

Archaeology of whaling in the Arctic prehistory

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Abstract This paper explores the archaeology of whaling in Arctic prehistory, focusing on the emergence and development of whaling as a central component of cultural ecology among prehistoric Inuit and related societies. Drawing on archaeological evidence from key sites across Alaska, the Chukchi Peninsula, and the Bering Strait region, the study examines how whaling technologies and practices evolved alongside climatic fluctuations, ecological shifts, and social transformations. Integrating ethnographic insights and paleoclimatic data, the study argues that Inuit engagement with whales was not only a subsistence strategy but a long-term, historically contingent relationship that shaped and was shaped by broader cultural systems.

Keywords Arctic whaling, Inuit subsistence, archaeology, cultural ecology, formation of social organizations

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1 Introduction

One of the core issues in Arctic archaeology is the relationship between human adaptability to the natural environment and human culture (Krupnik, 1993). The harshness of the Arctic environment is primarily reflected in aspects such as low temperatures, permafrost, the phenomena of polar day and night, and the scarcity of terrestrial vegetation and animal resources. Due to the difficulty of agricultural development, obtaining resources from the ocean has become an effective survival strategy for humans. According to Hoffecker (2004), Arctic cultures not only demonstrate a high degree of human adaptability to cold geographical environments, but also represent the subsistence wisdom developed in extreme conditions. Prehistoric Arctic societies developed a highly complex and specialized set of technologies, forming adaptive methods to the Arctic marine environment and systematic strategies to cope with such extremes. Whaling, in particular, is one of the most successful subsistence strategies within the Arctic cultural ecology. Research on whaling societies can reveal how the Arctic ecosystem has been reshaped through

interactions with biological resources, the environment, and social factors, offering new perspectives for exploring theories of cultural ecology.

Research in Arctic whaling archaeology primarily focuses on several key issues. The first is the relationship between climate change and whaling activities. Anderson (1984), as well as others, believes that while cultural migration and technological reform contributed to the transformation of prehistoric Eskimo culture, the fundamental driving force was climate change. However, Mason and Gerlach (1995) reject the decisive role of climate change, instead favoring an ecological perspective to explain the formation of cultural patterns. The second issue concerns the relationship between the social organization of Eskimo societies and whaling activities. Mason and Barber (2003) and Whitridge (2016) both argue that whaling activities contributed to the development of social complexity. However, Hill (2011) contends that social complexity actually originated from walrus hunting.

Doubtlessly, previous scholars have largely been engaged with a single theoretical framework—be it climatic determinism, ecological models, or social complexity—to draw divergent conclusions from similar archaeological records. As a result, a comprehensive synthesis that

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critically evaluates the merits of these competing explanations, particularly in light of recent paleoclimatic and archaeological findings, remains notably absent. This study aims to fill that gap by integrating multidisciplinary evidence to offer a more nuanced understanding of how and why whaling emerged and evolved as a cornerstone of Arctic cultural adaptation. Through a systematic examination of the interplay among environmental change, ecological opportunities, technological innovation, and social evolution, this study seeks to move beyond simplistic causality and contribute to a more holistic narrative of human resilience in the Arctic.

This paper will begin with a brief review of the history of whaling in the North American Arctic and the adjacent regions on the Russian side. It will then provide a comprehensive overview of archaeological debates related to the key issues discussed above in order to understand how whaling emerged as a vital subsistence strategy within Arctic cultural ecology through the interaction between humans and the polar environment.

2 A brief history of whaling in the Arctic prehistory

The origins of human whaling in the Arctic remain a subject of debate in Arctic archaeology. Rock art depicting whaling has been found in the Alta region of Norway as well as in the Vyg region and adjacent areas of Russia, dating to 4000–6000 BCE (Gjerde, 2010). However, archaeological records from this period and region lack corresponding material evidence or features directly related to whaling. It is generally accepted that the earliest evidence of whaling in the American Arctic was found at Cape Krusenstern, Alaska. Archaeologists discovered a large bowhead whale (*Balaena mysticetus*) cranium near an ancient dwelling on Beach Ridge 53 at Cape Krusenstern. This finding is believed to indicate the presence of whaling

activities during that period, and the culture was thus named the “Old Whaling” culture (Giddings, 1967). Radiocarbon dating indicates that these early whalers lived during the period 1200–800 BCE (Darwent and Darwent, 2016). Anderson (1984) strongly supports the existence of whaling technology in the Old Whaling culture, citing the presence of large lance heads and weapon head insets “resembling in most respects the whaling harpoon head insets of recent times”. Similar bifacial implements were also discovered on Wrangell Island in the Chukchi Sea on the Russian side. Ackerman (1988) suggests that hunters at both the Cape Krusenstern site and the Wrangell Island site possessed “a capability for taking whales.”

The problem is that the Choris phase (800–400 BCE) and the Norton tradition (500–1 BCE), which followed the Old Whaling culture in western Alaska, contain no evidence of whale hunting. This absence has led some archaeologists to question whether whaling activities truly existed in the Old Whaling culture. McCartney (1980), for example, argues that it is difficult to confirm whaling at the Cape Krusenstern site based solely on the discovery of whale faunal remains.

The Northern Maritime Tradition (NMT) emerged around 1 CE and persisted until 1700 CE, coinciding with the period of initial European contact (Figure 1). This cultural tradition comprises the following sequential phases: Okvik culture (1–400 CE), Old Bering Sea (OBS) culture (400–800 CE), Birnirk culture (800–1200 CE), Punuk culture (800–1200 CE), and Thule culture (1200–1700 CE). Additionally, the Ipiutak culture was contemporaneous with and adjacent to the OBS culture. Although it shared many cultural similarities with the OBS, archaeologists typically exclude it from the NMT sequence (Qu, 2021). The chronology of cultures such as Okvik, OBS, Ipiutak, Punuk, Birnirk, and Thule is widely debated (Gerlach and Mason, 1992). Krupnik (1993), for example, places the Okvik/OBS period between 500 BCE and 500 CE. However, this paper follows the dating provided by Dumond (2009).

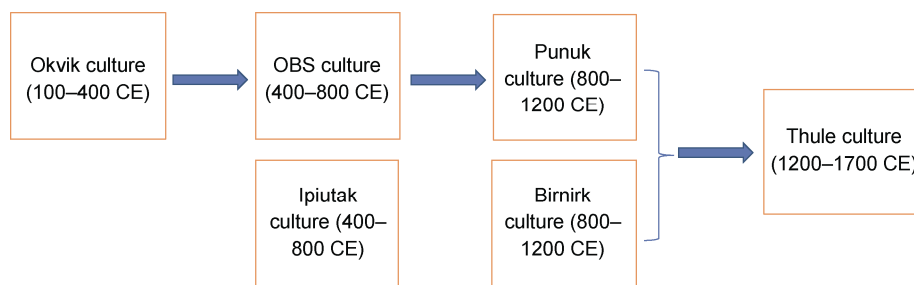


Figure 1 The sequence of the Northern Maritime Tradition.

Strong evidence from the Okvik/OBS cultures indicates that whaling as a subsistence strategy was already established in the early NMT period along the Bering Sea coasts of the Chukchi Peninsula and the islands of the Bering Strait region. This maritime hunting economy was characterized by sealing, walrus hunting, and whaling.

Whaling harpoons have been discovered at the Okvik site, and whale bones from the Hillside site on St. Lawrence Island have been dated to the Okvik period, further supporting the early practice of whaling in this region (Rainey, 1941). During the OBS period, whale bones were extensively used in house and grave construction across the

Chukchi Peninsula. Dinesman et al.'s (1999) statistical analysis of whale remains from OBS sites indicates that the majority belonged to gray whales (*Eschrichtius robustus*), with a small proportion identified as Greenland whales (*Balaena mysticetus*). Whitridge (1999) inferred that the success of whale hunting in OBS cultures was attributed to the invention of multi-person kayaks, advancements in maritime technology, and improvements in marine hunting techniques. More importantly, whaling activities were closely tied to the functioning of social organization. Cooperation among boat crews was likely the key to hunting success (Whitridge, 1999). It is noteworthy that almost no evidence of whaling has been found in the Ipiutak culture. This is one of the main reasons why it is excluded from the NMT sequence.

The Punuk culture emerged directly from the OBS culture and was centered on both sides of the Bering Sea, including the islands between Chukotka and Alaska. This period saw an increased use of whale bones in the construction of houses and graves, reflecting successful whaling practices. The appearance of large communal houses suggests the development of complex social organization and large-scale ceremonial activities. Additionally, sealing, walrus

hunting, fishing, and bird catching remained vital components of the subsistence economy (Qu, 2021). Soviet archaeologists discovered a remarkable structure known as “Whale Alley” on Yttygran Island in southeastern Chukotka. This site consists of two parallel rows of 50 to 60 whale skulls, a 50-meter-long stone pathway, and stone circles. Researchers believe it served as a sacred ceremonial site for Punuk hunters (Bronstein et al., 2016). The Birnirk culture was contemporaneous with the Punuk culture and inhabited the Chukchi Sea coasts of Siberia and Alaska. Unlike the Punuk, however, few whaling tools have been discovered in Birnirk sites (Dumond, 2009). Although a significant number of whale bones have been found in Birnirk settlements, Stanford (1976) argues that these were likely acquired through trade rather than active whaling.

The Thule culture (1200–1700 CE), which developed from both the Punuk and Birnirk cultures, is the direct ancestor of modern Inuit peoples. While whaling was the cornerstone of the Thule economy (Figure 2), the Thule people were also skilled in hunting other marine mammals, terrestrial animals, fishing, and bird catching (Mason, 2016). Because of this, the Thule culture has also been referred to as the “Arctic Whale Hunting Culture” (Larsen and Rainey, 1948).

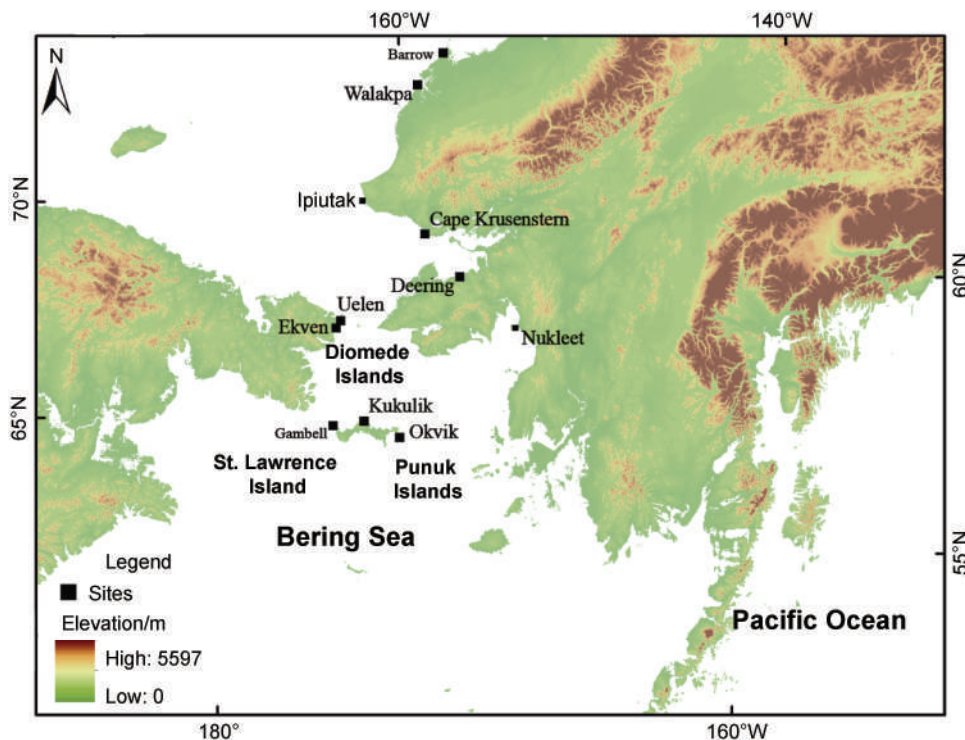


Figure 2 Map of the archaeological sites in the Bering Strait region. Map by Runqi Jiang.

Around 1200 CE, the Thule people in Alaska migrated to the High Arctic regions of Canada and Greenland, replacing the earlier inhabitants known as the Dorset culture (Mason, 2016). By the late 14th century, Thule settlements had spread throughout the Arctic regions of Canada and along both the eastern and western coasts of Greenland.

Bowhead whales were a crucial economic resource for the Eastern Thule people, providing large quantities of food, oil for lighting, baleen for making ropes, and whale bones for constructing houses (Whitridge, 2016). Toggle harpoon heads used for whaling were made from walrus ivory or whale bone. They were relatively large in size, typically

measuring between 12 and 24 cm in length (Figures 3 and 4). The socket pieces connecting the harpoon head to the shaft were also usually made of whale bone and similarly large in size. Several carved whale bone and walrus ivory artifacts unearthed from Thule sites vividly depict scenes of Thule whaling. These illustrations show that the whaling fleet included both multi-person boats (umiaq) and single-person kayaks working in coordination. The number of crew members in a whaling party typically ranged from four to seven (Maxwell, 1985).



Figure 3 Ivory whaling harpoon head from the Okvik site. UNMA collection, 1-1931-0757, length 7.5 cm. Photograph by Feng Qu. Courtesy of the Archaeology Department, University of Alaska Museum of the North.



Figure 4 Harpoon head of Thule culture (ivory with lithic point). Collected from St. Lawrence Island. National Museum of Natural History 364029. Photograph by Feng Qu. Courtesy of Department of Anthropology, National Museum of Natural History, Smithsonian Institution.

3 A climatic interpretation of shifts in whaling subsistence practices

Anderson (1984) has observed that each episode of social change and innovation in the prehistoric Eskimo cultural sequence of the Bering Strait region was accompanied by a shift in subsistence patterns. The early NMTs, such as the Okvik and OBS cultures, primarily focused on hunting seals, walrus (*Odobenus rosmarus*), and caribou (*Rangifer tarandus*) (though on St. Lawrence Island, where large terrestrial animals were absent, subsistence relied solely on marine mammals). In contrast, non-NMTs on the Alaskan mainland, such as the Ipiutak culture, practiced a mixed subsistence strategy that included hunting marine mammals like seals and walrus, terrestrial animals like caribou, and fishing. Following the Ipiutak culture in northwestern Alaska, the Punuk culture (which succeeded

the OBS culture) and the contemporaneous Birnirk culture both saw the emergence of whaling as a key subsistence activity. Compared to the Punuk culture, Birnirk settlements were generally smaller in scale. Anderson speculated that Birnirk whaling was likely conducted in ice leads, where fewer participants were required and small crews could carry out whale hunts effectively. In contrast, Punuk culture settlements on the Chukchi Peninsula were relatively large, sufficient to support open-water whaling activities. A large number of whaling harpoon heads have been unearthed from Punuk cultural sites on St. Lawrence Island, indicating that whaling was highly active among the island's Punuk inhabitants. By the time of the Thule period, the scale of whaling had expanded significantly—not only on the Chukchi Peninsula on the western side of the Bering–Chukchi seas, but also on St. Lawrence Island in the Bering Sea and along the northwestern coast of Alaska. During this time, caribou hunting also remained an important component of the subsistence economy (Anderson, 1983).

In Anderson's argument, although cultural migration and technological innovations contributed to changes in prehistoric Eskimo history and culture, the fundamental driving force was climate change. For example, according to paleoclimatic data, the Arctic entered a warming period beginning around 900 CE, which coincides with the eastward migration of the Alaskan Eskimo. Anderson (1983) hypothesizes that during this period, sea ice in the Arctic Ocean began to melt, causing whales to migrate toward the nearshore areas of the High Arctic in North America, and consequently, human whaling activities also shifted northward into Canada's High Arctic regions. Anderson's climate change hypothesis is clearly influenced by the earlier work of Canadian archaeologist McGhee, who has previously attributed the eastward migration to rising temperatures (McGhee, 1969/70). However, based on current research, the chronological data Anderson relies upon are now considered inaccurate. The Eskimo migration dates he uses in his 1983 paper are derived from measurements made in the 1960s. In contrast, McGhee's 1984 study revises the start of the migration to around 1200 CE (McGhee, 1984), and this revised chronology has since been widely accepted in Arctic archaeology. Given this discrepancy in timing, Anderson's inference linking cultural change directly to climate change is difficult to sustain.

Ackerman also uses climate change to explain cultural transformations. The Norton culture, distributed in the northwestern region of Alaska, predates the NMT and dates back approximately 2500 to 2000/1800 years ago. This period coincides with a historical cooling phase in the Northern Hemisphere known as the "Sub-Atlantic Interval", which lasted from 2900 to 1600 years ago. The Norton people sustained themselves through a combination of marine hunting, terrestrial hunting, and fishing. The discovery of whaling harpoon heads at sites near Ipiutak

suggests that whaling may also have been part of the Norton economy (Ackerman, 1988).

Around 2000 years ago, the Norton culture was rapidly replaced by the Ipiutak culture, an event that occurred during the late Sub-Atlantic Interval (2000–1600 years ago), when temperatures rose and the climate became relatively warmer. The Ipiutak culture saw a significant population increase, larger settlements, greater social complexity, and the development of a highly diversified economy. While they still engaged in marine hunting, their subsistence relied more heavily on terrestrial hunting, and whaling was not a prominent activity (Ackerman, 1988).

Simultaneously, this warm period also gave rise to the Okvik and OBS cultures, which represent the initial stages of Neo-Eskimo prehistory. Primarily distributed along the Chukchi coast and islands of the Bering Strait, these cultures were characterized by their inhabitants' sophisticated understanding of tidal movements, seasonal ice patterns, and the migratory behaviors of marine mammals. This knowledge enabled them to develop an economy heavily reliant on marine hunting. Their permanent settlements were often strategically located along whale migration routes during spring and autumn, indicating that whaling had become an established practice. Ackerman (1988) suggests that, much like the Ipiutak culture, the Okvik/OBS cultures emerged during the transitional phase from the Sub-Atlantic Interval to a warmer climatic period known as the Scandic Interval. Rising temperatures reduced sea ice coverage, facilitating whale migration through the Bering Strait region and thus supporting the development of these maritime-adapted societies.

However, around 1200 CE, the Northern Hemisphere entered another colder phase, which triggered the emergence of the Birnirk and Punuk cultures—both characterized by large-scale whaling activities. Along the coastal regions of the Chukchi Peninsula, from Anadyr Bay to the mouth of the Kolyma River, numerous whaling settlements of the Punuk and Birnirk cultures have been identified. In Alaska, Birnirk sites are primarily distributed along the Chukchi Sea coast, spanning from the Seward Peninsula to Point Barrow. By 1000 CE (approximately 950 BP), the onset of the Medieval Warm Period facilitated the southward expansion of the Thule culture into the Bering Sea region and their eastward migration into the Canadian Arctic (Ackerman, 1988).

Ackerman's analysis hinges on the assumption that temperature changes directly dictate sea ice conditions, which in turn determine the viability of certain subsistence practices (e.g., whaling vs. terrestrial hunting). However, Mason and Gerlach (1995) contend that sea ice variability is influenced by multiple factors beyond temperature, including ocean currents, wind patterns, and salinity changes. For instance, the "capacitor effect" observed in the North Atlantic suggests that seasonal sea ice dynamics can

amplify or dampen climatic variability independently of long-term warming or cooling trends. Thus, attributing cultural shifts solely to temperature-driven ice conditions may overlook other critical ecological and social factors.

Ackerman's interpretation also faces other issues. For example, at the time of his publication, the exact starting date of the Ipiutak culture had not been firmly established. Therefore, whether its emergence actually corresponded with the beginning of a warm period remains debatable (Mason and Gerlach, 1995). Additionally, whether the Birnirk culture engaged in whaling activities is still disputed today. Simply classifying them as a whaling society to fit a climate-driven narrative of sea ice changes is problematic.

4 Hotspots and a cultural ecological model

Mason and Gerlach (1995), however, advocate for an ecologically grounded approach to interpreting the cultural dynamics of whaling communities. According to oceanographic data, the Anadyr Bay in the northwestern Bering Sea features a cold-water upwelling that rises to the upper ocean layers, forming the nutrient-rich Anadyr Current. This current flows northward through the Bering Strait, extending as far as the fringes of the East Siberian Sea and even reaching the margins of the Laptev Sea. Within the southern Chukchi Sea, the Anadyr Current generates several ecological "hotspots". These hotspots form due to the abundance of nutrients, which attract concentrations of whales and walrus. Whales follow these nutrient-rich currents along the ice edge, establishing an annual migration pattern tied to the movement of these productive zones.

The nutrient-rich hotspots created by the Anadyr Current include several key locations: Point Hope on the Alaskan side, Cape Dezhnev (also known as East Cape) at the easternmost tip of the Chukchi Peninsula, and the eastern end of St. Lawrence Island. The Wales area in western Alaska also lies close to one of these productive zones. Mason and Gerlach observed that these hotspot-adjacent areas coincide with high concentrations of prehistoric cultural sites. Based on this correlation, they propose a "core-periphery" model, identifying Point Hope, East Cape, and St. Lawrence Island as core cultural regions, while classifying other sites as peripheral zones. For instance, the presence of high-status burials at the Ekven and Uelen sites on the Chukchi Peninsula suggests that these areas may have held dominant political power during certain periods. Following the OBS and Ipiutak periods, prehistoric populations expanded into peripheral regions like Norton Sound and Kotzebue Sound. This dispersal likely resulted from population growth and technological advancements, such as the adoption of dog sleds and improved watercraft, which significantly enhanced their

ability to access resources over wider areas. It's important to note that these "peripheral" zones were only marginal in terms of marine resource availability. Terrestrial resources, such as caribou hunting, remained economically vital in these areas. By integrating oceanographic data—including nutrient upwelling dynamics, biological productivity patterns, and human ecological adaptations—Mason and Gerlach developed an ecological model that moves beyond oversimplified climate-based explanations. Their framework emphasizes the interplay between marine productivity hotspots and cultural development while accounting for technological and demographic factors (Mason and Gerlach, 1995).

In Mason and Gerlach's ecological model, population density, resource stability, and surplus reliability emerge as critical factors. Their analysis reveals that the Chukchi Peninsula coast sustained higher population densities and greater resource stability—likely due to its proximity to seasonal whale migration routes during spring and autumn. Moreover, this region exhibited significantly more reliable surplus production compared to Alaskan coastal areas. On the other hand, the model also accounts for short-term variability: climatic shifts could temporarily displace these productive hotspots toward Alaskan waters (Mason and Barber, 2003).

Mason and Valerie Barber explore the relationship between the formation and flourishing of whaling culture and climate change in their joint paper. They place greater emphasis on establishing a cultural-ecological model based on climate change. Numerous gray whale skulls have been discovered at several archaeological sites in Ekven and Uelen on the Chukchi Peninsula (180 BCE–560 CE). According to paleoclimatic data, the period before 200 CE was relatively cold. The subsequent OBS and Ipiutak cultures thrived during a warmer climatic interval, approximately between 550 CE and 900 CE, with subsistence strategies centered on sealing, walrus hunting, and reindeer herding, supplemented by occasional whaling. After 900 CE, temperatures dropped and storm intensity increased. The OBS and Ipiutak cultures declined, while the Punuk and Birnirk cultures emerged. Population numbers rose significantly on both the Chukchi and Alaskan sides. Punuk culture in the Ekven site yielded abundant remains of small whales, alongside a notable increase in bowhead whale bones. Based on this analysis, Mason and Barber argue that colder climates favored whaling, as intensified storms enhanced nutrient upwelling, attracting more whales. However, they emphasize the linkage between population density, settlement patterns, and cultural dynamics. In their view, whaling generated surplus production, driving settlement expansion and population growth. After 1200 CE, temperatures rose again. Mason and Barber propose that this warming trend, combined with demographic pressures in Alaska, triggered the Thule migration eastward. Their key emphasis is that climatic changes created new ecological conditions, and these ecological shifts—rather

than climate alone—directly catalyzed societal transformation and cultural replacement (Mason and Barber, 2003).

5 Whaling activities and the formation of social organizations

Marine hunting activities were crucial to the formation of social organization among prehistoric Eskimo societies. According to ethnographic records, whaling required a crew of several people operating an open umiak boat, with each boat typically carrying six to ten crew members. The leader of the whaling team was usually the owner of the boat and possessed the coordination and leadership skills necessary for directing collaborative hunting efforts. In the Eastern Arctic, multi-person umiaks often conducted whaling in coordination with single-person kayak boats. Occasionally, successful whale hunts were achieved solely through the cooperation of multiple single-person kayaks. In any case, effective collaboration among team members, between boats, and between the crew and their leader was essential to the success of the hunt (Whitridge, 1999).

Both Spencer (1959, 1972) and Burch (1975, 1981) have studied the relationship between whaling activities and forms of social organization among the Eskimos based on ethnographic research, providing an important foundation for archaeologists seeking to reconstruct prehistoric whaling societies. Spencer argues that whaling gave rise to three of the most distinctive features of Inupiaq society in northwestern Alaska. First was the social role of the umialik, the leader of the whaling crew. Second was the significance of the men's communal house within the settlement. Third was the practice of hiring strangers during the formation of whaling teams (Spencer, 1972). Unlike Spencer, Burch emphasizes the leadership role of the umialik and the structure of relationships between the leader and the whaling crew. Through his examination of ethnographic data, he argues that 19th-century Inupiaq society was primarily composed of relatively autonomous grassroots social units. These basic social units were called *ilagiit* in the Inupiaq language, meaning "extended families". In addition, larger groupings known as *amilraq*—"expanded extended families"—also existed. Each *ilagiit* or *amilraq* group of men typically formed an independent whaling crew. As a result, Burch (1981) rejects Spencer's emphasis on the hiring of strangers and instead highlights the central role of kinship in Inupiaq social organization.

Wenzel proposes a more balanced, intermediary perspective. Based on his research in the 1970s on a whaling village on Baffin Island, Canada, composed of four families, he observes that these families indeed formed an "extended family" structure adapted to whaling activities. The core social organization was indeed characterized by kinship ties, but the hiring of outsiders also occurred. Moreover, different kin-based units could even merge to

form a single whaling team (Wenzel, 1981).

Whether prehistoric Eskimo social organization originated from whaling or walrus hunting is also a subject of ongoing debate in Arctic archaeology. Erica Hill argues that the formation of prehistoric Eskimo social organization was more likely driven by walrus hunting rather than whaling. In the case of hunting smaller marine animals like seals, one or two family members were typically sufficient. However, hunting larger animals such as walrus required more people than a single household could provide. Although walrus hunts were smaller in scale than whale hunts, they still demanded cooperation among members of different families, necessitating a certain level of organizational complexity. Therefore, before large-scale whaling emerged, walrus hunting played a key role in the development of social complexity. It served as a form of preparation and practice for the more demanding coordination required in whaling activities (Hill, 2011). Mason and Rasic have proposed similar arguments, suggesting that walrus hunting led to increased wealth, the emergence of surplus resources, and overall economic development. As a result, society acquired the organizational mechanisms necessary to engage in the more complex operations required for whaling activities (Mason and Rasic, 2019).

It appears that Hill sought to establish an evolutionary model progressing from walrus hunting to whaling. However, Whitridge's analysis of ethnographic data from the Bering Strait region reveals numerous similarities between walrus hunting and whaling activities. First, both marine species exhibit seasonal migration patterns along with drifting ice. Second, both hunting practices employ toggle harpoons, floats, and lances. Third, both activities rely on coordinated teamwork among umiak crews. Fourth, in both cases, the crew members follow the command of a high-status boat captain. Whitridge further notes that while the Okvik/OBS cultures on St. Lawrence Island have yielded large quantities of walrus bones but only sparse whale bones, significant remains of bowhead and gray whales have been unearthed at Okvik/OBS Sea sites on the Russian Chukotka Peninsula. This evidence suggests that whaling was not merely an occasional activity in early Chukotka Eskimo cultures. Although individual villages were typically only large enough to support a single umiak crew, multiple villages could collaborate to organize an effective whaling fleet. (Whitridge, 1999). Whitridge's findings indicate that whaling and walrus hunting probably functioned as parallel subsistence practices, each playing a significant role in advancing the social complexity of prehistoric Eskimo communities.

6 Conclusion

The archaeological evidence surrounding Arctic whaling reveals a long-term, complex interplay between human societies and their marine environments. From the

early emergence of the NMT to the expansive Thule culture, whaling practices were not only subsistence strategies but central pillars in the formation of social organization, technological innovation, and cultural identity. This study has illustrated that these cultures exhibited both flexible ecological strategies and resilient social structures, though within certain limits.

The flexibility of their ecological strategies is evident in the adaptive shifts between primary prey species. As Arne Kalland (1993) notes, many Arctic regions traditionally rely on renewable natural sources for their livelihood, including both marine and terrestrial mammals, as well as fish, birds, and plants. However, the availability of these resources "is highly unpredictable in that they vary greatly between seasons and from one year to the next" (Kalland, 1993). As outlined in the debates between climate and ecology models, cultures like Punuk and Birnirk intensified whaling as storm-driven upwelling increased whale populations, while contemporaneously maintaining hunting of seals, walrus, and caribou. This diversified subsistence base allowed communities to reduce risks of the failure of any single resource. Whaling was clearly a very important part of these resource acquisition systems.

The resilience of their social structures was rooted in the cooperative demands of marine hunting. As suggested by Hill (2011), Mason and Rasic (2019), and Whitridge (1999), the social organization around the umialik and the whaling crew created a system that could scale up from walrus hunting to the more complex enterprise of whaling. The construction of large communal houses and sites like "Whale Alley" indicate ritual and social mechanisms that reinforced group cohesion and identity, further strengthening social resilience.

However, the very succession of cultures within the NMT also underscores the limits of this flexibility and resilience. A changing climate could displace marine productivity hotspots, as Mason and Gerlach's model shows, potentially overwhelming a society's adaptive capacity. The replacement of the OBS culture by Punuk, and the eventual rise of Thule, suggest that existing social and ecological strategies were at times inadequate to cope with profound, synergistic changes. The collapse or transformation of a cultural tradition marks the boundary beyond which its specific adaptations could not hold.

Ultimately, as Sakakibara (2020) powerfully conveys, the relationship between the Inuit and whales extends far beyond utilitarian needs—it is spiritual, affective, and deeply interwoven with collective memory and belonging. This relational ontology underpins a worldview that likely further fortified societal resilience. Recognizing this interdependency between ecological flexibility, social resilience, and cultural worldview is crucial not only for understanding the dynamism of Arctic prehistory but also for appreciating the depth of Indigenous strategies for navigating environmental uncertainty, both in the past and for the future.

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