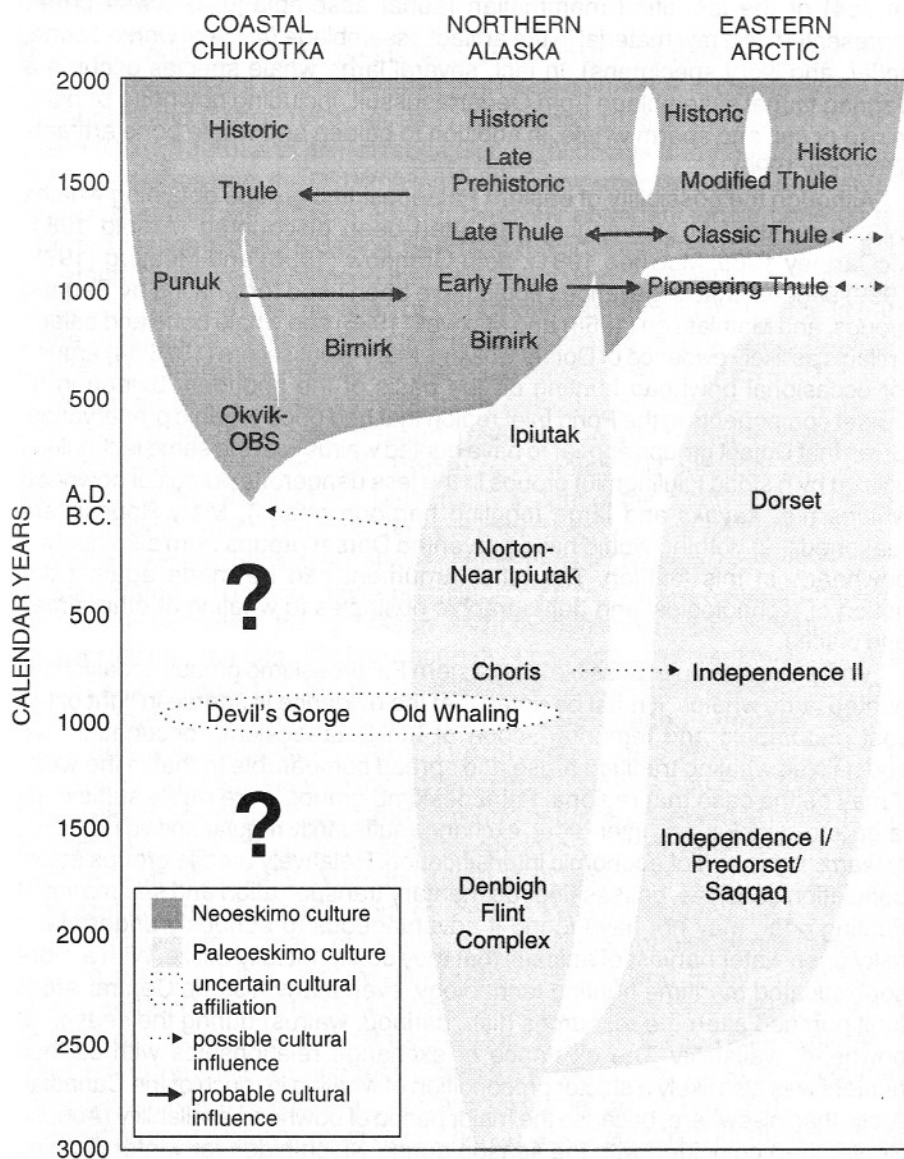


Figure 3. Chronological framework for regions discussed in the text.

1981:104; Mary-Rousselière 1976:47; Mathiassen 1958:34; Maxwell 1973:173; Schledermann 1989:188, 193, 264). At the Saqqaq site of Nipisat I in southwestern Greenland (Gottfredsen 1998) large whale bone accounted for only 0.4% (54/14,254) of the identified mammalian faunal assemblage, but was better represented as a raw material in the artifact assemblage (4.7% of worked bone, antler, and ivory specimens). In fact, several large whale species occur in a Saqqaq faunal assemblage from Qeqertasussuk, including bowhead or right, minke or sei, and sperm whale, in addition to baleen and whale bone artifacts (Grønnow 1996).

Although the possibility of eastern Palaeoeskimo groups obtaining whales by any means but scavenging has often been discounted (Arnold 1981; McCartney 1989; McGhee 1981), both Grønnow (1996) and Møbjerg (1998, 1999) suggest that large lances could have been used for whaling by Saqqaq groups, and Mathiassen (1958) and Maxwell (1985) see whale bone and baleen artifacts as likely evidence of Dorset whaling. Mary-Rousselière (1976:54) argued for occasional bowhead hunting on the basis of the abundant baleen in all Dorset components in the Pond Inlet region that had good organic preservation. Given that Dorset groups appear to have hunted walrus with the same technology utilized by historic Iglulingmiut groups in the less dangerous pursuit of bowhead whales (i.e. *kayaks* and large toggling harpoon heads), Mary-Rousselière reasoned that nothing would have prevented Dorset groups from also hunting bowheads in this fashion. The latter argument can be made against the notion of technological and demographic obstacles to whaling at other times and places.

While it seems quite possible that eastern Palaeoeskimo groups occasionally hunted large whales, it must be noted that the evidence is sparse in light of the vast geographic and temporal scope of the Palaeoeskimo occupation. No specialized whaling tradition arose and spread comparable to that in the west. It may be the case that regional Palaeoeskimo groups were rarely sufficiently large and complex, and inter-group exchange sufficiently regular and voluminous, to warrant this sort of economic intensification. Relatively mobile groups at low population densities, possessing rudimentary transportation and sea mammal hunting gear, may not have found it advantageous to seriously undertake a risky open water harvest of animals that they could not fully utilize. With a more sophisticated maritime hunting technology, even many historic Central Arctic Inuit pursued alternate resources (fish, caribou, walrus) during the season of bowhead availability. The existence of exchange relationships with caribou hunters was also likely a stricter precondition of whaling in much of the Canadian Arctic than elsewhere, because the major period of bowhead availability (August-September) coincided with the season during which hides for winter clothing had to be harvested. Interestingly, it is precisely in areas and periods that appear to have sustained relatively high density Palaeoeskimo occupations (southwest Greenland Saqqaq, Pond Inlet region Dorset), hence with the greatest

potential for economic differentiation, that the strongest suggestions of whale hunting occur.

Old Whaling

The oldest toggling harpoon heads recovered from the western part of the zone of Eskimo settlement date to the late fourth millennium B.P. at Devil's Gorge on Wrangel Island (Dikov 1988), at early Kachemak sites in the Gulf of Alaska region (Clark 1998), and on Kotzebue Sound (Giddings and Anderson 1986). The latter derives from the Old Whaling culture component at Cape Krusenstern, the oldest settlement associated with relatively abundant whale bone so far reported for the Chukchi-Bering Sea region. Giddings (1967; Giddings and Anderson 1986) was convinced that bowheads were actively hunted at Cape Krusenstern for the brief duration of Old Whaling settlement there, due in part to the abundance of lithic artifacts formally similar to later whaling harpoon head end blades, and large bifaces that could have served as lance and flensing knife blades. Recent researchers have downplayed this possibility (e.g., Ackerman 1998; Dumond and Bland 1995; Mason and Gerlach 1995a). For example, Mason and Gerlach (1995a) have noted the potential for natural deposition of the whale bones, particularly in light of the relatively long period of accumulation of the Old Whaling (and later Choris) beach ridges.

While bowhead hunting is not well established for Old Whaling, neither can it be considered disproved, since no osteometric or organic residue analyses such as those called for by Mason and Gerlach have been reported. It is noteworthy that the Old Whaling occupation consists of two settlements, one of five closely spaced winter houses with large alcoves likely used for storage, and the other of an equal number of closely spaced summer houses (Giddings and Anderson 1986). The proximity of summer and winter settlements is consistent with the generation of a surplus sufficient to promote multi-season use of the locale, and similar to patterns observed at many Thule whaling villages in the central Canadian Arctic (e.g., Park 1989; Savelle 1987; Taylor and McGhee 1979; Whitridge 1999). With respect to labour capacity and organization, the size and layout of the Old Whaling communities are also consistent with the small, cohesive, and relatively mobile bands believed to have practised low level whaling during Birnirk and Early Thule times (Arnold and McCullough 1990; McGhee 1969/70; Sheehan 1995, 1997). Whaling by small communities is well-established for areas of Classic Thule settlement peripheral to the prime whaling zone (Saville and McCartney 1999), and occurred historically in North Alaska (e.g., at Cape Lisburne; Burch 1981:25).

Besides poor organic preservation, hence lack of evidence for the artifactual use of bone and baleen, the greatest difficulty in assessing bowhead use in Old Whaling is the singularity of the Cape Krusenstern complex. The Devil's Gorge site, itself linked to Late Neolithic sites in interior Chukotka (Pitul'ko 1999), has

produced the only contemporary assemblage in the Chukchi Sea region with strong cultural affinities to Old Whaling (Ackerman 1984, 1998). Although whale bone is absent at Devil's Gorge while walrus bone is abundant (Dikov 1988), bowheads are not presently common around Wrangel Island (Bogoslovskaya *et al.* 1982), and later specialized whaling groups did not settle there (*ibid.*; Krupnik 1987). Since the skins of walrus or bearded seal were essential for covering large boat frames (Braund 1988; Petersen 1986), procurement of one or the other of these large pinnipeds can be considered a necessary accompaniment to *umiak* whaling. In fact, baleen does occur at a Late Neolithic site in western interior Chukotka roughly contemporaneous with Devil's Gorge, suggesting to Pitul'ko (1999) that by the end of the fourth millennium B.P. groups adapted to interior hunting and fishing had begun to incorporate summer sea mammal hunting into their annual round.

Choris

Precursors and successors of Old Whaling that might clarify the nature of sea mammal hunting economies during this interval are not widely recognized, although Dumond and Bland (1995) point to the Aleutian Islands/Alaska Peninsula/Kodiak Island region, with demonstrably greater time depth to seafaring and maritime harvesting, and similarities to Old Whaling lithic technology, as a plausible source area. At the other end, Old Whaling may have contributed to the ancestry of the subsequent, and more widely distributed, Choris culture (ca. 3200-2500 B.P.) (Dumond and Bland 1995; Giddings and Anderson 1986), which occurs along the coasts and in parts of the adjacent interior from Kotzebue Sound to the Mackenzie Delta (Mason and Gerlach 1995a; Sutherland 1994). A tradition of large sea mammal hunting inherited from Old Whaling would be consistent with McGhee's (1996) suggestion that the eastward expansion of Choris may have been associated with the introduction of improved maritime hunting techniques to Palaeoeskimo Dorset peoples in the Eastern Arctic. Like Old Whaling, Choris shares certain technological affinities with contemporary southern Alaskan cultures (Clark 1998), though the appearance of ceramics at this time likely indicates a strong cultural contribution from Asia (Dumond and Bland 1995; Dumond 1998b).

Giddings and Anderson (1986) felt that Choris groups were not whalers, despite whale bone being at least as abundant on the Choris as Old Whaling beaches at Cape Krusenstern. Although Choris lacks the over-sized bifaces and relatively sedentary settlement pattern of Old Whaling, Mason and Gerlach (1995a) note the inconsistency of accepting the faunal evidence in one case but not the other. The paucity of published information on settlement systems and site structure is unfortunate, since Choris groups appear to have possessed multi-family dwellings and large structures that may have been used as communal workshops (Giddings and Anderson 1986; Larson 1991; Sutherland

1994), in the latter function partly analogous to the historic North Alaskan *karigis* that functioned as communal workshops and sites of whaling ceremony for individuals affiliated with particular whaling boat crews. Choris may thus be associated with a level of social integration appropriate for small scale cooperative whaling. Although the case for whaling by Choris groups is even shakier than that for Old Whaling, it would fit a larger pattern of intensifying whale utilization around the North Pacific during the third millennium B.P., in such areas as the northwest Bering Sea (Orekhov 1998), northern Sea of Okhotsk (Lebedintsev 1998), and Gulf of Alaska regions (Yarborough and Yarborough 1998).

Norton-Near Ipiutak

Further indications of whale use appear along the Chukchi Sea coast from Point Hope to Cape Prince of Wales in Norton-Near Ipiutak times (ca. 2500-1800 B.P. in northwest Alaska; ca. 2500-1000 B.P. south of Seward Peninsula), in the form of both bowhead bones (Giddings and Anderson 1986) and the first unequivocal whaling harpoon heads (Larsen and Rainey 1948). In addition to the latter specimens being formally similar to the over-sized toggling harpoon heads utilized by later groups, one has an incised depiction of a whale (*ibid.*:163). This evidence of active attempts to hunt large whales precedes the archaeological appearance of sophisticated drag-float technology, and is not associated with abundant whale bone. It is however associated with the first appearance of relatively large and socially complex communities on the Alaskan Bering Sea coast (Ackerman 1998; Dumond and Bland 1995). A *karigi*-like communal workshop used predominantly by men is reported from one large settlement (Lutz 1973). Such communities may have been sufficiently sedentary and successful at meeting basic subsistence needs that at least casual effort could be devoted to procuring large whales (Harritt 1995). However, the coastlines with greatest whaling potential (from Bering Strait north) were sparsely settled, perhaps only during spring and summer (Ackerman 1998), implying that any whaling activity was not sufficiently productive to attract large populations nor anchor an annual subsistence round. Conceivably, the larger settlements south of Bering Strait represented the source area for spring-summer harvesting forays to the north, or a market for disposing of any surplus whale products.

The experimentation with whaling equipment implied by the appearance of whaling harpoon heads represents the technological milieu in which important innovations in float technology subsequently emerged, although whether by invention or adoption from elsewhere is not known. Floats are recognized most securely by an inflation nozzle or mouthpiece manufactured from wood or ivory. The occurrence of definite float mouthpieces emboldens archaeologists to identify the less distinctive mouthpiece stoppers, as well as the inflation tubes used to blow air through the nozzle. Float bars (small rods for attaching

the float to the harpoon line) and mending plugs are also identified archaeologically. Prehistoric examples made both from wood and hard organic materials (typically ivory) are known for each of these items.

The absence of these elements of the float complex does not necessarily imply the absence of floats. Float parts are rare archaeologically even at later sites where whaling was clearly important. Given the frequent manufacture of the oldest mouthpieces from perishable wood (Collins 1937; Rudenko 1961), and the very small size of Norton-Near Ipiutak organic artifact samples from potential whaling locales (Giddings and Anderson 1986; Larsen and Rainey 1948), the absence of float gear might be considered inconclusive. Furthermore, a simple skin storage container could be inflated, sealed, and attached to a harpoon line without elaborate plugs, nozzle and toggling apparatus. The appearance of such devices can thus as easily be taken to represent the *improvement* of floats as their invention or adoption. In any case, the use of whaling harpoon heads implies some strategy for securing the live harpoon line, one alternative being to fasten it to the boat for a "Nantucket sleigh ride", in the fashion of Koryak groups on the northeastern Sea of Okhotsk (Krupnik 1984). While rudimentary floats or comparable techniques were presumably employed for opportunistic whaling in Norton-Near Ipiutak and earlier times, the emergence of substantial economic reliance on open water hunting of large sea mammals may have necessitated new levels of technological investment in float performance and reliability.

Ipiutak

The Ipiutak successors of Norton-Near Ipiutak, inhabiting parts of coastal and interior Alaska from Seward Peninsula north (ca. A.D. 300-900 on the coast, perhaps persisting as late as A.D. 1200 in the interior) (Gerlach and Mason 1992; Giddings and Anderson 1986; Larsen 1952; Larsen and Rainey 1948; Mason 1998), did not adopt float technology despite apparent contacts with contemporary float-using Okvik-Old Bering Sea (OBS) and Birnirk groups (see below). Evidence for Ipiutak whaling, in the form of small amounts of whale bone and whaling harpoon heads (Giddings and Anderson 1986; Larsen and Rainey 1948), is comparable to that for Norton-Near Ipiutak, from which it is likely in part descended (with input from Okvik-OBS and/or some common ancestor in northern Asia reflected in the spectacular decorative and funerary art produced with imported iron tools). However, improved organic artifact samples indicate that equipment for sea mammal hunting of all kinds is truly rare.

While the precise nature of Ipiutak subsistence-settlement systems is still somewhat unclear, the high proportions of terrestrial hunting gear, together with anomalously high caries rates, suggest a marked emphasis on terrestrial resources. In fact, caries rates among Point Hope Ipiutak are triple those of late prehistoric groups at the same location, and within the range of those exhibited

by modern Eskimo populations consuming large quantities of sugars and starches (Costa 1980:510). Costa speculates that a genetic predilection may account for this pattern, but it seems equally plausible that Ipiutak groups simply consumed correlatively greater quantities of carbohydrates. In addition to such sources as roots and berries, slightly fermented caribou stomach contents were a regular constituent of the traditional interior North Alaskan Inupiat diet (Nickerson *et al.* 1973), and supply as much carbohydrate by weight as berries (Kuhnlein and Souedia 1992). Reindeer Chukchi groups are reported to have processed and stored this nutritious foodstuff, termed *rilkéil*, on a large scale (Arutiunov 1988:41). Perhaps, as Jenness (1952:33) suggested, the large Ipiutak site at Point Hope (and perhaps also Cape Krusenstern) (Mason 1998:281), was a seasonal trade fair and sea mammal hunting camp utilized by predominantly inland groups. It is now generally conceded that the large number of dwellings at Ipiutak (close to 600) (Larsen 1952; Larsen and Rainey 1948) accumulated over centuries of site use, and were not occupied contemporaneously. Cape Krusenstern Ipiutak communities consisted of 3-12 dwellings, along with a *karigi*-like communal workshop used by both women and men (Anderson 1984; Giddings and Anderson 1986). They were no doubt demographically sufficient to regularly hunt whales, but for the lack of commitment to coastal resource use.

The Emergence of Intensive Umiak-Float Whaling

Okvik-Old Bering Sea

The oldest assemblages in which float parts are recognized are those assigned to the Okvik-OBS culture (*ca.* A.D. 200-800, but variously, 500 B.C./A.D. 500-A.D. 600/1000) (Ackerman 1984; Arutiunov and Fitzhugh 1988; Collins 1937; Dumond 1998b; Geist and Rainey 1936; Gerlach and Mason 1992; Krupnik 1993a; Mason 1998; Rainey 1941; Rudenko 1961). Okvik-OBS assemblages are characterized by an elaborate decorative art style without any obvious Palaeoeskimo precedent, and an array of sophisticated sea mammal hunting equipment. Sites occur along the Chukotkan and St. Lawrence Island coasts in areas where any earlier settlement is undocumented. These groups are considered to belong to the Neoeskimo tradition, and to all appearances represent the principal biological and cultural ancestors of Inuit and Siberian Yupik groups. The genetic contribution of early ASTt, Choris, Norton-Near Ipiutak, and other Palaeoeskimo groups to historic populations is undetermined, though likely greater for Alaskan Yupik groups south of Seward Peninsula than for others (Dumond 1988a; Fitzhugh 1988; *cf.* McGhee 1988; Morrison 1991a).

Okvik-OBS economy at the St. Lawrence Island type sites appears to have been based largely on the harvesting of walrus, other pinnipeds, and small game. Since the bones of various baleen whale species (bowhead, humpback,

fin) are present in relatively small numbers, the float gear was likely used more often for walrus hunting than whaling, though whaling harpoon heads do occur (Rainey 1941). Historic Bering Strait walrus hunting has numerous close parallels with bowhead whaling, including 1) the seasonal interception of migrating animals, often confined by ice, 2) the use of large toggling harpoons, floats and lances, wielded from *umiaks*, 3) the cooperation of multiple *umiak* crews, and 4) the leadership of *umiak* crews by a boat captain with elevated status, who receives the largest share of the harvest (e.g., Bogojavlensky 1969; Ellanna 1988). Given the relatively widespread evidence for walrus hunting at Okvik-OBS and some earlier arctic sites, it might be considered a technical and organizational prologue to bowhead whaling (more so, perhaps, than beluga hunting, based on ethnographic harvesting techniques).

On the Chukotkan mainland Okvik-OBS may be up to a few centuries older than on St. Lawrence Island (Dumond 1998b; Gerlach and Mason 1992; Mason 1998), and is associated with abundant remains of bowheads, and some gray whale calves (Krupnik 1987), in addition to walrus and the usual suite of other pinnipeds, terrestrial mammals, and birds (Gusev *et al.* 1999). Whaling harpoon heads are present (Levin 1964), and some Okvik-OBS dwellings incorporate substantial amounts of bowhead bone in their construction (*ibid.*; Krupnik 1987; Rudenko 1961), representing the first occurrence of the semi-subterranean whale bone houses that become widespread from the late first millennium A.D. An emerging ritual dimension of whale use is suggested by occasional depictions of whales (Arutyunov *et al.* 1964:344; Collins 1937:178; Mason 1998:257), and especially by the frequent inclusion of bowhead bones in burials (Arutyunov *et al.* 1964; Krupnik 1987; Levin 1964).

Data are few, but Okvik-OBS settlements do not appear to have been very large. Rudenko (1961) indicates a maximum village size of about 20 houses (historic Chukotkan houses of comparable size averaged 7-8 occupants) (Mason 1998:253) for all periods on the Chukotkan coast. A site of this size at Enmylen consisted of clusters of intercommunicating houses and a single notably large feature (Rudenko 1961:96), a site structure suggestive of the *karigis* and *upsiksuis* (house groups), of historic North Alaskan (Burch 1981) and Eastern Classic Thule (Whitridge 1994, 1999) whaling villages. Unfortunately, it is difficult to determine the scale of the Okvik-OBS community, since Punuk and later material occurred in Rudenko's test. A similar situation obtains at Ekven, with at least 12 houses and a ceremonial structure (Bronstein and Plumet 1995; Mason [1998] cites a figure of 15 houses), and Chini, with 9 house features (*idem*). Given the predominantly Okvik-OBS character of the artifact assemblages, and large associated cemeteries, these may in fact be realistic size estimates for the larger communities of this period (*idem*). Eight houses are connected to a large central structure at Cape Chukchi, clearly indicating contemporaneity, but the small artifact sample is only mildly suggestive of Okvik-OBS affinity (Rudenko 1961:66). Gusev *et al.* (1999:363) estimate that

the site of Kaniskak consisted of five 1-3 room dwellings during Okvik-OBS times. Other small Okvik-OBS sites occur at Sirhenik (four houses) and Kiwak (two large houses; Rudenko 1961). It is more difficult to provide estimates for contemporary villages on St. Lawrence Island because of the massive accumulation of later deposits, reflecting population growth from Okvik-OBS to Punuk times (Mason 1998), but settlements appear to be comparable in size to the smaller Chukchi Peninsula villages.

The smaller Okvik-OBS communities may have housed as few as 25-45 people, sufficient to muster a single *umiak* crew's worth of adult male labour (assuming 7-8 persons per single house and 3-4 dependents per hunter) (Whitridge 1994, 1999), while the larger villages may have supported 2-4 *umiak* crews. The former would likely have had difficulty harvesting bowheads, but perhaps not gray whale calves, on their own. However, the spacing of Okvik-OBS settlements only 6.4-16.8 km apart, or 1-2.5 hours travel by *umiak* (Gusev *et al.* 1999:356), indicates that, logistically at least, several such communities could easily have cooperated in whaling. The clustering of houses at Enmylen and Ekven suggests that larger villages were in effect composed incrementally of small, "single boat crew communities" that retained distinct social identities within the larger social grouping, as was the case for *upsiksui*-based kin groups in large North Alaska whaling villages (Burch 1981). Social mechanisms were thus in place that would have facilitated economic cooperation amongst the smaller, dispersed communities. The cooperation of small villages in bowhead whaling is also suggested for peripheral (*sensu* Savelle and McCartney 1994) Classic Thule whaling areas in the central Canadian Arctic (McGhee 1984a; Whitridge 1999), as is the occurrence of multiple *upsiksui*-like house groups in the larger core area whaling villages (*idem*; Savelle and Wenzel 1996). This capacity for modular aggregation and disaggregation at the scale of a boat crew provided the flexibility essential for Neoeskimo colonization of vast expanses of the northeast Siberian and North American Arctic, much of which necessitated major adjustments in settlement pattern and resource use.

Although some researchers see Okvik-OBS groups as opportunistic whalers (Gusev *et al.* 1999) or even scavengers (Collins 1937), the abundance of whale bone, the extent to which bowhead products were incorporated into material culture and ritual, and the inception of selective harvesting of young animals (at least of gray whales) (Krupnik 1987; McCartney 1995b), all point to a dramatic escalation of whale harvesting in the Bering Strait region coincident with the appearance of sophisticated float gear, and perhaps also innovations in *umiak* design or seafaring techniques. The apparent colonization at this time of St. Lawrence Island and smaller islands in the Bering Strait region, and the Chukchi Peninsula coast itself, with their severely impoverished terrestrial faunas, indicates that Okvik-OBS groups were able to focus their harvesting energies almost entirely on sea mammals, due in part to these improvements in maritime hunting technology and, perhaps, associated organizational modes based upon

the cooperative *umiak* crew. Likely also important at this juncture was the establishment of secure exchange relationships with caribou-producing groups on the mainland (as suggested by abundant caribou antler artifacts). This secondary procurement of terrestrial resources in the context of maritime specialization contrasts with the large direct contribution of terrestrial hunting to earlier economies in the Bering-Chukchi Sea region, a pattern that persisted for some time on the Alaskan mainland (Ackerman 1998; Dumond and Bland 1995; Giddings and Anderson 1986; Mason and Gerlach 1995b; Pitul'ko 1999).

Birnirk

Contemporary with later Ipiutak and Okvik-OBS, Birnirk groups descended from the latter settled both the Siberian and Alaskan Chukchi Sea coasts in the second half of the first millennium A.D. (ca. A.D. 500-900) (Ackerman 1984; Anderson 1984; Bockstoce 1979; Chard 1955; Ford 1959; Gerlach and Mason 1992; Giddings and Anderson 1986; Krupnik 1993a; Mason 1998; Rudenko 1961; Stanford 1976). Morrison (1991a), following McGhee (1988), regards Birnirk as the adoption of Okvik-OBS material culture by biologically Ipiutak groups, but the available proxy genetic data suggest that Birnirk groups are closely related to Old Bering Sea populations at East Cape (Arutyunov 1979:30; Utermohle 1988: Figures 3 and 4). While not everywhere as heavily oriented towards the hunting of large sea mammals as Okvik-OBS, Birnirk groups utilized the same maritime hunting technology, and incorporated moderate amounts of bowhead (and sometimes gray) whale bone in their house construction and material culture (Krupnik 1987).

Most Birnirk villages appear to have been small (often only 2-3 small houses), and more widely dispersed than those of Okvik-OBS, likely limiting their ability to mobilize highly successful whale hunts. Larger 15-16 house villages may have existed in the Point Barrow area by late Birnirk times, but few house mounds at these sites were occupied throughout the period of site use (Ford 1959:Figure 34; Stanford 1976:108), suggesting that the communities were small during most of the period of Birnirk occupation (Mason 1998). Because of limited data on Birnirk site structure, it is not clear whether or not any institution analogous to the historic *karigi* existed to articulate whaling activities with village social structure and ritual. The small size of most settlements, and emphasis on non-cetacean resources, means that any such heritage from Okvik-OBS may not have been well-expressed. Nevertheless, supplementing a harvest of smaller sea mammals, terrestrial game, birds, and fish with consistent low level whaling was a successful pioneering strategy that resulted in a major northward extension of Neoeskimo settlement. Once Okvik-OBS populations in the Bering Strait region had reached some critical density, Birnirk seems to have developed as groups spilled over onto a largely uninhabited coastal frontier, maintaining contacts with the homeland but following a separate cultural

trajectory. Refined techniques for hunting ringed seals on the sea ice (Stanford 1976) may have been a distinguishing feature of Birnirk harvesting strategies, given the paucity of earlier winter settlement on the Chukchi Sea coasts north of East Cape and Point Hope. In many ways the Thule migration (discussed below) can be seen as merely a continuation of this pattern of Birnirk expansion.

Punuk

On the Chukchi Peninsula coast and St. Lawrence Island in the later first millennium A.D. there was a shift in Okvik-OBS design, towards simpler, geometric decoration and tool forms. The new style is assigned to a new cultural entity termed Punuk (ca. A.D. 800-1300), but clearly emerges directly from Okvik-OBS (Ackerman 1984; Arutiunov and Fitzhugh 1988; Chard 1955; Collins 1937; Ford 1959; Geist and Rainey 1936; Krupnik 1993a; Mason 1998; Rainey 1941; Rudenko 1961). That Punuk settlements are often underlain by Okvik-OBS deposits, but are somewhat larger and more widespread within roughly the same geographic confines, is taken to reflect indigenous population growth (Arutiunov and Fitzhugh 1988:128; Mason 1998). Although major immigration is not suggested, external influences occur in the form of a warfare complex including sinew-backed compound bows, bow wrist guards, new arrow styles, and bone slat armour, all with antecedents to the south in East Asia (Bandi 1995; Collins 1937).

Punuk represents a significant new threshold in the level of whaling activity in the northern Bering Sea, paralleling similar patterns of whaling intensification around the Sea of Okhotsk (Lebedintsev 1998; Yamaura 1998), and on the northeasternmost Arctic coast of Europe (Krupnik 1993a:202) in the later first and early second millennia A.D. While some researchers remain doubtful of the extent of Okvik-OBS whaling, there is virtually unanimous agreement that Punuk groups harvested large numbers of bowhead (and sometimes gray) whales. This is reflected in the abundance of whale bone in Punuk houses and middens, and the increasing occurrence of whaling equipment (harpoon heads, foreshafts, float gear, etc.), and material culture and architecture associated with whaling ritual. The latter includes a large arrangement of bowhead mandibles and skulls on Ittygran Island, off the southeast Chukchi Peninsula coast (Chlenov and Krupnik 1984; Krupnik 1993a, 1993b), and additional sites with smaller whale bone constructions of a ceremonial nature.

Punuk whaling intensification, and the related expansion of Thule whalers, are often attributed to the favourable environmental conditions of the Medieval Warm Period, which are believed to have resulted in an expansion of bowhead summering range in the Arctic Basin and a consequent absolute increase in bowhead numbers. While the former is likely, and can be demonstrated for the Eastern Arctic from the record of natural strandings (Dyke *et al.* 1996), establishing the scope of the latter is more difficult. The effects of climatic

amelioration on bowhead whaling conditions in the Bering-Chukchi Sea region are rarely closely modeled (Mason 1998; Mason and Gerlach 1995b), but unless stocks increased dramatically, a proposition that is not supported by the Eastern Arctic data, it is unclear how environmental change could have promoted increased whaling simultaneously on the Bering, Chukchi, and Beaufort Sea coasts (Tynan and DeMaster 1997).

An important variable in the other Eurasian whaling developments noted above was the intensification of inter-regional exchange of prestige goods, raw materials, and foodstuffs (with reindeer pastoralists in northeast Europe, and with settled agriculturalists, via maritime traders, on the southeastern Sea of Okhotsk). Exchange provided a means of converting a local surplus in whale and walrus products into other useful or desirable commodities, and could solve serious scheduling conflicts by providing an alternate means of acquiring some critical resource, thus motivating and facilitating increased whale harvesting. One of the problems with intensive whaling is that the scale of the harvest tends to vary substantially from year to year, since unpredictable variability in the pattern of sea ice clearance strongly influences hunting success (Mason and Gerlach 1995b; Nelson 1969). This would normally encourage an adjustment to harvesting minima, since populations that expand to the level that can be supported by average harvests will face a crisis in a stretch of bad years. The correlate of this is that such risk-averse groups will often be capable of harvesting whales well beyond their immediate needs. However, once storage capacity is reached, the only incentive to continue whaling in a propitious year is the availability of some means of converting the surplus into other forms. Intensive whaling thus appears to develop only in the context of intensive exchange between whalers and non-whalers.

The appearance of domesticated reindeer in interior Chukotka between the 8th-10th centuries A.D. (Arutiunov and Fitzhugh 1988:128) may have resulted in an increase in such opportunities for coastal groups to dispose of surplus sea mammal products and acquire the caribou hides so valued for winter clothing. Although intensive reindeer herding only emerged in Chukotka after about A.D. 1700 (Krupnik 1993a), incorporation of the domesticated variety into a wild reindeer hunting and fishing economy likely contributed to the progressive expansion of Chukchi groups onto first the interior tundra, and later the coast, leading to the escalation of conflict and trade with existing coastal populations that is widely noted from Punuk times (e.g., Arutyunov 1979:29; Bandi 1995; Mason 1998). Links between Bering Strait and East Asian trading networks would have been tenuous before this expansion of Chukchi and Koryak settlement in the intervening zone.

The Punuk adoption of bow and armour technology from the south, the apparent adoption of Punuk styles of sea mammal hunting equipment around the Sea of Okhotsk (Lebedintsev 1998; Yamaura 1998), northwest Bering Sea (Orekhov 1998), and Chukchi Sea (Ackerman 1984; Ford 1959; Stanford 1976),

and the increasing movement of Asian iron across Bering Strait (McCartney 1988), point to heightened interaction of all kinds throughout northeast Asia during Punuk times. Besides the incentive to intensify production of surplus whale products for exchange, increased whaling efficiency may have been achieved through the promotion of intra-group cooperation and discipline in the context of expanding inter-group conflict (Bandi 1995). The cohesive kinship-based boat crew, with its dual social character involving cooperation (in harvesting, trade, and inter-group conflict) and competition (for wealth and prestige; Bogojavlensky 1969; Burch 1975, 1981; Sheehan 1985; Spencer 1972, 1979) may have fully emerged at this time, as Rudenko (1961:172) suggests, although its roots appear to stretch back into Okvik-OBS. Punuk population growth could have followed rapidly on whaling intensification, while whaling intensification itself followed on the intensification of inter-societal interactions in Chukotka related to the spread of reindeer hunter-pastoralists and articulation with the East Asian trading sphere.

Western Early Thule/Eastern Pioneering Thule

The increasingly complex interactions around Bering Strait during the 9th-10th centuries A.D. provided the setting for the emergence of Early or Pioneering Thule culture (ca. A.D. 900-1200 in the west, perhaps A.D. 1000-1100 in the east) (Arnold 1983; Ford 1959, 1964; Giddings 1952; Giddings and Anderson 1986; Mathiassen 1927; Maxwell 1985; McGhee 1969/70, 1984a; Stanford 1976; Taylor 1963), which spread throughout the Canadian Arctic and Greenland in subsequent centuries through migration from the Chukchi/Beaufort Sea coasts, and ultimately supplanted Punuk and Norton styles of material culture in Siberia, and south of Bering Strait in Alaska. Thule material culture is essentially continuous with Late Birnirk in northern Alaska, with relatively minor changes in artifact styles and type frequencies, and the adoption of some Punuk harpoon head types. The latter, together with the prior occurrence of Punuk whaling harpoon heads in Late Birnirk contexts, has led to the widespread characterization of the Birnirk-Thule transition in terms of the adoption of intensive Punuk-style bowhead whaling.

The borrowing of Punuk-style whaling harpoon heads rather than use of some more typically Birnirk form implies emulation of some aspects of intensive Punuk whaling practises, and indeed bowhead whaling eventually emerged as the cornerstone of Thule economy in many regions. However, it is not entirely clear that whaling by early Western Thule groups was that much more intensive than it had been in Late Birnirk times. On the little available evidence, Early Thule settlements dating to the 10th-11th centuries A.D. in North Alaska (Giddings and Anderson 1986:71, 86; Larsen and Rainey 1948; Sheehan 1997; Stanford 1976) were comparable in size to Birnirk settlements, usually consisting of only 2-4 houses. The handful of Pioneering Thule assemblages from

the Canadian Arctic consist of small artifact collections that appear to derive, where data are available, from settlements similarly consisting of at most 2-3 houses (e.g., Arnold 1986; Collins 1952; Manning 1956; Yorga 1980). Direct evidence for whaling takes the form of moderate amounts of structural, artifactual, and midden whale bone, and occasional pieces of whaling gear, as in Late Birnirk.

McGhee's (1969/70) model of a relatively mobile and small scale mode of initial Thule whaling around the shores of Amundsen Gulf has generally been supported by the gradually accumulating archaeological data (Arnold and McCullough 1990; Sheehan 1997), although the notion that Pacific and Atlantic bowhead stocks mingled in a zone of continuous availability across the North American Arctic can probably no longer be sustained (Dyke *et al.* 1996). Indeed, elements of the model might even be projected back into earlier, pioneering Birnirk times. The seasonal occurrence of migrating bowheads close to shore at various locations from Cape Baranov to Point Barrow may have been critical to the establishment of relatively sedentary Birnirk communities with an economy that combined occasional whaling, sealing, and hunting of caribou and small game, just as some Early and Pioneering Thule groups settled into such an economic routine on the Chukchi and Beaufort Sea, and perhaps Amundsen Gulf, coasts.

The expansion of Early Thule settlement along the coasts east of Bering Strait may have been an effect of the economic intensification evident in Punuk. The clear suggestions of Punuk-terminal Birnirk cultural exchange can be taken to reflect the capture of Alaskan Birnirk within the northeast Asian interaction sphere during the 10th century A.D. Although not on the scale of late prehistoric trade (Hickey 1979; Morrison 1991b; Sheehan 1997), North Alaskan groups thereafter participated in an emerging inter-regional economy, their gradually growing numbers increasingly subsidized by a leveling of resource imbalances predicated on whaling surpluses and trade. At some relatively low threshold of population density, Pioneering Thule budded off from the North Alaskan coast as a frontier movement, much as Okvik-OBS had spawned Birnirk four or five centuries earlier. While initial Thule colonization of the Western Arctic coasts took root, the fate of groups that moved on into Barrow Strait and Lancaster Sound is less clear. An assemblage from southern Somerset Island with early Classic Thule characteristics dates to little older than A.D. 1200 (Whitridge 1999), implying a hiatus of as much two centuries between Pioneering and Classic Thule. Alternatively, Robert McGhee (pers. comm.) suggests that Pioneering Thule itself may not be as old as traditionally thought; given the poor radiometric control over Birnirk chronology (Gerlach and Mason 1992; Morrison 1989). A late Birnirk-Thule transition in North Alaska is not entirely out of the question.

Hints of assemblages transitional between Early/Pioneering and Late/Classic Thule occur in Amundsen and Coronation Gulfs and most clearly in North Alaska, at sites like Nunagiak in the Point Barrow region, but none have been described

from further east and north. More excavation data are needed to sort out the nature of Canadian Thule occupations in immediate post-Birnirk times, but one scenario would have Classic Thule represent a population movement distinct from, and later than, an abortive Pioneering Thule colonization of the Eastern Arctic (Figure 3; Whitridge 1999). The apparent persistence through Pioneering Thule times of Late Dorset groups with access to meteoritic iron from northern Greenland and native copper from Coronation Gulf (Appelt *et al.* 1998; Helmer *et al.* 1993), adds an additional complication. The ambiguous character of evidence for direct Dorset-Thule contact (Park 1993) would be partially explained by the absence of permanent Thule settlement in the Eastern Arctic before about A.D. 1200, while the inception of multiple migration streams from the west could be due to the reports of metal (not to mention whales) brought back by Pioneering Thule explorers, as some have speculated (e.g. McCartney 1988:78; McGhee 1996:221).

Western Late Thule/Eastern Classic Thule

After about A.D. 1200, large Late Thule (*ca.* A.D. 1200-1400) whaling villages arose at some of the coastal promontories occupied by Early Thule groups in northern Alaska (Sheehan 1997), and settlement expanded up a number of the nearby river systems (Giddings 1952). Sheehan (1997) sees interdependence between coastal and interior groups beginning to develop at this time, with marked interior settlement expansion from about A.D. 1400 marking the end of this period of transition to the fullblown late prehistoric/historic pattern of coast-interior economic symbiosis. This system likely developed initially as a seasonal division of labour within communities, analogous to the age- or status-based divisions of marine and terrestrial harvesting labour reported historically among the Iglulingmiut of Foxe Basin (Damas 1969) and the Inuit of the Mackenzie Delta region (Morrison 1988), eventually expanding to the complex regional and inter-regional economies, articulated by several major trade fairs, documented ethnohistorically in northern Alaska (e.g., Burch 1970, 1981, 1988, 1998; Sheehan 1997). The pattern of coast-interior exchange that seems to have spurred the growth of Punuk whaling was thus reproduced on the Alaskan mainland in a similar context of whaling intensification.

Large and small bowhead whaling villages appear along the channels of the central Canadian Arctic (Figure 4) during Classic Thule times (*ca.* A.D. 1200-1450), perhaps due to the posited late migration originating along the coast between Point Hope and Amundsen Gulf. A second migration brought heavily Punuk-influenced groups, likely from the Bering Strait area, into the Canadian High Arctic (principally Ellesmere Island) and Greenland (Holtved 1944; McCullough 1989; Schledermann and McCullough 1980) at approximately the same time (Morrison 1989). Walrus and small seals were more important than bowhead whales for the latter Ruin Island groups (McCullough 1989). Although caribou

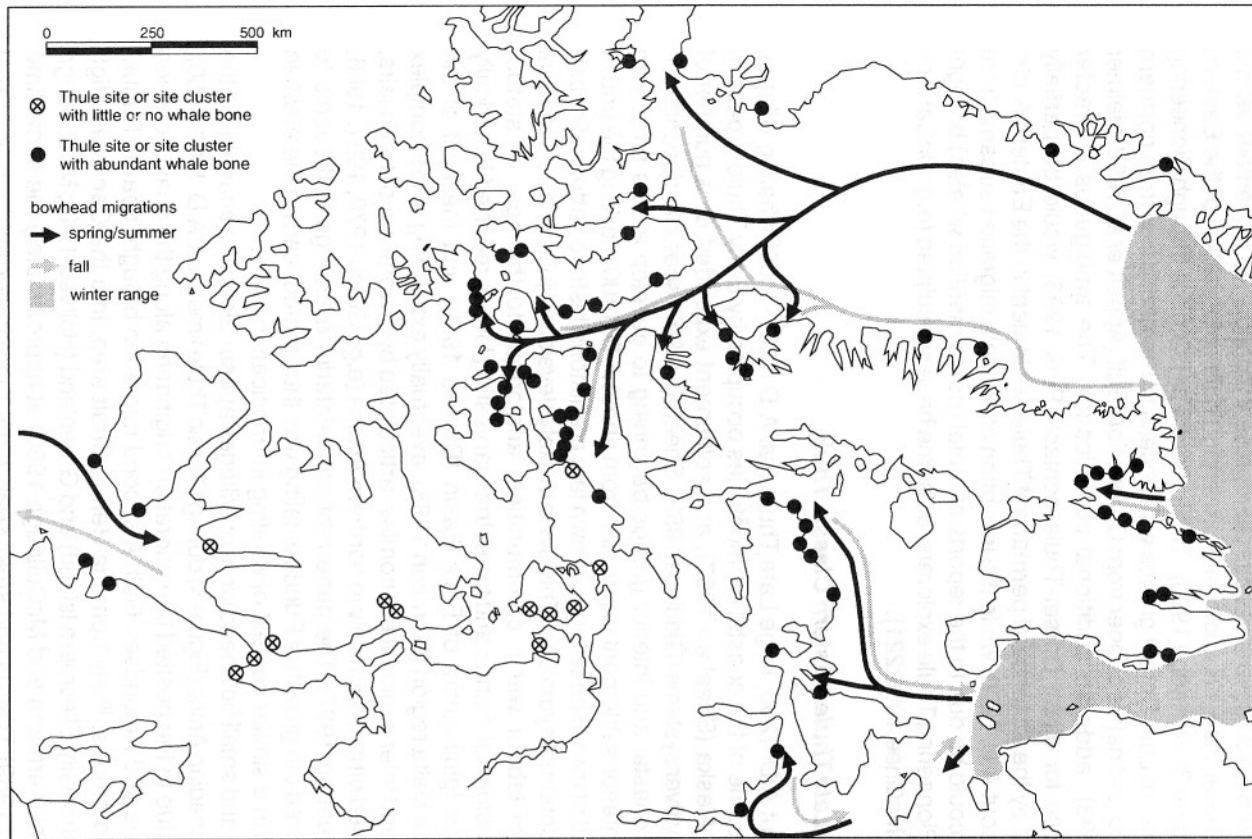


Figure 4. Distribution of Thule sites with respect to bowhead migration routes in the Eastern Arctic (adapted from Dyke *et al.* 1996: Figure 19 and Moore and Reeves 1993:Figure 9.22).

are extremely scarce in the area, these groups had strategic access to the source of meteoritic iron, and by the later 13th century were a conduit for Norse goods (McGhee 1984b). Contemporary Glachan phase populations around Coronation Gulf had neither whales nor walrus, subsisting instead on ringed seal and caribou, but sat atop an important source of native copper (Morrison 1983, 1987). Caribou and seal were also the mainstay of groups in the King William Island area (Mathiassen 1927; Savelle 1987; Savelle and McCartney 1988). The major Classic Thule whaling region encompassing Barrow Strait, Lancaster Sound, and large inlets to the north and south (McCartney 1979b; McCartney and Savelle 1985; McGhee 1984a; Savelle 1996; Savelle and McCartney 1988; Taylor 1981; Taylor and McGhee 1979) was thus bounded by areas with other economic specialties. The abundant use of meteoritic iron, native copper, and other trade goods in the central whaling region, the widespread occurrence of distinctive artifact styles, and the general homogeneity of Classic Thule material culture over a vast area, indicate that these distinct regions were in frequent interaction during Classic Thule times (McCartney 1991; Whitridge 1999). The emergence of intensive whaling in the Central Arctic is thus inseparable from the emergence of an exchange sphere that would have provided for the disposal of surplus whale products.

Classic Thule whaling in the central Canadian Arctic is better described than Eskimo whaling in any other time or place. Savelle and McCartney (1990, 1991, 1994, 1999; McCartney and Savelle 1993) have mapped and measured thousands of whale bones on the surface of dozens of Classic Thule sites, as well as reconstructing patterns of natural bowhead mortality over the course of the Holocene as a baseline for exploring Thule prey selection. Dividing the region into core, intermediate, and peripheral whaling areas according to the abundance of bowheads and the duration of their availability, Savelle and McCartney have observed differences in overall harvesting success and selectivity for small animals between core and peripheral settlements, and have even discerned a gradient in the size of harvested whales that corresponds to the growth of yearlings as they proceed along their summer migration route (Savelle and McCartney 1994, 1999). At the large Classic Thule site of Qariaraqyuk on southeast Somerset Island, spatial patterning in the thousands of surface bowhead bones indicated heightened consumption of the historically prized flipper and tail portions within a restricted, presumably high status, neighbourhood of this large core area site (Whitridge n.d.a).

Sites in the core whaling area tend to be larger and more highly structured than those on the periphery (Grier and Savelle 1994; Savelle 1987), and often contain one or more communal structures that served as men's workshops and sites of whaling ceremonialism, and are thus functionally indistinguishable from the historic North Alaskan *karigi* (e.g., Habu and Savelle 1994; Whitridge 1999). Similar *karigis* and house groups occur on Ruin Island phase sites (McCullough 1989), where they likely integrated boat crews concerned primarily with walrus,

such as those described historically for Bering Strait. *Karigis* have not been recognized in excavations at Early or Late Thule sites in North Alaska, although a likely *karigi* is reported for the site of Nunagiak southwest of Point Barrow, which appears to span the Thule period (Ford 1959:53). Giddings and Anderson (1986) suggest that one of the rooms attached to large complex houses at Cape Krusenstern may have performed a *karigi*-like community function. Sheehan (1990, 1997) reports a late prehistoric *karigi* with attributes of the historic institution from a site at Point Barrow. Presumably, the ethnographically described association of *karigis* with boat crews and whaling ritual developed under Punuk influence during Early Thule times, and was introduced to the east as part of the Classic Thule and Ruin Island migrations.

Certain dwellings at Qariaraqyuk were differentiated by their greater size, complexity, and occurrence in the *upsiksuis* which often contained a *karigi*, by the frequency of whaling equipment and prized whale portions, and by the degree of access to such exotic commodities as native copper and meteoritic iron (Whitridge 1999). Central Arctic whaling thus appears to have been organized on the basis of *karigi*-centred boat crews, and to have been associated with competition for wealth and status, as was historic North Alaskan bowhead whaling (Burch 1981; Cassell 1988; Mason 1998; Sheehan 1985; Spencer 1959). Later Classic Thule settlement expanded into Foxe Basin (Mathiassen 1927), northwest Hudson bay (McCartney 1977), and southern Baffin Island (Sabo 1991; Schledermann 1975), but whaling in these areas never appears to have achieved the scale and complexity it did along the Central Arctic channels.

Western Late Prehistoric/Eastern Modified Thule

The abrupt onset of the Little Ice Age (LIA) at around A.D. 1400 marked the most severe climatic downturn of the past 4000 years (Kreutz *et al.* 1997:1294). Whaling apparently declined at East Cape from about A.D. 1400 (Mason 1998), and was eventually abandoned along parts of the northern Chukotkan coast, but it is noteworthy that intensive whaling persisted at numerous villages along the southeast Chukchi Peninsula coast and on St. Lawrence Island (Ackerman 1984; Collins 1937; Krupnik 1993a). Similarly, although whaling was abandoned at small outlying settlements like Cape Krusenstern, the human populations of both the North Alaskan coast and interior reached their highest levels in late prehistoric times (ca. A.D. 1400-1800), and settlements of a few hundred people arose at the major whaling locales (Sheehan 1997). The expression of the LIA in North Alaska may actually have resulted in improved whaling conditions, by bringing the spring lead systems close to shore, but the critical factor in the persistence and intensification of the whaling-based inter-regional economy was the continuing strength of the larger "Beringian" exchange network (Hickey 1979). The increasing protohistoric infiltration of Russian and East Asian trade goods promoted still greater production of whaling surpluses, with new

exotic goods such as beads and tobacco (having made its way around the world from eastern North America) providing new domains of consumption and wealth display for successful traders and *umialiks*. The 19th century brought catastrophic epidemics and decimation of the bowhead stocks by American whalers, but whaling survived into the 20th century in numerous Siberian and Alaskan villages, and has continued to the present in some (Braund and Moorehead 1995; Krupnik 1987).

Bowhead whaling in the eastern Beaufort Sea-Amundsen Gulf region, likely never highly productive, tapered off to a few villages in the Mackenzie Delta area in late prehistoric times, with fishing and beluga whaling assuming great importance for some groups, and sealing and caribou hunting persisting as economic mainstays among the rest (Friesen and Arnold 1995; McGhee 1974; Morrison 1997). In the Eastern Arctic, the LIA seems to be implicated in extensive shifts in subsistence-settlement systems during Modified Thule times (*ca.* A.D. 1450-1600/1800). Much of the Canadian Central and High Arctic was abandoned, including most of the whaling area that had been the densely populated heart of Classic Thule settlement (Figure 5). Although bowheads occasionally penetrated these channels even at the height of the LIA (Moore and Reeves 1993; Ross

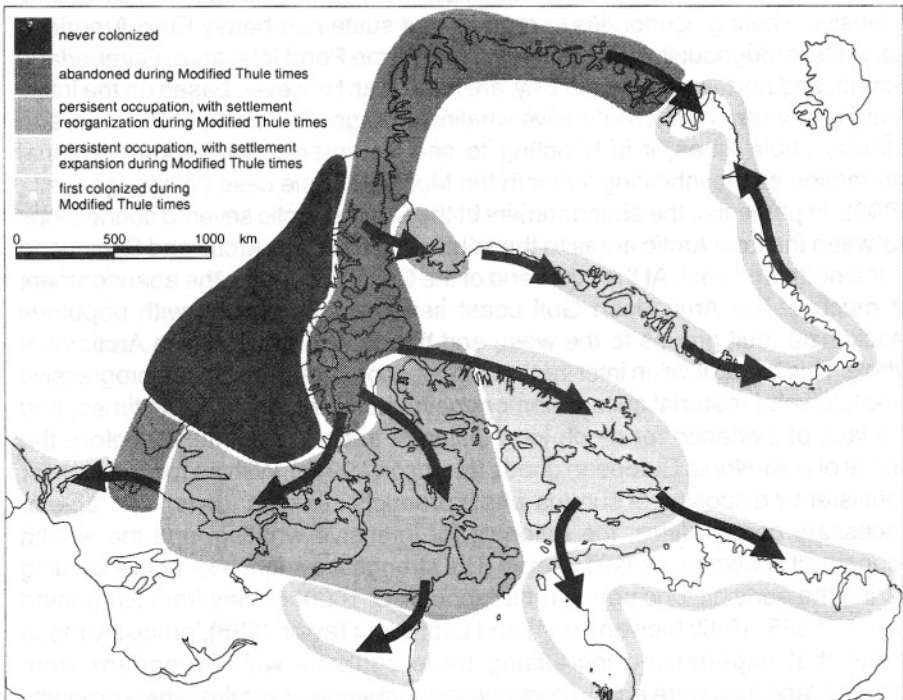


Figure 5. Model of settlement shifts at the Classic-Modified Thule transition.

1993), it appears that their summer migrations were no longer sufficiently large, predictable, and accessible to support even low level whaling (Dyke *et al.* 1996).

Abundant evidence for Modified Thule settlement along the east coast of Baffin Island from Bylot Island through Hudson Strait, and in northwest Hudson Bay and western Foxe Basin (e.g., Henshaw 1995; Mathiassen 1927; McCartney 1977; Sabo 1991; Schledermann 1975; Stenton 1987; Stevenson 1997) likely reflects an influx of groups from the Central Arctic. Modified Thule groups also moved into the Barrengrounds, Ungava, Labrador, and southern Greenland. Whaling was practised in many of these areas, but at a level usually more reminiscent of Birnirk and Early Thule than Classic Thule. By protohistoric or early historic times (*ca.* A.D. 1600-1800), European whaling had begun to take a toll on North Atlantic bowhead stocks (Ross 1993), and epidemics had brought about severe social disruption (McGhee 1994). At the beginning of the 20th century bowheads were on the verge of extirpation in the Eastern Arctic, and indigenous whaling (increasingly of other species) survived on a much reduced scale in only a handful of areas.

While at first glance the collapse of Classic Thule whaling might appear to be simply explained by the climatic downturn, this holds only for those areas where there was a severe decline in access to bowheads, namely the Central Arctic channels. The reasons that Modified Thule groups failed to rebuild stable, intensive whaling economies in regions that sustained heavy Euro-American harvests throughout the 19th century, such as the Pond Inlet area, Cumberland Sound, and northwest Hudson Bay, are less clear. However, based on the inter-regional context in which intensive whaling emerged in Punuk, Late Thule, and Classic Thule times, it is tempting to see the interruption of inter-regional interaction as the inhibiting factor in the Modified Thule case (Whitridge *n.d.b.*, 1999). In particular, the abandonment of the Central Arctic severed connections between the Low Arctic areas to the south, and the High Arctic and Greenland to the north and east. At the other end of the Canadian Arctic, the abandonment of much of the Amundsen Gulf coast severed connections with populous Mackenzie Inuit groups to the west, and hence with the Western Arctic as a whole. This breakdown in inter-regional interaction is reflected in the progressive breakdown of material culture homogeneity during Modified Thule times, and the lack of evidence for much long distance trade in the interval before the arrival of post-Norse European goods (Morrison 1991b). With no mechanism for consistently disposing of surplus whale products in exchange for desirable or necessary commodities, the rationale for intensive whaling, and the wealth economy it spawned, ceased to exist. The strongest evidence for active whaling during the early historic period (after about A.D. 1600) comes from Greenland (Gulløv 1985, 1997; Kleivan 1984) and Labrador (Taylor 1988), precisely those areas that experienced increasing trade contacts with Europeans from this time, and thus were able to continue the exchange of surplus whale products (Gulløv 1985; Kaplan 1985).

Conclusions

The reconstructions presented here of major episodes in the prehistory of Inuit and Yupik whaling are based on incomplete data, and so must be considered models to be tested by further archaeological research. Nevertheless, examining whale use in the broadest possible time frame draws attention to unsuspected commonalities in the larger economic contexts in which whale-reliance seems to have arisen. Perhaps the most interesting patterning relates to the degree to which large baleen whales emerged as focal resources where evidence is also present for the independent intensification of exchange networks, especially in Punuk/Thule through early historic times in the Bering-Chukchi Sea region, and during the Classic Thule period in the central Canadian Arctic. Outside the Eskimo world, this appears also to characterize the intensification of whaling in the Sea of Okhotsk region during the first millennium A.D., and the emergence of whaling economies in northeasternmost Europe from around a thousand years ago.

It seems that intensive whaling can sustain large arctic communities if the mechanisms exist to convert surplus whale products into other important commodities. This function is essential for levelling out the unpredictable peaks and troughs in local whale harvests, and provides the opportunity for entrepreneurial individuals to profit from the sponsorship of risky whale hunts. In many instances, exchange also resolved scheduling conflicts, by providing critical access to resources (especially caribou hides) foregone by whalers. Bulky staple commodities such as oil, caribou hides, walrus skins, and wood likely moved predominantly at a local scale, between neighbouring groups and within polities through an intra-societal division of harvesting labour. The long distance trade in low bulk prestige goods such as metal, amber, nephrite, and rare furs would have promoted local trading activity and competition for wealth, and drawn the various regions together into an integrated trading sphere. Once stable exchange systems existed, positive feedbacks promoted the intensification of whaling and other harvesting activities: the greater the value created locally through surplus production, the greater the volume of short and long distance exchange, and the greater the potential for intensified production of local economic specialties. The emergence of intensive whaling in the Bering-Chukchi Sea region during the first millennium A.D. and in the Eastern Arctic during the early second millennium A.D. appear to have followed this trajectory, while the collapse of Classic Thule whaling economies in the Eastern Arctic illustrates the process in reverse, with disruption of the inter-regional exchange networks contributing to the demise of intensive whaling.

Another noteworthy pattern is the recurrent suggestion of at least low level whale hunting in the Bering-Chukchi Sea region (and possibly the Eastern Arctic) since at least 3000 B.P. Rather than representing an archaeological dilemma, the increasingly equivocal nature of the evidence for bowhead use as one moves

Table 3
Summary of the occurrence of some archaeological indicators of whale use in prehistoric arctic cultures

Archaeological culture	Misc. wale bone	Baleen/ whale bone artifacts	Whaling harpoon head	Depiction of whale	Float gear	Whale bone house	Selection of small whales	Whale bone in burials	Whaling-related karigi	Ritual whale bone structure	Depiction of whaling	Source
Denbigh	—	—	—	—	—	—	—	—	—	—	—	1
Independence I	—	—	—	—	—	—	—	—	—	—	—	2, 3
Predorset	+	+	—	—	—	—	—	—	—	—	—	2-4
Saqqaq	+	+	—	—	—	—	—	—	—	—	—	5-7
Old Whaling	+	?	—	—	—	—	—	—	—	—	—	8
Choris	+	?	—	—	—	—	—	—	—	—	—	8
Dorset	+	+	—	—	—	—	—	—	—	—	—	3, 9, 10
Norton-Near Ipiutak	+	+	+	+	—	—	—	—	—	—	—	8, 11
Ipiutak	+	+	+	—	—	—	—	—	—	—	—	8, 11
Okvik-Old Bering Sea	++	++	+	+	+	+	+	+	?	—	—	12-17
Birnirk	++	++	+	+	+	+	+	+	—	—	—	14, 18-22
Early/Pioneering Thule	++	++	+	+	+	+	+	+	—	—	—	8, 18, 20, 22, 23
Punuk	++	++	++	++	+	++	++	+	?	+	—	12, 14, 21
Late/Classic Thule	++	++	++	++	+	++	++	+	+	+	+	8, 10, 18, 20, 24, 25
Late Prehistoric	++	++	++	++	+	++	++	+	+	+	+	8, 11, 18, 22
Modified Thule	++	++	+	+	+	+	?	—	?	—	+	10, 24

— absent + present ++ relatively common ? not reported but likely present

Sources: 1. Giddings 1964; 2. McGhee 1979; 3. Schledermann 1989; 4. McCartney 1989; 5. Grønnow 1996; 6. Gottfredsen 1998; 7. Møbjerg 1999; 8. Giddings and Anderson 1986; 9. Mary-Rousseliere 1976; 10. Maxwell 1985; 11. Larsen and Rainey 1948; 12. Collins 1937; 13. Rainey 1941; 14. Rudenko 1961; 15. Arutyunov *et al.* 1964; 16. Mason 1998; 17. Gusev *et al.* 1999; 18. Ford 1959; 19. Levin 1964; 20. Stanford 1976; 21. Krupnik 1987; 22. McCartney 1995b; 23. Collins 1952; 24. Mathiassen 1927; 25. Saville and McCartney 1994.

back in time from Punuk to Old Whaling is precisely what one would expect if sea mammal hunters increasingly obtained the technical expertise, organizational capacity and, especially, economic flexibility, to indulge in whaling as populations grew through the late Holocene (Table 3). While thresholds of whaling activity occur at the beginning of Okvik-OBS and Punuk, in concert with population growth and new levels of exchange activity, groups in the Bering-Chukchi Sea region have probably always possessed the ability to hunt baleen whales, and have probably always done so on a sporadic basis.

The opposing view, that whale hunting was an unusual phenomenon before Punuk/Thule times, cannot be considered a conservative position, given the widespread evidence for sophisticated maritime hunting skills amongst all but the earliest Palaeoeskimo cultures. The failure to hunt large whales implies quite specific things about the societies in question, and thus is as much in need of explanation as active whaling. Some of the conventional reasons advanced for the absence of whaling, such as technological or ecological limitation, contradict the archaeological and ethnographic evidence that large whales have been hunted by small groups employing relatively simple sea mammal hunting gear under a wide range of environmental conditions. Beyond the requisite presence of whales close to shore, economic demand appears to be the strongest determinant of the degree of whale hunting, a demand that was in turn conditioned by the size and, especially, economic complexity of the groups utilizing them.

Whales were available to Bering-Chukchi Sea groups throughout the late Holocene, although their accessibility varied somewhat over time due to climatically-controlled changes in seasonal sea ice patterns. Environmental change has been an important force in arctic prehistory, providing a critical backdrop to regional events and processes, and producing a certain cyclicity in local harvesting patterns and settlement systems. However, social and demographic forces have been at least as important, in the form of growing indigenous and extra-regional populations that interacted with each other in increasingly complex ways. The impact of changing environmental circumstances on whaling and other economic activities cannot be understood without taking into account the patterns of inter-regional interaction that increasingly shaped the course of arctic prehistory over the last 3000 years.

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