RECONSTRUCTING MID-ATLANTIC NATIVE AMERICAN
NET-MAKING TECHNOLOGY

by

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ABSTRACT

The work of Clem Carney, the last known Lenape net maker, inspired this study of fishing nets, their construction, and materiality from Native groups throughout the Mid-Atlantic region. For this research, I located and examined nets and associated tools at both the National Museum of the American Indian and the American Museum of Natural History, and compiled all data in systematic examination forms. I consulted with the Lenape Tribe of Delaware in every step of the research. I then shared my findings in numerous public and tribal forums and taught net-making through public workshops held at the Biggs Museum of American Art in Dover, DE. Through these events and a range of media posts and articles, at least 5,550 people learned about this collaboration between the field of art conservation and an indigenous community, prompting greater respect and interest in the work of Clem Carney and the material culture of Native Mid-Atlantic groups as a whole.
Chapter 1

INTRODUCTION

Among Native groups of the Mid-Atlantic, historic fishing nets represent both a lost craft and a reminder of how their ancestors once sustained themselves along the Atlantic coast and the shores of the Delaware and Chesapeake Bays. For the Lenape Tribe of Delaware, the work of the last community net maker, Clem Carney, offers a specific point of pride. Carney’s nets and tools were collected in the early 1900s by the cultural anthropologist C.A. Weslager, who illustrated them in his work *Delaware’s Forgotten Folk*. While two of these objects can be found within the collections of the National Museum of the American Indian at the Smithsonian Institution, most cannot be found or have not been preserved. This loss highlights years of misidentification and neglect of the Lenape Tribe of Delaware. It also points at a need to study, understand, and preserve this once crucial technology—a need which this research attempts to fill.

I proposed this project in collaboration with the Lenape Tribe of Delaware. I have investigated all extant examples of historic Mid-Atlantic Native American fishing nets within museum collections in a technical study that incorporates not only descriptive analysis but also replication of the observed construction methods (Drooker and Webster 2000, 1). Such a study not only enables the revival of the net making craft; it ultimately preserves a valuable part of Lenape heritage for future generations.
In this research, I provide a history of the Lenape Tribe of Delaware and Clem Carney before discussing fishing nets in general. I then assess the nets which I personally studied in the collections of the National Museum of the American Indian and the American Museum of Natural History. I also provide a synopsis of the various outreach events I organized among the tribe and the greater state-wide community before proposing steps for future research.
Clem Carney, the Lenape’s last community net maker, was born in Cheswold, Delaware shortly after the American Civil War, and his descendants still live in the same area today. Carney’s nets, as well as those made and used by his native contemporaries throughout the Mid-Atlantic, harken to a technology used for millennia prior to the arrival of European colonizers and centuries afterward. Carney was not recognized as a Native American when his materials were collected in the 1940s. However, the Lenape Tribe of Delaware recognizes the value of his and similar materials. They see their preservation as central to highlighting and preserving their cultural heritage at large. This chapter provides a brief survey of the community’s long and once forgotten history.

Colonization of Lenapehoking

In 1610, English explorer and captain Samuel Argall found a bay north of the Chesapeake on the Atlantic Coast. In honor of the then governor of Virginia, Thomas West, the Lord of de la Warre, Argall, named the bay—and consequently the surrounding region and peoples—Delaware (Stonefish Ryan 2007, 37). Delaware has since been adopted as an appropriate name for the indigenous peoples of the region and their descendants. However, Lenni Lenape, meaning “the people,” is how these groups traditionally referred to themselves (Weslager 1978, 3).
Prior to the arrival of European colonizers, the Lenni Lenape lived in semi-
permanent communities along the Delaware and Chesapeake Bays and their tributaries in what is now New Jersey, Delaware, eastern Pennsylvania, southern New York, and western Connecticut (Figure 1). The Lenape are an Algonkian group, historically referred to by many of their fellow Algonkian tribes as “grandfather” (Garbarino and Sasso 1994, 311). The Lenape language includes two dialects: Unami, which was spoken among the southern tribes, and Munsee, spoken in the north (Kraft 1984, 1). The Munsee are today considered a sub group of the Lenape.

Figure 1: Approximate area of Lenapehoking, with names of bands recorded by early explorers and colonists. (Kraft 2001, 2).
While Europeans are recorded to have visited “Lenapehoking,” land of the Lenape, as early as 1524 (Kraft 1984, 22), colonization of the region did not begin until 1609, during the third voyage of Henry Hudson (Kraft 1984, 23). Between 1638 and 1664, the region was controlled by the Swedes, and then the Dutch, before finally becoming part of the English colonies.

While peoples living along the east coast of modern-day North America are believed to have exploited the local environment of lakes, rivers, and coastlines since approximately 8000 BCE (Garbarino and Sasso 1994, 229), no written record prior to colonization exists. Numerous colonists and missionaries documented and even published their first hand accounts and observations of the Lenape. However, there is no account of their daily lives or “material, spiritual, and social conditions” (Kraft 2001, 24). The majority of existing accounts are biased and inaccurate, if not indisputably hostile. Johan Printz, governor of New Sweden from 1643 to 1653, wrote in a letter to his superiors:

Nothing would be better than a couple of hundred soldiers should be sent here and kept here until we broke the necks of all of them in the river….and also we could take possession of the places (which are most fruitful) that the savages now possess (Kraft 2001, 23).

This greed for land and disrespect of its inhabitants has been the leading cause of mistreatment of indigenous North American populations by Europeans. As one of the
first indigenous groups to interact with Europeans, the Lenape have been severely affected. Since the beginning of colonization, the Lenape either acculturated, converting to Christianity and marrying white colonists (Kraft 2001, 24), or moved. “In the early eighteenth century, the Iroquois assumed control over the Lenape” throughout Lenapehoking (Garbarino and Sasso 1994, 312). Thus the pressure for Lenape to leave their traditional lands was coming from both the Iroquois and white settlers.

**Lenape Migration**

The mass migration of Lenape peoples has been described in detail in C.A. Weslager’s text *The Delaware Indian Westward Migration*. Their first known migration destination was the Susquehanna River Valley, in what is now western Pennsylvania (Weslager 1978, 12), The region was then under the claim of the Six Nation Iroquois, allies of the English government. In successive migrations, instigated in part by the French and Indian War of 1754, Lenape groups went west to Ohio. Some also traveled north to Ontario, where a Munsee-Delaware Nation is still located. The Lenape lived in these locations in relative peace for the subsequent twenty years, with many in Ohio moving into Moravian mission towns where they converted to Christianity (Weslager 1978, 31). The group, however, was seriously disrupted by the American Revolution; following ample bloodshed in the Ohio Frontier, the Greenville Treaty was signed in 1795. The treaty gave the indigenous populations living in the region the sole right to “occupy lands lying west of the Cuyahoga River and south and west of the Great
Lakes as far as the Mississippi River” (Weslager 1978, 49). Thus, the Lenape, now mixed with white captives and without its members who converted to Christianity, moved again: into western Ohio and Indiana.

With a growing need for agricultural land and a hunger for expansion, the United States government continued to push the indigenous populations west. In 1823, immediately after being forced west of the Mississippi into western Missouri, Lenape were documented living in Oklahoma, Arkansas, Illinois, Ohio, Wisconsin, and Canada (Weslager 1978 215). In 1868, after 38 years living in eastern Kansas, the Lenape were once again forced to move, this time to Oklahoma, where the federally recognized Delaware tribe is still based.

The “Forgotten Folk”

In his 1978 work, Weslager chronicles this journey of the Lenape, commonly referred to as the Delaware, peoples from Delaware, Pennsylvania, and New Jersey west to Ohio, Indiana, Illinois, Missouri, Kansas, and finally Oklahoma. He also provides a list of where the 4,708 Delaware Indians of voting age lived in 1977 (Weslager 1978, 251). According to these data, obtained at the time from the Delaware Tribal Business Committee, Delaware people lived in 45 US states and Washington, D.C. The state of Delaware is not listed.

The belief that Lenape people no longer lived within “Lenapehoking” persisted late into the 20th century. Weslager’s 1977 figure states only 29 Delaware adults lived within New York, New Jersey, and Pennsylvania at the time, with no mention of the
states of Delaware or Connecticut. The map showing the approximate area of Lenapehoking provided by Kraft in 2001 (Figure 1) references the names of bands as recorded by colonial-era explorers. It suggests that much of the state of Delaware was either uninhabited by Lenape or not recorded by Europeans. Although controversial, archaeological excavations of the region suggest the latter (Miller 2001).

Today the Lenape Indian Tribe of Delaware, located in Cheswold in Kent County (Figure 2) is one of two state recognized tribes within the state of Delaware. The tribe, under the leadership of Principal Chief Dennis Coker, formed a constitutional tribal government in 2010 and after a 26-year battle was recognized in 2016 (Schmidt 2018). Although the tribe “has an unbroken history of hundreds of years of settlement and continued residency in the vicinity of” Cheswold and “can date their ancestral ties as far backs as the early 1700s” (29 DE Code 106 2016), the lengthy battle for recognition was due in part to decades of misidentification by leading anthropologists.

In 1912, responding to rumors that people claiming Indian ancestry lived in the region, University of Pennsylvania anthropologists Frank Speck and Wilson Wallis, arrived in southern Delaware. The visit would spark a lifelong study for Speck, a
student of Franz Boas, and his student C.A. Weslager. Both men collected objects, stories, and observations from the indigenous populations in the region, whom Weslager referred to as “Delaware’s Forgotten Folk.” Both men studied ancestors of today’s modern Lenape community in Cheswold, including Clem Carney (Fig. 3), who Weslager describes as an aged fisherman and amusing story teller—a status confirmed by Chief Dennis Coker (Coker 2018). Despite their close studies and interactions with the community, neither Speck nor Weslager identified Carney and his relatives as Lenape, but instead Moors. For much of the early 20th century, the Lenape people of Delaware were referred to as Moors, supposed peoples of Spanish descent, despite their obvious resemblance to their indigenous neighbors the Nanticoke. In his work, Weslager provides numerous myths regarding the origin of the Moor community in Cheswold, accurately noting the high amount of intermarriage between the community, the Nanticoke, and African Americans within the region. Yet, he fails to recognize their Native American identity.

In 1948, however, the Smithsonian Institution did refer to the tribe as “a surviving
Indian group of the eastern U.S.” (29 DE Code 106 2016), while still failing to identify them as Lenape.

Many factors, including misidentification, displacement, intermarriage, and acculturation have resulted in the loss of traditional lifeways within the Cheswold Lenape community. Additionally, as Barbarino and Sasso so poignantly note,

The Atlantic seaboard was the scene of the first European colonies, and consequently of the first and most complete damage and destruction to Indian societies. Native American life was so disrupted that little was left to be recorded by the time scholars realized what had happened (Garbarino and Sasso 1994, 301).

The Lenape Tribe of Delaware, unlike other Delaware groups who, despite resettlement, remained as a cohesive group in either Canada or Oklahoma, has struggled to retain its Native identity while surrounded by white colonizers for over 400 years. While fortunate to have remained on the land of their ancestors, due to their small group and forgotten and even misidentified status, the Lenape of Delaware and their lifeways have been more heavily affected post-contact than many other tribes within the United States.

As a part of the prolonged battle for state recognition, the community has been working to revitalize traditional lifeways, such as cooking, herbal medicine, and crafts. Today, no one within the Delaware Lenape community makes fishing nets, a practice that most likely sustained their ancestors for thousands of years and is still relevant as
they fight to remain close, both spiritually and physically, to the water that surrounds them.
Chapter 3
NET MAKING

Nets used by fishermen today differ in material and scale from those used historically; they can cost millions of dollars and measure miles in length, posing a huge environmental threat (UN News 2016). However, their overall structure would not be entirely foreign to Clem Carney and the net-makers examined in this research. Almost all fishing nets, exempting the most modern synthetic “knot-less” netting materials, have the same general construction.

Net Construction

Nets are “produced with one single continuous thread or element (at least in theory) which is worked into meshes at definite and repeated intervals” (Seiler-Baldinger 1994, 7). The construction of a single-element fabric with meshes of fixed dimension and of almost any size is made possible by the addition of securing knots (Seiler-Baldinger 1994, 7). Thus, netting is also considered a type of knotted looping: “a single element loop structure in which the loops are secured by knots” (Emery 1980, 34). All nets are tied using two fundamental tools: a gauge (also known as a paddle) (Fig. 4), which allows for the repeated construction of meshes of fixed dimension, and a shuttle (also known as a needle) (Fig. 5).

These tools also differ very little throughout time and region. Frank Speck noted, in reference to a collection of Mattaponi shuttles currently housed at the
National Museum of the American Indian Cultural Resource Center, that the implements are “practically identical with those of eastern Algonkians now from North Carolina to Labrador” (Speck 1928, 231). Throughout Native North American groups, the biggest difference among these tools is the material from which they were made; bone and wood are both common. During the tying process, the shuttle, which is loaded with cordage, is wrapped around the gauge. It carries the entire length of cordage through the resulting loops to create a knot, resulting in a singular mesh (Fig. 6). The process is repeated, with each new mesh created by leading the entire cordage length through the mesh last formed, resulting in linear, uniform rows.
Netting Knots

Knotted fabrics can be highly diverse based on the wide variety of knots used to secure the meshes. Many of these possibilities are well illustrated in Emery’s work *The Primary Structure of Fabrics*. However, the most common knot found in fishing nets is unsurprisingly the so-called fishnet knot (Fig. 7), which is fundamentally a variation of the sheet bend (Seiler-Baldinger 1994, 22) (Fig. 8). When tying a sheet bend, the working thread, which is guided by the shuttle, “passes through the pendant loop in the previous row, wraps around its two ends and crosses over its ascending portion before leaving the loop” (Seiler-Baldinger 1994, 21).

The fishnet knot is typically made with stiffer materials, allowing for a more fixed position of the cordage. If the material is more pliant, the knot is easily “converted into the sheet bend knot by tightening the crossing ends” (Seiler-Baldinger 1994, 22). This knot type is asymmetrical and varies based on the dominant hand of the maker. Additionally, Benjamin Dize, a non-native net maker from Crisfield, MD, located in the southern Chesapeake, uses a clove hitch when netting (Fig 9). This is a symmetrical knot, which I have found to work well in my own net reconstructions.
Net Making Today

In the case of fishing nets, the uniform network created during the knotted looping process has the ability to filter water and smaller particulates, while preventing the escape of targeted marine life. Based on the ample amount of “how to” workbooks available today, it is clear that net making has become a hobbyist’s pastime, with common projects including satchels and basketball nets. It is also apparent that throughout the Mid-Atlantic, only the rare aged fisherman maintains traditional fishnet tying skills, as such skills are no longer viable in the highly competitive fishing industry.

To this day, however, the fishing culture of the Mid-Atlantic, and the Delmarva Peninsula specifically, remains very strong. The fishing industry, which relies on watermen of the Chesapeake and Delaware Bays, is key for the economy of Virginia, Maryland, and Delaware (Delmarva Fisheries Association, Inc. 2019). These waterways, which are warmed by the Gulf Stream, once teemed with “trout, flounder,
bluefish, crabs, oysters, clams, tarpon” and a variety of migrant waterfowl (Drummond Ayres 1982). Many men, particularly on islands such as Tilghman, Smith, and Tangiers, live similarly to the people that fished the bays and rivers of this area years ago. It is on such islands where the skill of net making still survives (Dize 2018). While the fishermen in these communities are of non-Native descent, their tying methods and resulting nets are probably very similar to those found historically throughout Native Mid-Atlantic groups.

Net Types

The largest influence on variation among fishing nets is their intended use. The shape, dimensions, and mesh size of a net varies based on where it was meant to be used and what type of fish it was meant to catch. Native fishermen throughout the Mid-Atlantic would have had options based on their location to fish in the open bays or in an estuary or creek, each requiring different fishing practices. Clem Carney, for example, is known to have fished in the Leipsic River, a tributary of the Delaware Bay. Common nets used within rivers included fykes or weirs (Fig. 10). These tube-like nets have an interior funnel which allows fish to swim in but not exit and would have been staked in flowing water to catch anadramous fish during large migrations. Other nets that could have been used in a similar matter were seines or drift nets (Fig. 11). These long rectangular nets are weighted or staked in place and act similar to a wall to trap migrating fish. While

Figure 10: Diagram of a simple, three-hoop fyke (VectorStock)
seines are often weighted on the bottom to keep them in place, fykes are comprised of netting around wooden hoops that allowed them to be buoyant in the moving current. Weslager states that Clem Carney and the Lenape community used both fykes and seines (Weslager [1943] 2006, 185).

Common fish found in rivers throughout the Mid-Atlantic include yellow perch, striped bass, croaker, shad, herring, sturgeon and drum. Carney specifically is said to have caught perch, bluefish, and bass using small-meshed nets and carp in large-meshed nets (Weslager [1943] 2006, 185). These meshes ranged between approximately one and two inches wide (Weslager [1943] 2006, 185). Eels were also commonly caught, although they were captured using specifically designed traps. These were traditionally made of oak splints, but were later made using wire mesh (Weslager [1943] 2006, 186) (Fig. 12).

In both rivers and more open bodies of water, cast, seine, and dip nets are known to have been used by Native Mid-Atlantic fishermen. Cast nets could be either
round or rectangular. A leadline with weights attached to it goes around the perimeter of the net, allowing it to sink and entrap a school of fish (Fig. 13).

These nets also typically have handlines, which the fisherman used to cast and retrieve them. The construction of cast nets is similar to that of seines. However, instead of sinkers on both sides, seines have floats attached to the leadline on one side to allow them to create a floating net wall. Sinkers were typically made of stone. However, when stones were not available, bags of sand were successful replacements (NMAI Object Record 117018).

Typically, floats were hand carved from wood. Clem Carney definitely used seines, which were used prehistorically in the region. One of his pine floats is located in the National Museum of the American Indian collection (NMAI 246726.000) (Appendix B). While Weslager does say that Carney also used cast nets, they are believed to have been a more recent import in the Lenape community and were foreign to Carney’s elders (Weslager [1943] 2006, 184).
Additionally, Weslager’s work states that Carney made dip nets, also known as hand nets (Fig. 14). Dip nets were typically employed to catch small numbers of fish to be used as bait. These can also be used to pick crabs from the bottom of a creek or coastline. It is crucial to remember that the water these men were fishing in was much clearer than it is today, and crabs and fish could have been spotted at the bottom of a creek 10 or more feet deep (Dize 2018).

**Net Making Cordage**

In addition to variable net shapes and sizes, the cordage material could vary depending on region and access. Today, fishing nets are typically made of synthetics: nylon, polypropylene, or polyester knotted or knotless material. The latter was developed in 1922 by the Japanese Nippon Seimo Co. Ltd and has numerous advantages, as spelled out by Butterworth and Coles (Coles and Butterworth 1976). Prior to the 1950s however, most commercial cordages or twines were made from plant fibers, including cotton, sisal, manila, and hemp. While commercial cordage was widely available beginning in the Industrial Revolution, it was likely not common in isolated communities, including Native communities of the Mid-Atlantic (e.g. Cheswold) until the introduction of mail-order catalogues at the turn of the 19th century. According to
Weslager, Carney used mail-order commercial cordage for his nets (Weslager [1943] 2006, 184). It is unknown what brand of cordage Carney used or what catalogue he ordered from. A list of twine companies is provided in Barbara Morton’s book *Down East Netting: A History and How-to of Netmaking*.

While few archeological or historic examples survive, fishing nets were made with handmade cordage from locally sourced plants prior to the use of the commercial cordages. Due to the limited number of examples, very little research has been done on these materials, and almost all existing research has been conducted with a western perspective, resulting in these fibers being broadly coined “Indian hemp.” During an Andrew W. Mellon Fellowship in Textile Conservation at NMAI, Nora Frankel, now Associate Conservator of Objects and Textiles at Williamstown Art Conservation Center, conducted extensive research on common fibers used in cordage of North American Woodlands cultures (Frankel 2019). Frankel’s research focuses on the identification of bast (phloem) fibers: the inner stems of certain plant species. Many of the species studied by Frankel may have been used in the production of fishnet cordage in the Mid-Atlantic, including dogbane, milkweed, nettle, slippery elm, and basswood. I encountered at least three of these fibers in the nets discussed in Chapter 4.

Due to the use of natural fibers in their construction, nets rapidly degraded and were quickly erased from both the archaeological and historical record. Fishing nets in particular, which are used in water and stored near it, are typical targets of bacterial degradation sparked and accelerated by high relative humidity levels, salt water, and
fish slime. This, paired with a loss of the tying craft, has led to today’s paucity of Native Mid-Atlantic fishing nets.

The Work of Clem Carney

As of 1943, Clem Carney was considered “the only man left” in the Lenape community who could tie a fishing net (Weslager 1978, 184). He was known throughout the region for his unique skills. Even the nearby Van Holten Pickle Factory in Kenton, DE hired him to tie individual pickle dipping nets (Weslager 1978, 186).

While Carney did teach his net making skills to other male community members, these lessons did not survive into the twenty-first century. All that is now known about his nets comes from three sources: reports from those who knew him within the community, Delaware’s Forgotten Folk by C.A. Weslager, and nets of similar construction and material.

Few people who knew Clem Carney personally survive within the Lenape community. Tribal member Patsy Cline knows that Clem taught her grandfather how to tie nets and remembers Carney tying nets in a shed at the end of his driveway (Cline 2018). Yet no one else within her family learned the craft, and I have identified no other Carney students.

Figure 15: Illustration of Clem's work in Delaware's Forgotten Folk (Weslager [1943] 2006, 186)
During his many visits to Cheswold, Weslager collected some of Carney’s tools and nets, including two gauges, two shuttles, a net float, and a dip net (Fig. 15). All of these objects are documented in *Delaware’s Forgotten Folk*, and are believed to have been donated to the Heye Collection, which was transferred to the Smithsonian Institution in 1989 and became the founding collection of the National Museum of the American Indian (*Smithsonian National Museum of the American Indian 2019*). Unfortunately, however, I could not locate all of Clem Carney’s materials documented by Weslager within the NMAI collection and am unsure whether they were traded with other anthropologists or kept by Weslager himself. I also found no evidence of Carney’s work within the collection of the University of Pennsylvania Museum, where Weslager was a student. Additionally, the nets that Carney made for the pickle factory in Kenton were most likely destroyed when the factory burned to the ground in 1987 (*Cheswold Volunteer Fire Department 2018*). Thus, to more fully understand Carney’s net-tying techniques, I examined the netting techniques of the region at large. The nets I address within this research are from a variety of Mid-Atlantic Native American tribes. Because the region’s other tribes fished in similar, if not the same, environment for the same fish species, it is safe to draw parallels between the construction of other Mid-Atlantic fishing nets and those of Clem Carney. Additionally, these nets alone provide valuable information on the region’s broader net-making tradition.
Chapter 4

TECHNICAL STUDY OF HISTORIC NETS

To fully understand the construction methods of Native Mid-Atlantic fishing nets, I examined historic period nets and the tools used to make them. I located and studied 20 nets or net fragments and 39 historic net making tools from the collections of the National Museum of the American Indian at the Smithsonian Institution (NMAI) and the American Museum of Natural History in New York, NY (AMNH). As part of the technical study, I analyzed key features relating to the construction, material, and cultural context of the nets and recorded these data systematically on examination forms which are included in Appendix B. To assist future researchers, I shared these forms with the respective institutions. The recorded features include net type and culture of manufacture, overall dimensions, material, cordage twist and diameter, mesh size, construction method, and signs of historic repair or preservation. The data are summarized in Appendix C.

Net Attribution and Provenience

It is important to note that none of the objects studied or listed in the inventory are labeled as Lenape, not even the two objects known to have been made by Clem Carney. This clearly reinforces the concept that centuries of misidentification have contributed to the Lenape Tribe of Delaware’s loss of cultural identity. The majority of the nets studied are instead listed as Nanticoke, a fellow Algonkian Tribe that the
Lenape have historically lived by along the Delaware and Chesapeake Bays. Most of the objects in both the NMAI and AMNH collections were collected by Frank Speck, C.A. Weslager’s mentor. Speck served as chair of the University of Pennsylvania’s anthropology department from 1925 to 1950, during which time he conducted field work in Delaware, Maine, Massachusetts, Maryland, North Carolina, and parts of the American Midwest. (Menyuk 2018). He specifically studied Algonkian peoples and extensively collected their material culture. Although Speck accompanied Weslager during his first visit to Cheswold, he himself did not study the Lenape.

In Delaware, Speck primarily collected in Sussex County, in what was referred to as Indian River Hundred, near the current town of Angola on Delaware Route 24. Speck sold the majority of these materials to both NMAI and AMNH between 1915 and 1919. Letters and handwritten inventories in both institutions’ archives chronicle these various sales, which included varied objects from numerous Canadian and Mid-Atlantic Tribes.

**Net Type and Construction**

The majority of the nets examined are fragmentary. I only studied two complete nets in person, but also saw three on exhibit in the Eastern Woodlands display on the third floor of AMNH. The entire sample includes four fykes, five possible seines, two possible dip nets, and five of unknown type. The two fully intact nets I studied are both Nanticoke fykes. One additional fyke is on display and could not be thoroughly examined, and one fragmentary fyke was examined at NMAI. As discussed in the
previous chapter, a fyke consists of a tubular net wrapped around wooden hoops, tied at one end. The hoops typically differ in size, with the largest at the net opening. It has an interior net funnel that guides and ultimately traps fish in the net. The net is typically staked in a current or dragged through water. Three of the four fykes still have intact hoops, all of which are made of untreated branches, possibly of willow (Coker 2018) or elm, bent and lashed together, and the number of hoops vary between three and four. Two of the fykes have pull lines which may have been used to drag the net, and those that do not were probably staked in a moving current. Additionally, three of the four nets were tied in the round; they are tubular nets knotted at one end and wrapped around the hoops before being simply turned inside to create the interior funnel. The turned in end is then tied to the interior of the knotted end with numerous cordage lengths. NMAI 032490.000, however, is composed of four net pieces. The hoops are covered in one net, tied flat, that was wrapped and seamed down one side and knotted at one end. Inside this larger tube is a funnel shaped net which would have directed fish into the net. This is attached via 14 individual cordage lengths that are knotted to the larger tube. Two large, rectangular net wings are then attached to the largest, exterior hoop. The cordage pulls are attached to these wings.

My sample also included five possible seine nets. Three of these are definite seines, due to their structure and the presence of floats. The others are considered possible seines due to their size and shape (long and rectangular) or their mesh size, which suggests they would be used to catch migrating fish.
Additionally, I examined two fragments that are triangular or funnel shaped, suggesting they may have been used as dip nets (Morton 1988, 70) or possibly the interior funnel pieces of fykes. NMAI 097119.000 is actually a net fragment in construction, with the fragment still attached to the shuttle. It has 14 meshes cast on one end with one mesh added on each row. Archival letters from Frank Speck suggest that he requested a net sample in process such as this from the Nanticoke to show the net making process.

Finally, there are five fragments for which the original construction or use could not be identified or approximated. These materials still provide useful information on net tying and, in many cases, the use of preservatives, within Native Mid-Atlantic communities.

**Commercial Cordage**

The main bodies of all of the nets are made from commercial cotton cordages. This is slightly surprising, as other commercially available cordages, such as those made from sisal or manila, are more naturally rot resistant (D’Costa 2012). However, cotton is lightweight, making it more appropriate for nets such as fykes or drift nets that are meant to be buoyant (Morton 1988, 70). Additionally, cotton is very cheap and would have been widely available for fishermen throughout the Mid-Atlantic. The average cordage diameter of the main body is 0.13 cm, with all examined ranging between 0.05 and 0.2 cm.
Six nets have additional commercial cordage elements, including thicker commercial cotton cordages used as leadlines around the exterior edges. AMNH 50.2/602 has a partial commercial cotton leadline, as well as a leadline that appears to be from commercial sisal or manila cordage, around the exterior edge. The leadlines have been lashed to the main body of the net using a third, commercial cordage. On this net, all three cordages appear to be evenly worn, suggesting they were all incorporated in the original manufacture. It is possible that the probable sisal or manila rope was chosen as the leadline for the sinker side of the net due to its greater weight and strength.

The three intact fykes have additional commercial cotton cordages used to attach the interior funnel to the top of the net, to lash the exterior netting to the hoops, to lash the hoops together, and in the case of NMAI 032490.000, to act as pull lines. AMNH NAE/0069 is not accessible for study due to its display. On the other two, the lashing and connecting cordages are slightly smaller in diameter than the main body cordages (0.05 and 0.15cm for the lashings compared to 0.15 and 0.2cm for the main body). The pull on AMNH NAE/0069 is significantly thicker than the main body (0.4cm compared to 0.15cm).

The cordages do not have any common structure, nor is a pattern apparent among cultures or net types. In total, I examined 20 different commercial cordages in both nets and remaining on shuttles. I observed the following cordage structures: S(4z), Z(3s), Z(4s(2i)), Z(3s(2i)), Z(3s(3i)), S(3i), S(2s(2i)), Z(3s(26i)) and Z(3s(10i)) (Splitstoser 2012), in addition to one indiscernible Z-twist cordage used as hoop
lashings. The Z(3s(26i)) and Z(3s(10i)) twist cordages were on thicker leadlines. The most commonly observed cordage was Z(3s), which I noted in both Nanticoke and Chickahominy nets.

**Handmade Cordage**

In addition to the commercial cordages used in the nets’ bodies, three nets have handmade cordage elements: NMAI 033805.000, AMNH 50.2/598, and NMAI 032490.000. The latter two are in tact fykes. Additionally, I examined two AMNH specimens made entirely of handmade cordage. AMNH 50.1/1621 is a braided basswood rope from a Delaware tribe of Canada, and AMNH NAE/0176 is a plant fiber net of unknown culture. Because neither of these specimens fall definitely into the geographical range of the research, they are not included in Appendix B. They do, however, provide unique examples of handmade cordage.

Both of the NMAI specimens, an unidentified fragment and fyke, had single dogbane cordage knots. Nora Frankel identified the cordage as dogbane based on the reddish color of the interior fibers, as well as their flat, wide shape. Dogbane (*Apocynum cannabinum*) is an herbaceous perennial plant with a long, straight central stem (Fig. 16). The central stem is dried

*Figures 16 and 17: Dogbane plant and photomicrograph of plant fiber (MDC Discover Nature and Nora Frankel)*
and stripped of its interior bast fibers to create cordage (Fig. 17). The cordage on NMAI 033805.000 is 1.0 cm in diameter, with a structure of Z(3s(2i)). The knot on NMAI 032490.000 is also 1.0 cm in diameter, but with a less complex structure: S(2i). The former is in much better condition than the latter, most likely because NMAI 033805.000 appears to have been previously treated with a preservative after the knot was added.

AMNH 50.2/598 has six different examples of handmade cordage. In general, this net is the most complex one I encountered. The only handmade cordage which is integral to the fyke’s structure appears to be made of milkweed or nettle. Milkweed (Asclepius syriaca) and nettle (U. dioica), like dogbane, are a perennial herbaceous plants with erect central stems (Fig. 18 and 19). The fiber, which is found in the central stalk, is very fine and milky white or gray. The fibers of both are fuzzy, and the two cannot be discerned without microscopy (Frankel 2019, 4) (Fig. 20). The milkweed or nettle cordage on the fyke measures approximately 0.1 cm in diameter and has been used to lash the bottom two hoops of the fyke together.
AMNH 50.2/598 has four other handmade cordage knots on the bottom hoop, as well as one on the exterior top knot of the net. The cordages range between 0.3 and 0.7 cm in diameter. One knot on the bottom hoop is stiff, reddish brown, and has a very unique tubular fiber structure when observed using low magnification. It appears similar to a water grass or reed. The remaining four knots are coarse and appear very similar under low magnification: they have flat wide fibers. These knots, however, vary in color between reddish brown, tan, and dark brown. To varying degrees, these handmade cordages resemble both dogbane and slippery elm, with the reddest knot most likely dogbane. However, the darkest cordage has more heavily clumped fibers and areas of intact bark, suggesting the presence of slippery elm.

Slippery elm fibers come from the interior bark of the slippery elm tree (*Ulmus rubra*) (Fig. 21). To be used as a fiber, the dense inner bark is typically washed, boiled with hardwood ash, or retted to soften it. Retting can be completed using a variety of chemicals which variably affect the fiber’s color and texture. This thus makes the fiber difficult to identify with certainty (Fig 22).

Interestingly, however, the third hoop of the fyke varies from the remaining three. It is larger than

*Figure 21: Exposed interior bark of a slippery elm tree (NBC news)*

*Figure 22: Photomicrograph of slippery elm fiber (Nora Frankel)
the one below it, and the wood is a slightly different color. In areas, the outer bark has also been stripped, revealing a fiber similar to that seen on some of the knots. It is possible that this differing hoop was a replacement and is itself made of elm. It is unfortunately impossible to say with certainty what exact plant the handmade cordages or the hoops are made of without more in depth (and possibly destructive) analysis, including polarized light microscopy and scanning electron microscopy. However, it is most likely that the four similar knots are all slippery elm of varying degrees of processing, or a combination of both dogbane and slippery elm cordages. Additionally, they are most likely made by the same hand, as they all have the same twist: S(2i).

Every example of handmade cordage I observed, except the use of milkweed or nettle on AMNH 50.2/598, serves no structural purpose. Instead they are thick cordages that serve as decoration-like elements on the nets’ exteriors. It seems that these fishermen, who retained the skill of hand-tying nets, also retained the skill of making cordage. In a modern era where cordage was available commercially, they took one step out of the arduous net making process. Nevertheless, they appear to have maintained a relationship with the environment around them, possibly grabbing and twisting fiber materials while out fishing or preparing fibers during the down season. Thus, these nets provide examples of not only utilitarian objects, but a small window into a now lost craft of cordage making that these fishermen preserved one small knot at a time.
Mesh Size and Targeted Fish Species

When nets are tied, gauges are used to determine the mesh size and ensure uniformity. These are typically hand-carved pine or oak wedge or tear drop shaped blocks of varying width. On all of the nets I examined, the meshes are roughly square. The average mesh measured approximately 3.3 x 3.3 cm diagonally. The smallest mesh is 1.9 x 2.1 cm diagonally, observed on NMAI 033805.000. The largest mesh measures 7.1 x 6.5 cm diagonally, observed on AMNH 50.1/9906. Mesh size varies based on the type of fish the net is meant to catch. AMNH 50.1/9906, a fragment 8-meshes wide, is described as a shad net. American shad, which typically measure between 8 and 14 inches in length, travel into the Chesapeake and Delaware Bays in the spring to spawn before returning to ocean waters in the summer (Chesapeake Bay Foundation 2019). Rockfish could also be caught using a similarly sized net.

The type of fish NMAI 033805.000 was meant to catch is not identified in museum records. NMAI 032473.000, which is a large fragment measuring approximately 43 x 56 cm, has meshes measuring 2.4 x 2.2 cm, is identified as a perch net. The idea that it would be used to catch a small fish species is supported by the fine cordage the net is made of. Other fish species that may be caught with a mesh of this size include croaker, trout, and sunfish. AMNH 50.1/9907, which has a mesh size close to the average, measuring 3.1 x 2.6 cm, is identified as a herring net. Herring and other anadromous fish, including shad, can also be caught using fykes. In addition to fish, other marine animals, such as crabs, turtles, and terrapins are caught with nets.
NMAI 032491.000 is believed to possibly be a turtle fyke because it has thicker body cordage.

**Signs of Historic Repair or Preservation**

Fishing nets, particularly those made of natural fibers such as cotton, easily rot and tear. The degradation is accelerated by fish slime, water, sand, and repeated use, and fishermen took numerous efforts to extend their nets’ lives. Tears and holes are easily repaired using cordage mends and mesh fills. Such repairs are seen on two nets: NMAI 032491.000 and AMNH 50.2/600. The former, the turtle fyke has numerous holes and repairs using cordage that is slightly thinner than that used in the rest of the body (0.1 vs 0.2 cm in diameter). The repairs and surrounding cordage, however, appear to have both experienced substantial use. It is most likely that the repairs were made by the original craftsman and repeatedly required as turtles bit through the fyke’s main body.

On AMNH 50.2/600, the repair is much more obvious. It has a crescent-shaped fill measuring approximately 43 by 6 cm. It measures between 1 and 3 meshes wide. The mesh dimensions within the repair vary, with the smallest measuring 2.0 by 2.2 cm diagonally and the largest measuring 3.2 by 2.4 cm. This variation in mesh size, as well as the fact that numerous knots in the fill are tied backwards, suggests that the repair was completed very hastily or not by the original maker. The repair has also not received the same treatment as the surrounding original net.

In addition to mending their nets, fishermen are also known to have treated...
them with preservative solutions. Preservative recipes from the late 19th century onward are found in handbooks and industry articles (Steven 1950, 188; Atkins and Warren 1953), but were undoubtedly used much earlier. Probably the earliest and most widely used treatment was tanning or “barking” (Steven 1950, 189). In this process, nets were soaked in warm aqueous tannic acid solutions. In North America, the tannins were typically quercitron, derived from the bark of the oak tree (Steven 1950, 189). The process helps slow the rotting process by halting mold and bacteria growth and visually darkens the net. Over time, tanning results in shrinkage and stiffness of the material. Additionally, because the tanning solution is easily removed in water, it was often fixed using potassium dichromate, which acts as a mordant for the tannins (Steven 1950, 190). Two nets: NMAI 106575.000 (.2) and AMNH 50.2/600 appear to have been treated in this way, as both are darkened and incredibly stiff. On AMNH 50.2/600 the previously discussed mesh fill is especially obvious because the fill cordage has not undergone a preservation treatment and thus is lighter and suppler than the surrounding original net.

NMAI 33805.000, a net fragment with probable dogbane knot, is also very stiff, possibly the result of tanning. However, the net also left a vibrant yellow green stain on the Volara foam that lined its museum housing. This green color suggests the presence of a copper-based preservative (Steven 1950, 194). Copper soaps, copper naphthenate specifically, are often found in store-bought deck preservers, such as Cuprinol, and were commonly used to treat nets (Steven 1950, 195). Copper oleate is a more cost-effective solution with the same effect.
One final common net preservative is wood or coal tar. Tar was typically used to coat nets more prone to mechanical wear (Steven 1950, 195) and allows for a waterproof, but very stiff coating. While seen on Nanticoke eel pots in the NMAI collection, it was only slightly splattered on nets, such as AMNH 50.2/598. This suggests that these fishermen may have been using tar on other nets or pots within their workshops and sheds.

Numerous other nets exhibit varying degrees of discoloration. It is possible these were caused by fish blood or the environments in which the nets were used. However, much more research remains to be done on the historic use of preservatives on fishing nets, especially when considering that both tanning and tar treatments could have also occurred prehistorically. To continue this research, it would be best to first identify the preservatives discussed above with certainty using analytical methods. X-Ray fluorescence spectroscopy could be used to detect metal soaps, such as copper naphthenate, while Fourier-transform infrared spectroscopy could help to identify organic compounds such as tar.
Chapter 5

NET MAKING TOOLS AND OBJECT INVENTORY

To further inform the study of the nets themselves, I examined a number of net making tools, including gauges, shuttles, floats, and sinkers at both AMNH and NMAI. Two of the tools—one float and one shuttle with cordage—were owned by Clem Carney and depicted in Delaware’s Forgotten Folk (NMAI 246726.000 and 246724.000). These materials provide insight on construction methods and how the nets were used. The shuttle used, and most likely carved by Clem Carney, is 2.4 cm wide, so it is inferred that the meshes he tied with this tool could be no smaller than 2.4 cm. Additionally, the shuttle is still wrapped with commercial cotton cordage, with a structure of S(4z), providing insight on the materials Carney used for his nets.

In addition to studying objects in person, I compiled an inventory of Native Mid-Atlantic nets and associated materials in the hope that future researchers will continue my unprecedented study of Native Mid-Atlantic fishnets. The inventory, found in Appendix D, includes 292 objects from four North American institutions: the University of Pennsylvania Museum of Archaeology and Anthropology, the American Museum of Natural History, the National Museum of the American Indian at the Smithsonian Institution, and the Peabody Museum of Archaeology and Ethnology at Harvard University. While I only examined historic materials in person, I have included archaeological materials, such as stone sinkers and ceramic sherds, in the inventory. Cordage impressions on ceramic sherds are very common in the
archaeological record of the Mid-Atlantic, and can be used to draw ethnoarchaeological parallels (Peterson and Wolford 2000, 101). For this reason, I did include the impressions in the inventory, although it is unknown whether or not the cordages were in fact used for fishing nets. Historic objects include sinkers, gauges, shuttles, floats, net fragments, and nets and represent the Pamunkey, Potomac, Nanticoke, Mattaponi, Powhatan, Chickahominy, and Delaware native groups.
Chapter 6

OUTREACH

The field of art conservation today recognizes the need to engage indigenous communities with the preservation of their material culture. As Miriam Clavir illustrates in her work *Preserving What is Valued: Museums, Conservation, and First Nations*, conservators, who have the primary goal of preserving an object for future generations, and Native groups, who often wish to use their material culture, can find themselves at odds. However, an object’s value is not purely physical. Conservators have a responsibility to preserve whenever possible not only the tangible aspects of an object by attempting to slow its physical degradation, but also the intangible knowledge it conveys: how it was made, how it was used, and what it means within a specific culture or community. To not gather this information from a source community, and to not involve a community with the preservation of their own material culture, poses as great a risk to the object’s meaning as allowing it to physically degrade.

Numerous conservators throughout North America have sought to gather this information about a variety of objects and to collaborate with source communities in the preservation of their material culture. Dr. Nancy Odegaard, Head of the Preservation Division at the Arizona State Museum, has worked for over 30 years to engage Native groups throughout Arizona in the preservation of their material culture. She is also actively training Native apprentices within the field, and is key to the
museum’s larger mission to collaborate with communities in the display and repatriation of their materials (Ravesloot 1989). Her mentorship and my internship at the Arizona State Museum under her supervision heavily guided the outreach component of this project. Similarly, Ellen Pearlstein, Professor in the UCLA/Getty Program in the Conservation of Archaeological and Ethnographic Materials, and her students have worked extensively with tribes throughout California in the preservation of their material culture. Both women and their colleagues have published prolifically about the challenges and rewards of such collaborations, and the ongoing effort to engage source communities in conservation will be a topic of discussion at the Untold Stories event at the 2019 meeting of the American Institute for the Conservation (Untold Stories 2019). However, as Nicole Marie Loya Talamantes states in her 2013 Master of Arts in American Indian Studies thesis, despite this progress, there often remains an “ocean of differences” between museum professionals, including conservators, and Native communities, whose objects they often steward.

The goal of this thesis is to help make that ocean slightly smaller and more navigable. Conservators have a unique set of skills that can be used not only to preserve an object, but also investigate its manufacture, material, and greater cultural context. At every step, this project was completed in tandem with the Lenape Tribe of Delaware. From initial proposal and onward, decisions regarding research goals and methods were made in conjunction with Principal Chief Dennis Coker and other tribal members. Additionally, the tribal community has been engaged in the project through
a delegation visit to the National Museum of the American Indian Culture Resource Center, numerous public talks, and net-making workshops.

**Tribal Delegation to the National Museum of the American Indian Cultural Resources Center**

Eighty-seven of the 292 objects listed on the inventory are housed at the National Museum of the American Indian Cultural Resources Center (CRC) in Suitland, MD. The CRC is a thoughtfully designed storage and research facility that welcomes Native and non-Native visitors from tribal, academic, artistic, and educational communities. On August 28, 2018, after my examination of the nets and related objects, I was able to organize a Lenape Delegation to the Center to see the materials. The delegation included Principal Chief Dennis Coker, archaeologist Henry Ward, Delaware Public Media journalist Sophia Schmidt, and Lenape community members Ruth Ann Purchase, Simon James, and the Cline Family: Drew and Melody Cline and their three children, Charlotte, Cannon, and Jude. Melody is a descendent of Clem Carney, and she spoke throughout the day of how wonderful it was to see her ancestor’s materials, which bore the sign of his use.

The day began with a tour of the facility led by Maria Martinez, Program Specialist. The Chief and tribal members said blessings and prayers in the museum’s designated ceremony rooms before seeing the materials. The tribe not only saw materials I was studying as part of my research; members of the CRC collections staff
showed the delegation other community objects prior to an incredibly hospitable pot luck hosted by the entire CRC staff.

During the visit, the delegation was able to meet with the conservation team, including Nora Frankel, Andrew W. Mellon Fellow in Textile Conservation. In addition to understanding the net making technology of their ancestors, the Lenape Tribe of Delaware is interested in learning about the use of natural fibers more broadly in their material culture, primarily to rebuild their connection to Mother Earth. We were all grateful to hear Nora present her research, and delegation members even tried their hand at spinning cordage.

Sophia Schmidt, who wrote an article about the day, captured the wonderful moment when Nora taught 7-year-old Charlotte Cline how to make dogbane cordage (Fig. 23), similar to that on two of the nets she saw that day.

The delegation visit had many positive outcomes. Chief Coker and tribal members made valuable connections to the collections staff and archivists that have already resulted in productive collaborations. Additionally, the delegation members

Figure 23: Nora Frankel, former Andrew W. Mellon Fellow in Textile Conservation, shows Melody and Charlotte Cline bast fibers commonly used for cordage (Sophia Schmidt)
provided me with a unique insight on how the nets and associated materials were used within the greater context of the region. Chief Coker and Henry Ward discussed the types of fish that each net may have been used to catch and how the ecology of former Lenapehoking has changed over time. Chief Coker shared personal stories of fishing as a young boy in the same waters as Clem Carney and using nets similar to those I examined. Most importantly, however, the delegation members were able to observe and connect to the materials similar to those made and used by their ancestors. Ruth Ann Purchase spoke of the strong connection to the water and the environment at large that the nets represent, calling the water where Lenape ancestors fished “their lives.” Watching Melody Cline and her children admire the shuttle and float that were used and most likely carved by their ancestor Clem Carney was incredibly powerful. I completed paperwork with the collections staff to ensure that Clem Carney’s materials will now be listed as Lenape within the NMAI records.

**Public Talks**

Following research visits at both AMNH and NMAI, I shared the preliminary findings to the Lenape community at large. Additionally, members of the delegation wished to share their experience with other tribal members who were unable to attend. I held two public lectures: one on November 17, 2018 at Immanuel Union Church in Cheswold, DE, and the other on December 3, 2018 at the Newark Natural Food Cooperative in Newark, DE. The lecture was scheduled twice so that Lenape from both Cheswold and northern Delaware, as well as scholars from throughout the state, could learn about the
research. Tribal community members and elders, University of Delaware professors, and employees from the Partnership for the Delaware Estuary attended and engaged in valuable discussion about the initial research. Chief Coker and other community members provided me with valuable feedback and suggestions on how to continue the research and best ways to engage a larger audience, which has continued to be a large obstacle.

Additionally, the Delaware State Parks learned about the project and invited me to speak to a group of approximately twenty people at Seashore State Park in Rehoboth, Delaware, as part of the State Parks Winter Lecture Series. I also presented the research as part of the University of Delaware Center for Historic Architecture and Design Symposium, titled Documenting Delaware’s Historic Architecture and Heritage on May 4, 2019. All of these events are outlined in Appendix E.

**Net Making Workshops**

In addition to technical study, this project incorporates replication research methodology (Drooker and Webster 2000, 1). Chief Dennis Coker knows that few, if any, tribal members will begin tying nets as a result of this research. However, he believes that understanding these materials is most valuable as an “exercise in reminding [Lenape] people in how resourceful they were in order to survive” and has the ability to spark a greater interest in the tribe’s material culture in general. Reconstructing an ancestral craft allows tribal members to more fully understand and to gain a greater appreciation for the object that was previously crucial to their
sustenance. Additionally, the tribe agrees that including the non-native public in the net making workshops allows for a wider acceptance and respect for Lenape culture within the state of Delaware and on a national level.

The Biggs Museum of American Art in Dover, Delaware, located approximately seven miles from Cheswold, agreed to host a series of net making workshops. The workshops coincided with the museum’s exhibition “Rooted, Revived and Reinvented: Basketry in America” and provided an exciting opportunity to bring Native American art and technology into an American art museum.

The tying workshops were held in conjunction with the museum’s admission-free Saturdays, so that the events were not cost-prohibitive and open to all community members. The March 2, 2018 workshop was well-attended by people of all ages and both Native and non-Native community members. I began the event with an introduction to the research followed by a hands-on workshop focused on tying flat nets. I provided participants with cotton cordage and plastic shuttles, as well as handouts illustrating common knots used in the net-tying process. Hand-outs are included in Appendix F. I demonstrated two different methods of casting on, so that people had opportunities to see what worked best for them and their learning style. The most enthusiastic attendee was 10-year old Peyton Vied, who adeptly cast on a net using the

![Figure 24: Peyton Vied with his first hand-tied net (Peyton Vied)](image)
horizontal method. I sent him home with materials to complete his net and was overjoyed when he enthusiastically shared a picture of the final product (Fig. 24). Peyton’s excitement was contagious during the workshop. I also found it incredibly rewarding to see a young non-Native community member excited about Native arts. The tribal members who attended and I believed the event was definitely success.

The April 6, 2019 workshop had the same structure as the March 2 event. However, the focus was on tying nets in the round. The May 4 workshop was held in conjunction with Dover Days, a long running, free event, which brings hundreds of visitors through Downtown Dover and the Biggs Museum. I developed a shorter hands-on activity for this event in collaboration with Ryan Grover, the museum’s Curator.

**Media Attention**

The scope of the project’s outreach has been broadened by unexpected but very much appreciated media coverage, outlined in Appendix G. The project has been featured on the department webpages of the University of Delaware Departments of Art Conservation, Art History, and Anthropology, as well as the departments’ various social media accounts. A blog post concerning the project was also featured on the Department of Art Conservation homepage as part of Native American Heritage month in November 2018. Additionally, Sophia Schmidt of Delaware Public Media wrote a wonderful article about the tribal delegation visit to the CRC, which was then picked up by other outlets, including National Native News, Ink Sherds: the
Archaeological Society of Delaware Newsletter, and the American Institute for the Conservation (AIC). AIC tweeted with a clear understanding of the project’s overarching aim: that conservation and technical examination of objects can play a valuable role in connecting communities with their material culture. A blog post about the project was included on the AIC website in April.

**Outreach Findings and Recommendations**

To date, this research has been featured on six different websites, including both state-wide and national news sources. It has also been acknowledged by two professional organizations in archaeology and art conservation, as well as the Delaware State Parks Department. Information regarding the project has been shared in hard copy newsletters, exhibition brochures, web articles, blog posts, and a variety of social media outlets including Twitter, Facebook, and Instagram. Additionally, the research has been presented in four public lectures in all three of Delaware’s counties, three workshops, and one University-wide symposium.

Based on attendance at these public events and the recorded number of people reached by web-based content, it is estimated that over 5,550 people have learned about this research, the work of Clem Carney, and the importance of collaboration between art conservation and indigenous communities.

There is no way to know the exact demographics of the people who have learned about this work. However, it is believed that the majority of the audience has been non-Native, even though the research was proposed and executed with a Native
audience in mind. Encouraging engagement from the Lenape community has been difficult due to larger community issues. In January 2019, one of two historic Lenape churches, Immanuel Union United Methodist Church, burned to the ground, and numerous tribal elders have passed during the course of the research. Additionally, many community members are rightfully leery of non-Native scholars and anthropologists. Weslager’s *Delaware’s Forgotten Folk* is replete with racist ideology, and even modern-day anthropologists and archaeologists in the state of Delaware have fought against the tribe’s recognition. The engagement of tribal members has grown slowly as the legitimacy and thoughtfulness of the research has been proven, but there remains much room for growth.

Despite these challenges, the project has succeeded in many ways. It has connected the Lenape Tribe with large institutions, including the National Museum of the American Indian and the Biggs Museum of American Art. Many conservators and museum professionals have also learned about the Lenape and the collaboration as a whole. Additionally, non-Native Delawareans have learned about and gained a greater respect for the Lenape through the outreach events. Two Rehobeth-based attendees at the public talk hosted by the Delaware State Parks noted how the research made them contemplate and admire how people sustained themselves in the area prior to colonization. The project has therefore prompted non-Natives to think more deeply about the cultures that came before them, certainly an accomplishment in itself.
Chapter 7
THE NETS AS STORY TELLERS

This research on Native American fishing nets has achieved two important goals of engaging the Lenape community in the study of their material culture, and in doing so, connecting them to their historic and prehistoric ancestors. Ariana Curtis, in a TED talk titled “Museums should honor the everyday, not just the extraordinary,” highlights the need for museums to accurately represent the histories of all cultures, races, and genders. She states that underrepresented groups should not only be incorporated into contemporary imagery in museum exhibits, but also historical representations, because they have always been present in the region’s history. While Curtis is referencing the representation of women, particularly women of color, this statement can be applied to all underrepresented communities. This is especially true of Native peoples, who have of course “always been there” but never fully or accurately represented.

Representations of native communities in museums and popular culture often focus on the ancient, the intricate, and the foreign. While ancient Hohokam ceramics, Pomo featherwork baskets, atlatls, and objects of war tell valuable parts of the Native North American story, they do not tell the whole story. It is essential that everyday objects from Native groups across the continent be incorporated into historic representations of the Native communities. For the Lenape, the fishing net represents their history on the Atlantic coast, as well as their contemporary ongoing fight for cultural identity.
This research has been simultaneously heartbreaking and hopeful. The loss and misidentification of Clem Carney’s materials highlight the disappearance of not only material culture but also cultural identity for the Lenape Community as a whole, due to colonization and acculturation. However, it has been heartening to witness the interest of Delaware’s cultural leaders, including Delaware Humanities, Partnership for the Delaware Estuary, the University of Delaware, Delaware State Parks, and the Biggs Museum of American Art. Both the Biggs and the American Museum of Natural History have featured these or similar nets in their exhibits, a valuable step toward displaying the less glamorous, but equally valuable material culture of Native communities.

The interest of both Native and non-Native community members proves this research has made an important contribution in documenting Lenape cultural heritage, while also allowing for a renewal and reassessment of their cultural identity. The Lenape Tribe of Delaware knows that much of the information and material that has been lost can never be reclaimed, but small steps, like net-tying can bind them to their historic and ancient ancestors. Additionally, by being displayed in larger public forums, such as museums, key cultural objects, like fishing nets, remind viewers that the Lenape have always been in Delaware. While they may have been “forgotten,” they were never gone.
Chapter 8
CONCLUSIONS

The fishing nets and net making tools of Clem Carney, which were illustrated in *Delaware’s Forgotten Folk* by C.A. Weslager, are a point of pride for the Lenape Tribe of Delaware, a state tribe which gained recognition in 2016. Unfortunately, much of Carney’s material has been lost, representing the larger loss of Lenape material culture and practices in the face of centuries of colonization and acculturation on the Atlantic coast.

Nevertheless, this study has succeeded in documenting Carney’s extant materials and similar materials from Native groups throughout the Mid-Atlantic region. Fourteen nets or net fragments were examined in collections at both the National Museum of the American Indian and the American Museum of Natural History. Data pertaining to the nets’ dimensions, construction, material, and greater cultural context were collected, and all information was compiled systematically to enable future research. Additionally, a list of all related objects pertaining to nets and net making in institutions throughout North America were compiled to encourage the continued study of Native Mid-Atlantic fishing nets. While this research has focused purely on historic materials, the list includes historic nets and net making tools, as well as archaeological net sinkers and cordage impressions on ceramics.

The Lenape Tribe of Delaware has been involved in every step of the research, and outreach has been a large and valuable component of this collaborative effort. As
part of the research conducted at NMAI, a visit was organized for a Lenape delegation that included four Carney descendants. The research has additionally been shared through traditional and social media outlets, public talks, and workshops, reaching approximately 5,550 people.

There are numerous areas where this project could be expanded or improved. Nora Frankel’s research on the identification of bast fibers in eastern Native groups is unprecedented, and her identification methods should be employed to reevaluate natural fiber cordages in museum collections throughout the United States. Many American institutions have yet to decolonize their collections, and this is a valuable step in that effort, as it helps remove the scientifically inaccurate term “Indian hemp” from museum databases. Additionally, there is currently little to no research on the use of fishing net preservatives and their identification in a technical art historical or anthropological context. The materials examined in this research should be studied using advanced analytical methods, such as infrared reflectography, gas chromatography mass spectrometry, and X-ray fluorescence spectroscopy to gain a better understanding of what materials fishermen were using to preserve their work.

Most importantly, this work should act as an impetus for increased collaborations between art conservators, material culturists, and Native groups. While the Lenape and their lifeways were “forgotten” within their home state for centuries, this project has proven that many avenues for research and study remain. While only two of Clem Carney’s net making tools were found during the course of this study, the work of the last known Lenape fishermen inspired the project as a whole. Through this
research and the associated outreach events, thousands of people learned about the Lenape Tribe of Delaware and their history, and an art form, which has been so integral to the history of the Lenape and Mid-Atlantic Native groups collectively has in many ways been revived. Participation of community members, both Native and non-Native, in this project, proves there is a strong investment and interest in the material culture and history of indigenous communities. This research has already encouraged future research on the use of natural fibers within the region and Principal Chief Dennis Coker stated, “the research has inspired our community members to get more involved, study the arts and sciences and humanities, then see how each discipline informs the other.” With this inspiration and increased involvement, this work has and will continue to encourage further study and collaboration among all participants. Clem Carney will no longer be known as the last Lenape net maker, but instead as an inspiration for generations of net makers to come.
REFERENCES


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Appendix A

NET MAKING TERMINOLOGY

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barking</td>
<td>A common net preservation technique, in which the net is soaked in a warm tannic acid solution</td>
</tr>
<tr>
<td>Basswood</td>
<td><em>Tilia americana</em>, a medium-sized deciduous tree native to North America.</td>
</tr>
<tr>
<td>Bast fibers</td>
<td>Plant fiber which surrounds the inner stem of certain plant species, commonly used in textile production</td>
</tr>
<tr>
<td>Clove hitch</td>
<td>A widely used knot, consisting of two half hitches</td>
</tr>
<tr>
<td>Dip net</td>
<td>A small, bucket-like fishing net with long handle</td>
</tr>
<tr>
<td>Dogbane</td>
<td><em>Apocynum cannabinum</em>, a perennial herbaceous plant which is native to North America, believed to have positive connotations in some native groups</td>
</tr>
<tr>
<td>Drift net</td>
<td>Rectangular, wall-like net often used in moving currents with weights on the bottom and floats on the top</td>
</tr>
<tr>
<td>Fishnet knot</td>
<td>The most common netting knot, a variation of the sheet bend</td>
</tr>
<tr>
<td>Fyke</td>
<td>A tubular net supported with hoops used to trap fish</td>
</tr>
<tr>
<td>Gauge</td>
<td>A block or stick, typically of wood, used to maintain consistent mesh sizes when making a net</td>
</tr>
<tr>
<td>Hand net</td>
<td>see Dip Net</td>
</tr>
<tr>
<td>Indian hemp</td>
<td>A broad, inaccurate term, commonly used to refer to all Native North American bast fibers</td>
</tr>
<tr>
<td>Mesh</td>
<td>One open square within a net</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Milkweed</td>
<td><em>Asclepius</em> spp., a perennial herbaceous flowering plant native to North America</td>
</tr>
<tr>
<td>Needle</td>
<td>A tool, often made of wood, used to guide cordage during net making</td>
</tr>
<tr>
<td>Paddle</td>
<td>see Gauge</td>
</tr>
<tr>
<td>Quercitron</td>
<td>Tannins derived from oak bark, using in the barking process</td>
</tr>
<tr>
<td>Seine</td>
<td>see Drift net</td>
</tr>
<tr>
<td>Sheet bend</td>
<td>An essential knot, often used to join two lines</td>
</tr>
<tr>
<td>Shuttle</td>
<td>see Needle</td>
</tr>
<tr>
<td>Slippery Elm</td>
<td><em>Ulmus rubra</em>, a species of elm native to North America</td>
</tr>
<tr>
<td>Stinging Nettle</td>
<td><em>Utrica dioica</em> a perennial herbaceous flowering plant, originally native to Europe</td>
</tr>
<tr>
<td>Tanning</td>
<td>see Barking</td>
</tr>
<tr>
<td>Weir</td>
<td>see Fyke</td>
</tr>
</tbody>
</table>
Appendix B

EXAMINATION FORMS

Institution: The National Museum of the American Indian
Catalog Number: 106575.000 (.1)
Object ID: Fishing net part/fragment
Culture of Manufacture: Chickahominy
Museum Description: Fragment of hand made fish-net
Collection History: Chickahominy River, VA/ Dr. Frank Speck

Material: commercial cordage, most likely cotton
Cordage Diameter (cm): 0.1
Cordage Structure:* Z(3s)
Overall Dimensions: (LxW): 63.5 x 21.0 cm
Dimension of singular open mesh (cm):

Observations: The net fragment has a greenish cast. The cord is frayed on the exterior edges, at large knots where weights may have once been tied. Seeds are imbedded within the frayed material, and a small amount of bird down was found within the net.
Date of Examination: August 27, 2018
Consulted:
Laura Mina, Associate Conservator of Textiles and Head of Lab, Winterthur Museum
Susan Heald, Textile Conservator, National Museum of the American Indian
Nora Frankel, Former Mellon Fellow in Textile Conservation, National Museum of the American Indian
Chief Dennis Coker, Lenape Indian Tribe of Delaware

Photographic Documentation:

*Cordage structure is described using Jeffrey C. Splitstoser’s Parenthetical Notation Method.
Institution: National Museum of the American Indian
Catalog Number: 097121.000
Object ID: Fishing net part/fragment
Culture of Manufacture: Nanticoke
Museum Description: Fragment of fish net
Collection History: Indian River Hundred, Sussex County, DE/ Frank Speck

Material: commercial cordage, most likely cotton
Cordage Diameter (cm): 0.1
Cordage Structure: * Z(3s)
Overall Dimensions: (LxW): 25.5 x 16 cm
Dimension of singular open mesh (cm):

![Diagram of open mesh dimensions]

Signs of Previous Repair or Preservation: There is minimal iron-colored staining and brown accretions on the net, concentrated around the knots.

Date of Examination: August 27, 2018
Consulted:
Laura Mina, Associate Conservator of Textiles and Head of Lab, Winterthur Museum
Susan Heald, Textile Conservator, National Museum of the American Indian
Nora Frankel, Former Mellon Fellow in Textile Conservation, National Museum of the American Indian
Chief Dennis Coker, Lenape Indian Tribe of Delaware

Photographic Documentation:

* Cordage structure is described using Jeffrey C. Splitstoser’s Parenthetical Notation Method.
Institution: National Museum of the American Indian
Catalog Number: 032491.000
Object ID: Turtle net/fyke
Culture of Manufacture: Nanticoke
Museum Description: Turtle fyke
Collection History: Indian River Hundred, Sussex County, DE/ Frank Speck
Material: commercial cordage, most likely cotton
Cordage Diameter (cm):
Main body: 0.2
Repairs: 0.1
Cordage Structure:*
Main body: Z(4s(2i))
Repairs: Z(3s(2i))
Overall Dimensions: (LxW): Larger fragment: 66 x 227 cm
Dimension of singular open mesh (cm):

3.5

2.8

Signs of Previous Repair or Preservation: The long tubular net has numerous holes and repairs using the thinner cordage. If this was in fact a turtle fyke, it is very likely that turtles bit through the cordage, requiring frequent repairs.

Observations: The fyke has a reddish brown cast. The thinner, repair cordage seems less used than that of the main body. The net was most likely once on hoops or other frame. The opening has 60 meshes. The net appears to have been made in the round, as there are no visible seams. It has two longer pulls that would have been used to pull or stake the net in a moving current.

Date of Examination: August 27, 2018
Consulted:
Laura Mina, Associate Conservator of Textiles and Head of Lab, Winterthur Museum
Susan Heald, Textile Conservator, National Museum of the American Indian
Nora Frankel, Former Mellon Fellow in Textile Conservation, National Museum of the American Indian
Chief Dennis Coker, Lenape Indian Tribe of Delaware

*Cordage structure is described using Jeffrey C. Splitstoser’s Parenthetical Notation Method.
Institution: National Museum of the American Indian
Catalog Number: 032490.000
Object ID: Fish net/fyke
Culture of Manufacture: Nanticoke
Museum Description: Fish fyke
Collection History: Indian River Hundred, Sussex County, DE/ Frank Speck

Material:
- Commercial cordage, most likely cotton
- Handmade cordage, most likely dogbane, based on its reddish brown color, coarse texture, and the flat, wide structure of the fibers (identified by Nora Frankel)
- Wood structure, most likely willow, based on the wood flexibility and color (identified by Chief Dennis Coker)

Cordage Diameter (cm) and Structure:*  
Main body: 0.15, Z(3s)
Pull: 0.4, Z(3s(10i))
Lashing: 0.05, Z(3s(2i))
Handmade cordage: 1.0, S(2i)

Overall Dimensions: (LxWxH): 70 x 70 x 340 cm
Dimension of singular open mesh (cm):

![Diagram of fish fyke]

Signs of Previous Repair or Preservation: There are small traces of red staining, and the ends of the cordage have been cut along the bottom edge.

Observations: The fish fyke was most likely made for shad, herring, or other anadromous fish. It is composed of three concentric wooden hoops and four major net fragments. The hoops are covered in one net that has been seamed down one side and knotted at one end. Inside this larger tube is a funnel shaped net which would have directed fish into the net. This is attached via 14 individual cordage lengths that are knotted with the larger tube. Two large net wings are then attached to the largest, exterior hoop. These have cordage pulls which would have enabled the fyke to be pulled or staked in a moving current.
*Cordage structure is described using Jeffrey C. Splitstoser’s Parenthetical Notation Method.*
The pulls are made from the same cordage as that used to lash the nets to the hoops. Attached
to the smallest hoop is a natural fiber cord knot, that Nora Frankel believes is made of
dogbane. It has a reddish orange cast. It is actively shedding. Overall the net is muddy brown,
most likely from use.

**Date of Examination:** August 27, 2018

**Consulted:**
Laura Mina, *Associate Conservator of Textiles and Head of Lab, Winterthur Museum*
Susan Heald, *Textile Conservator, National Museum of the American Indian*
Nora Frankel, *Former Mellon Fellow in Textile Conservation, National Museum of the American Indian*
Chief Dennis Coker, *Lenape Indian Tribe of Delaware*
Henry Ward, *Supervising Archaeologist, WSP USA*

**Photographic Documentation:**
**Institution:** National Museum of the American Indian  
**Catalog Number:** 246724.000  
**Object ID:** Net shuttle with line/cordage  
**Culture of Manufacture:** Nanticoke  
**Museum Description:** Netting needle made from white oak  
**Collection History:** USA; Delaware; Sussex County; Indian River  

**Material:** commercial cordage, most likely cotton; white oak  
**Cordage Diameter (cm):** varying width  
**Cordage Structure:** S(4z)  

**Overall Dimensions:** (L x W): 19.7 x 2.4cm  
**Observations:** The shuttle is hand carved white oak. The cordage is wrapped around the shuttle, as if ready to tie nets. There is one visible knot joining two lengths of cordage within the bundle. The tongue of the shuttle is not carved perfectly straight and is slightly bent due to the tension of the cordage. The commercial cordage is white and would have most likely been used to tie small fishing nets (croaker, perch, etc.).  

**Date of Examination:** August 27, 2018  
**Consulted:**  
Laura Mina, *Associate Conservator of Textiles and Head of Lab, Winterthur Museum*  
Susan Heald, *Textile Conservator, National Museum of the American Indian*  
Nora Frankel, *Former Mellon Fellow in Textile Conservation, National Museum of the American Indian*  
Chief Dennis Coker, *Lenape Indian Tribe of Delaware*  

*Cordage structure is described using Jeffrey C. Splitstoser’s Parenthetical Notation Method.*
Institution: National Museum of the American Indian
Catalog Number: 033805.000
Object ID: Fishing net
Culture of Manufacture: Nanticoke
Museum Description: Net
Collection History: Indian River Hundred, Sussex County, DE/ Frank Speck

Material:
- commercial cordage, most likely cotton
- handmade cordage, most likely dogbane, based on its reddish brown color, coarse texture, and the flat, wide structure of the fibers (identified by Nora Frankel)

Cordage Diameter (cm):
Commercial cordage: 0.2
Handmade cordage: 1.0

Cordage Structure:
Commercial cordage: Z(3s)
Handmade cordage: Z(3s(2i))

Overall Dimensions: (LxW): The net is too stiff to fully unfold.
Dimension of singular open mesh (cm):

![Diagram of mesh size]

Signs of Previous Repair or Preservation: The net is very stiff and dark. Additionally, the Volara lining of its storage container is stained yellow, possibly from a Cuprinol treatment.

Observations: The net was most likely used to catch perch or other small species such as croaker, trout, or sunfish. It has one handmade cordage element: a knot made of dogbane (identified by Nora Frankel).

Date of Examination: August 27, 2018
Consulted:
Laura Mina, Associate Conservator of Textiles and Head of Lab, Winterthur Museum
Susan Heald, Textile Conservator, National Museum of the American Indian

*Cordage structure is described using Jeffrey C. Splitstoser’s Parenthetical Notation Method
Nora Frankel, Former Mellon Fellow in Textile Conservation, National Museum of the American Indian
Chief Dennis Coker, Lenape Indian Tribe of Delaware

Photographic Documentation:
**Institution:** National Museum of the American Indian  
**Catalog Number:** 032473.000  
**Object ID:** Fishing net part/fragment  
**Culture of Manufacture:** Nanticoke  
**Museum Description:** Fragment perch net  
**Collection History:** Indian River Hundred, Sussex County, DE/ Frank Speck

**Material:** commercial cordage, most likely cotton  
**Cordage Diameter (cm):** 0.05  
**Cordage Structure:*** S(4z)  
**Overall Dimensions:** (LxW): Larger fragment: 43 x 56 cm  
**Dimension of singular open mesh (cm):**

![Diagram of mesh dimensions]

**Signs of Previous Repair or Preservation:** There are minor dark accretions, but no staining present. Small knots are present within the mesh. However, appears that these were made during the tying process not as repairs.  
**Observations:** The net size is appropriate for perch or croaker. It is in two fragments. Both are incredibly twisted. This could be due to storage within the museum setting or how the net was prior to acquisition. Often nets are twisted and stored in the off season.  
**Date of Examination:** August 27, 2018  
**Consulted:**  
Laura Mina, *Associate Conservator of Textiles and Head of Lab, Winterthur Museum*  
Susan Heald, *Textile Conservator, National Museum of the American Indian*  
Nora Frankel, *Former Mellon Fellow in Textile Conservation, National Museum of the American Indian*  
Chief Dennis Coker, *Lenape Indian Tribe of Delaware*  

**Photographic Documentation:**

![Photographs of the net]

*Cordage structure is described using Jeffrey C. Splitstoser’s Parenthetical Notation Method.*
Institution: National Museum of the American Indian
Catalog Number: 106575.000 (.2)
Object ID: Fishing net part/fragment
Culture of Manufacture: Chickahominy
Museum Description: Fragment of hand made fish-net
Collection History: Chickahominy River, VA/ Dr. Frank Speck

Material: commercial cordage, most likely cotton
Cordage Diameter (cm): 0.15
Cordage Structure:* Z(3s)

Overall Dimensions: (LxW): The net was too stiff to spread out for measurements.
Dimension of singular open mesh (cm):

2.3

Signs of Previous Repair or Preservation: The net is dark and stiff, with dark accretions around the knots. It is possible the net was treated with a preservative, such as a tanning solution, and after use, the preservatives only remains in the knots, not the lengths of the meshes.

Observations: The net size is appropriate for perch or shad.
Date of Examination: August 27, 2018
Consulted:
Laura Mina, Associate Conservator of Textiles and Head of Lab, Winterthur Museum
Susan Heald, Textile Conservator, National Museum of the American Indian
Nora Frankel, Former Mellon Fellow in Textile Conservation, National Museum of the American Indian
Chief Dennis Coker, Lenape Indian Tribe of Delaware

Photographic Documentation:

*Cordage structure is described using Jeffrey C. Splitstoser’s Parenthetical Notation Method.
**Institution:** National Museum of the American Indian  
**Catalog Number:** 246726.000  
**Object ID:** Net float  
**Culture of Manufacture:** Nanticoke  
**Museum Description:** Pine wood net float, drilled for cord  
**Collection History:** USA; Delaware; Sussex County; Indian River  
**Material:** pine  

**Overall Dimensions:** (LxHxW): 18 x 2.6 x 7.5cm  

**Observations:** The float is hand carved pine with a hole drilled for cord. There are cordage abrasions on either side of the hole where it would have been tied to the net.  

**Date of Examination:** August 27, 2018  
**Consulted:**  
Laura Mina, *Associate Conservator of Textiles and Head of Lab, Winterthur Museum*  
Susan Heald, *Textile Conservator, National Museum of the American Indian*  
Nora Frankel, *Former Mellon Fellow in Textile Conservation, National Museum of the American Indian*  
Chief Dennis Coker, *Lenape Indian Tribe of Delaware*
Institution: National Museum of the American Indian
Catalog Number: 097119.000
Object ID: Net shuttle and unfinished net
Culture of Manufacture: Nanticoke
Museum Description: Netting needle with mesh gauge and partly constructed net attached
Collection History: Indian River Hundred, Sussex County, DE/ Frank Speck

Material:
- commercial cordage, most likely cotton
- light colored wood, possibly white oak

Cordage Diameter (cm): 0.1
Cordage Structure: *Z(3s(2i))

Overall Dimensions (cm):
Net fragment (LxWxH): 27.5 x 33 x 11 cm
Shuttle: 16.3 x 1.8

Dimension of singular open mesh (cm):

![Diagram of mesh dimensions]

Observations: The net is cast onto a single cordage loop. 14 loops have been cast. One mesh is added with each row, creating a triangular shape. There are knots in the net, where various lengths of cordage were joined during the tying process. The net is still attached to the shuttle, as if still in the tying process. The shuttle has 11 score marks on body, each about 1cm apart.

Date of Examination: August 27, 2018
Consulted:
Laura Mina, Associate Conservator of Textiles and Head of Lab, Winterthur Museum
Susan Heald, Textile Conservator, National Museum of the American Indian
Nora Frankel, Former Mellon Fellow in Textile Conservation, National Museum of the American Indian
Chief Dennis Coker, Lenape Indian Tribe of Delaware

*Cordage structure is described using Jeffrey C. Splitstoser’s Parenthetical Notation Method.*
Photographic Documentation:
**Institution:** American Museum of Natural History  
**Catalog Number:** 50.2/600  
**Object ID:** Net  
**Culture of Manufacture:** Nanticoke  
**Museum Description:** Net  
**Collection History:** Frank Speck

**Material:** commercial cordage, most likely cotton  
**Cordage Diameter (cm):** 0.1  
**Cordage Structure:** *Z(3s(3i))  
**Overall Dimensions:** (LxW): approximately 67x65 cm (the net is too stiff to fully flatten)  
**Dimension of singular open mesh (cm):**

![Diagram of mesh dimensions](image)

**Signs of Previous Repair or Preservation:** The net has a crescent-shaped repair measuring approximately 43x6 cm. It measures between 1 and 3 meshes wide. The mesh dimensions within the repair vary. The smallest is 2.0x2.2 cm. The largest is 3.2x2.4 cm. Some knots are tied backwards within the repair as well, suggesting the job was done hastily or not by the original maker. The cordage diameter of the repair is 0.12 cm, and the twist is **Z3s2**. The rest of the net appears to have been treated with tanning preservative, causing the cordage to be very stiff. The repair is much lighter in color, and the cordage is supple. Thus, the repair was added after the preservation treatment. The same cordage used for the repair is woven into the exterior meshes on one side and tied in two places.

**Observations:** There is what appears to be a purposeful hole measuring 6.7x7.5 cm. Within this hole is one complete mesh that is only knotted at three corners. It is perhaps where the maker cast on.

**Date of Examination:** November 9, 2018  
**Consulted:**  
Mary Lou Murillo, *Textile Specialist, American Museum of Natural History*

*Cordage structure is described using Jeffrey C. Splitstoser’s Parenthetical Notation Method.*
Photographic Documentation:
**Institution:** American Museum of Natural History  
**Catalog Number:** 50.1/9906  
**Object ID:** Net  
**Culture of Manufacture:** Powhatan, Pamunkey  
**Museum Description:** Shad net  
**Collection History:** Frank Speck

**Material:** commercial cordage, most likely cotton  
**Cordage Diameter (cm):** 0.15  
**Cordage Structure:*** Z(3s(3i))  
**Overall Dimensions:** (LxW): 47x56 cm  
**Dimension of singular open mesh (cm):**

![Cordage structure diagram](image)

**Signs of Previous Repair or Preservation:** There are some small areas where cordage appears darker. This could be a sign of preservatives, but is most likely just associated with use. Areas along the bottom, where the cordage has become untwisted, hint at the cordage’s original color prior to use.

**Observations:** The net fragment has 8 meshes along the top and bottom. It has a three-dimensionality and appears to be funnel- or dip net-shaped.

**Date of Examination:** November 9, 2018  
**Consulted:**  
Mary Lou Murillo, *Textile Specialist, American Museum of Natural History*

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*Cordage structure is described using Jeffrey C. Splitstoser’s Parenthetical Notation Method.*
Photographic Documentation:
Institution: American Museum of Natural History
Catalog Number: 50.1/9907
Object ID: Net
Culture of Manufacture: Powhatan, Pamunkey
Museum Description: Herring net
Collection History: Frank Speck

Material: commercial cordage, most likely cotton
Cordage Diameter (cm): 0.07
Cordage Structure: S(3i)
Overall Dimensions: (LxW): 64x24 cm
Dimension of singular open mesh (cm):

![Diagram of a net with dimensions 3.1 x 3.1 x 2.6 cm]

Signs of Previous Repair or Preservation: The cordage of this net is very fine. In numerous areas, there are small reddish-brown stains. Where staining is present, the cordage is slightly thinner, as if contracted.
Observations: The fragment is 10x20 meshes. It is unclear if the hole along one edge was tied purposefully or is the result of damage. Some lengths of cordage extending from the surrounding meshes appear torn, while others appear finished. It is possible that some of the meshes on the edge of the hole have torn, but it appears the hole itself was tied as part of the original net design.

Date of Examination: November 9, 2018
Consulted:
Mary Lou Murillo, Textile Specialist, American Museum of Natural History

*Cordage structure is described using Jeffrey C. Splitstoser’s Parenthetical Notation Method.*
Photographic Documentation:
Institution: American Museum of Natural History
Catalog Number: 50.1/9908
Object ID: Net
Culture of Manufacture: Powhatan, Pamunkey
Museum Description: Net measure
Collection History: Frank Speck

Material: Softwood, possibly cedar
Overall Dimensions: (LxWxH): 7.0 x 3.6 x 0.7 cm
Observations: Records of this object’s purchase (a collection of 42 objects accessioned in 1915) suggest that it was previously attached to a herring net, although the width does not match the mesh size of herring net 50.1/9908, which is part of the same collection.
Date of Examination: November 9, 2018
Consulted:
Mary Lou Murillo, Textile Specialist, American Museum of Natural History
Institution: American Museum of Natural History
Catalog Number: 50.2/602
Object ID: Net
Culture of Manufacture: Nanticoke
Museum Description: Net piece
Collection History: Frank Speck

Material:
- Soft wood, possibly pine
- Commercial cordage, most likely cotton
- Commercial cordage, most likely sisal or manila, based on its coarse and stiff texture

Cordage Diameter (cm) and Structure:*  
Main body: 0.07, S(2s(2i))  
Cordage along edge and corner with float: 0.5, Z(3s(2(26i))  
Cordage used to lash larger cord to main body: 0.1, Z(3s)  
Sisal or manila cordage in corner opposite float (46cm long): 0.7, Z(3s(2i))

Overall Dimensions:
Net, (LxW): approximately 64x 76 cm. The corner opposite the float is very tangled and could not be fully laid out.
Float, (LxWxH): 5.5x 5.0x 4.5 cm

Dimension of singular open mesh (cm):

3 3

Observations: The fragment appears to have been a cast net. A hand-carved wooden float is still attached in one corner. In the opposite cordage is a length of coarser and thicker cordage, possibly from sisal or manila. The net is evenly worn, suggesting all of the cordages listed were incorporated during the original manufacture. There is a large loss in the center of the net.

Date of Examination: November 9, 2018
Consulted:
Mary Lou Murillo, Textile Specialist, American Museum of Natural History

* Cordage structure is described using Jeffrey C. Splitstoser’s Parenthetical Notation Method.
Photographic Documentation:
Institution: American Museum of Natural History
Catalog Number: 50.2/598
Object ID: Net
Culture of Manufacture: Nanticoke
Museum Description: Fishing net
Collection History: Frank Speck

Material:
- commercial cordage, most likely cotton
- wood, possibly willow and elm
- hand made cordages, possibly dogbane, slippery elm, milkweed or nettle, basswood, and an unidentified grass

Cordage Diameter and Structure* (Reference Figure 3 for 5-9):
1. Commercial cordage used to tie main body: 0.2cm, Z(3s(3i))
2. Commercial cordage used to attach inner funnel and net to hoops: 0.15cm, Z(3s(3i))
3. Commercial cordage used to lash hoops 1-3 to net: 0.1, Z twist
4. Handmade cordage used to lash hoops 3 and 4 together: 0.1, Z twist
   - The cordage is very fine, off white in color, and soft, most likely milkweed or stingy nettle
5. Handmade cordage used to partially lash bottom hoop to net: 0.5cm, S(2i)
   - The cordage is reddish brown in color with flat brown fibers, possibly dogbane or retted basswood
6. Handmade cordage looped 4 times around the bottom hoop: 0.7 cm, S(2i)
   - The cordage has stiff brown fibers that appear tubular under magnification, possibly a marsh grass
7. Handmade cordage tied around the bottom hoop, approximately 30cm in length: 0.4cm, S(2i)
   - The cordage is very stiff, gray brown in color, and has flat, wide fibers, some of which are clumped together, possibly slippery elm
8. Handmade cordage tied around the bottom hoop, approximately 38cm long: 0.4cm, S(2i)
   - Reddish brown color, flat fibers, possibly dogbane or retted basswood
9. Handmade cordage tied around top knot, roughly 22cm long: 0.3cm, S(2i)
   - Yellow brown in color, flat fibers, possibly dogbane or retted basswood

*Cordage structure is described using Jeffrey C. Splitstoser’s Parenthetical Notation Method.
Overall Dimensions: (LxW): 144.5 x 76 x 76 cm
Dimension of singular open mesh (cm):

Signs of Previous Repair or Preservation: There are small areas of black staining or accretions, possibly from tar, but the net does not appear to have received an overall treatment or coating (Figure 4).

Observations:
The fyke is composed of one large net piece tied in the round. It is 54 meshes around. It is stretched over four wooden hoops and inverted to create an interior funnel. The hoops are made from untreated wood, curved into hoops and lashed into position. From top to bottom, the hoops measure 56, 70, 68, and 76 cm in diameter. The second hoop (70cm) is a slightly different color from the others (Figure 5), and was perhaps a replacement. It is partially stripped of its bark, and the underlying fibers resemble that of elm. It clearly resembles the fiber of cordage 7. All of the handmade cordages, although different materials, are the same twist (S(2i)) and were likely made by the same hand.

Date of Examination: November 9, 2018
Consulted:
Mary Lou Murillo, Textile Specialist, American Museum of Natural History

Photographic Documentation:

Figure 1

Figure 2
Figure 6
### Appendix C

**COMPILED NET STATISTICS**

**Table 1: Net Type and Culture**

<table>
<thead>
<tr>
<th>Institution</th>
<th>Accession number</th>
<th>Title</th>
<th>Possible Net Type</th>
<th>Culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMAI</td>
<td>97121.000</td>
<td>Fragment of fish net</td>
<td>Unknown</td>
<td>Nanticoke</td>
</tr>
<tr>
<td>NMAI</td>
<td>106575.000 (.1)</td>
<td>Fragment of hand made fish-net</td>
<td>Unknown</td>
<td>Chickahominy</td>
</tr>
<tr>
<td>NMAI</td>
<td>106575.000 (.1)</td>
<td>Fragment of hand made fish-net</td>
<td>Unknown</td>
<td>Chickahominy</td>
</tr>
<tr>
<td>NMAI</td>
<td>32473.000</td>
<td>Fragment perch net</td>
<td>Possible seine</td>
<td>Nanticoke</td>
</tr>
<tr>
<td>NMAI</td>
<td>32490.000</td>
<td>Fish fyke</td>
<td>Fyke</td>
<td>Nanticoke</td>
</tr>
<tr>
<td>NMAI</td>
<td>32491.000</td>
<td>Turtle fyke</td>
<td>Fyke</td>
<td>Nanticoke</td>
</tr>
<tr>
<td>NMAI</td>
<td>33805.000</td>
<td>Net</td>
<td>Fragment</td>
<td>Nanticoke</td>
</tr>
<tr>
<td>NMAI</td>
<td>97119.000</td>
<td>Unfinished net</td>
<td>Possible dip</td>
<td>Nanticoke</td>
</tr>
<tr>
<td>AMNH</td>
<td>50.1/9906</td>
<td>Shad net</td>
<td>Possible dip</td>
<td>Powhatan, Pamunkey</td>
</tr>
<tr>
<td>AMNH</td>
<td>50.1/9907</td>
<td>Herring net</td>
<td>Possible seine</td>
<td>Powhatan, Pamunkey</td>
</tr>
<tr>
<td>AMNH</td>
<td>50.2/602</td>
<td>Net piece</td>
<td>Seine</td>
<td>Nanticoke</td>
</tr>
<tr>
<td>AMNH</td>
<td>50.2/600</td>
<td>Net</td>
<td>Unknown</td>
<td>Nanticoke</td>
</tr>
<tr>
<td>AMNH</td>
<td>50.2/598</td>
<td>Fishing net</td>
<td>Fyke</td>
<td>Nanticoke</td>
</tr>
</tbody>
</table>
Table 2: Dimensions

<table>
<thead>
<tr>
<th>Institution</th>
<th>Accession number</th>
<th>Width (cm)</th>
<th>Length (cm)</th>
<th>Height (cm)</th>
<th>Mesh Diagonal 1 (cm)</th>
<th>Mesh Diagonal 2 (cm)</th>
<th>Mesh Area (cm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMAI</td>
<td>97121.000</td>
<td>25.5</td>
<td>16</td>
<td>NA</td>
<td>3.5</td>
<td>3.0</td>
<td>5.25</td>
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<tr>
<td>NMAI</td>
<td>106575.000 (.1)</td>
<td>63.5</td>
<td>21</td>
<td>NA</td>
<td>3.3</td>
<td>3.1</td>
<td>5.12</td>
</tr>
<tr>
<td>NMAI</td>
<td>106575.000 (.1)</td>
<td>Too stiff</td>
<td>Too stiff</td>
<td>Too stiff</td>
<td>2.3</td>
<td>2.0</td>
<td>2.30</td>
</tr>
<tr>
<td>NMAI</td>
<td>32473.000</td>
<td>43</td>
<td>56</td>
<td>NA</td>
<td>2.4</td>
<td>2.2</td>
<td>2.64</td>
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<td>NMAI</td>
<td>32490.000</td>
<td>70</td>
<td>340</td>
<td>70</td>
<td>2.4</td>
<td>2.8</td>
<td>3.36</td>
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<td>NMAI</td>
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<td>42</td>
<td>227</td>
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<td>3.5</td>
<td>2.8</td>
<td>4.90</td>
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<tr>
<td>NMAI</td>
<td>33805.000</td>
<td>Too stiff</td>
<td>Too stiff</td>
<td>Too stiff</td>
<td>1.9</td>
<td>2.1</td>
<td>2.00</td>
</tr>
<tr>
<td>NMAI</td>
<td>97119.000</td>
<td>33</td>
<td>11.5</td>
<td>27.5</td>
<td>3.0</td>
<td>2.9</td>
<td>4.35</td>
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<td>AMNH</td>
<td>50.1/9906</td>
<td>47</td>
<td>56</td>
<td>NA</td>
<td>7.1</td>
<td>6.5</td>
<td>23.10</td>
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<tr>
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<td>50.1/9907</td>
<td>64</td>
<td>24</td>
<td>NA</td>
<td>3.1</td>
<td>2.6</td>
<td>4.03</td>
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<tr>
<td>AMNH</td>
<td>50.2/602</td>
<td>64</td>
<td>76</td>
<td>NA</td>
<td>3.0</td>
<td>3.0</td>
<td>4.50</td>
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<tr>
<td>AMNH</td>
<td>50.2/600</td>
<td>67</td>
<td>65</td>
<td>NA</td>
<td>3.0</td>
<td>2.1</td>
<td>3.15</td>
</tr>
<tr>
<td>AMNH</td>
<td>50.2/598</td>
<td>144.5</td>
<td>76</td>
<td>76</td>
<td>3.5</td>
<td>3.6</td>
<td>6.30</td>
</tr>
</tbody>
</table>
### Table 3: Cordage Statistics

<table>
<thead>
<tr>
<th>Institution</th>
<th>Accession number</th>
<th>Main Body Cordage Diameter (cm)</th>
<th>Main Body Twist</th>
<th>Presence of Handmade Cordage (Y/N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMAI</td>
<td>97121.000</td>
<td>0.1</td>
<td>Z(3s)</td>
<td>N</td>
</tr>
<tr>
<td>NMAI</td>
<td>106575.000 (.1)</td>
<td>0.1</td>
<td>Z(3s)</td>
<td>N</td>
</tr>
<tr>
<td>NMAI</td>
<td>106575.000 (.1)</td>
<td>0.15</td>
<td>Z(3s)</td>
<td>N</td>
</tr>
<tr>
<td>NMAI</td>
<td>32473.000</td>
<td>0.05</td>
<td>S(4z)</td>
<td>N</td>
</tr>
<tr>
<td>NMAI</td>
<td>32490.000</td>
<td>0.15</td>
<td>Z(3s)</td>
<td>Y: 1, probable dogbane</td>
</tr>
<tr>
<td>NMAI</td>
<td>32491.000</td>
<td>0.2</td>
<td>Z(4s(2i))</td>
<td>N</td>
</tr>
<tr>
<td>NMAI</td>
<td>33805.000</td>
<td>0.2</td>
<td>Z(3s)</td>
<td>Y: 1, probable dogbane</td>
</tr>
<tr>
<td>NMAI</td>
<td>97119.000</td>
<td>0.1</td>
<td>Z(3s(2i))</td>
<td>N</td>
</tr>
<tr>
<td>AMNH</td>
<td>50.1/9906</td>
<td>0.15</td>
<td>Z(3s(3i))</td>
<td>N</td>
</tr>
<tr>
<td>AMNH</td>
<td>50.1/9907</td>
<td>0.07</td>
<td>S(3i)</td>
<td>N</td>
</tr>
<tr>
<td>AMNH</td>
<td>50.2/602</td>
<td>0.07</td>
<td>S(2s(2i))</td>
<td>N</td>
</tr>
<tr>
<td>AMNH</td>
<td>50.2/600</td>
<td>0.1</td>
<td>Z(3s(3i))</td>
<td>N</td>
</tr>
<tr>
<td>AMNH</td>
<td>50.2/598</td>
<td>0.2</td>
<td>Z(3s(3i))</td>
<td>Y: 6, possible slippery elm, dogbane, and milkweed/nettle</td>
</tr>
</tbody>
</table>

### Table 4: Presence of Preservatives and Repairs

<table>
<thead>
<tr>
<th>Institution</th>
<th>Accession number</th>
<th>Presence of Preservatives (Y/N)</th>
<th>Presence of Historic Repairs (Y/N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMAI</td>
<td>97121.000</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>NMAI</td>
<td>106575.000 (.1)</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>NMAI</td>
<td>106575.000 (.1)</td>
<td>Y, possible barking</td>
<td>N</td>
</tr>
<tr>
<td>NMAI</td>
<td>32473.000</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>NMAI</td>
<td>32490.000</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>NMAI</td>
<td>32491.000</td>
<td>N</td>
<td>Y, thinner cordage repairs</td>
</tr>
<tr>
<td>NMAI</td>
<td>33805.000</td>
<td>Y, possible copper based preservative</td>
<td>N</td>
</tr>
<tr>
<td>NMAI</td>
<td>97119.000</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>AMNH</td>
<td>50.1/9906</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>AMNH</td>
<td>50.1/9907</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>AMNH</td>
<td>50.2/602</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>AMNH</td>
<td>50.2/600</td>
<td>Y, possible barking</td>
<td>Y, crescent-shaped fill</td>
</tr>
<tr>
<td>AMNH</td>
<td>50.2/598</td>
<td>Y, tar splatters</td>
<td>N</td>
</tr>
</tbody>
</table>
### Table 5: Nets on Display, Not Examined

<table>
<thead>
<tr>
<th>Institution</th>
<th>Accession Number</th>
<th>Title</th>
<th>Possible Net Type</th>
<th>Culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMNH</td>
<td>NAE/0069</td>
<td>Fishing net</td>
<td>Fyke</td>
<td>Eastern Woodlands</td>
</tr>
<tr>
<td>AMNH</td>
<td>NAE/0072</td>
<td>Fishing net</td>
<td>Seine</td>
<td>Eastern Woodlands</td>
</tr>
<tr>
<td>AMNH</td>
<td>50.2/599</td>
<td>Fishing net</td>
<td>Seine</td>
<td>Nanticoke</td>
</tr>
</tbody>
</table>
Appendix D

INVENTORY

Institution: Peabody Museum of Archaeology and Ethnology at Harvard University, Cambridge, MA, USA
Item Number: 88-8-10/46538
Description: 61 ceramic sherds with cordage impressions
Image:

Institution: Peabody Museum of Archaeology and Ethnology at Harvard University, Cambridge, MA, USA
Item Number: 88-8-10/46539
Description: 23 ceramic sherds with cordage impressions
Image:

Institution: American Museum of Natural History, New York City, NY, USA
Item Number: NAE/0065
Description: Powhatan wood net float
Image:
Institution: American Museum of Natural History, New York City, NY, USA
Item Number: NAE/0072
Description: Eastern Woodland twine fishing net
Image:

Institution: American Museum of Natural History, New York City, NY, USA
Item Number: NAE/0069
Description: Eastern woodlands (?) fishing net
Image:

Institution: American Museum of Natural History, New York City, NY, USA
Item Number: NAE/0176
Description: North American plant fiber (Milkweed?) fishing net
Image:
**Institution:** American Museum of Natural History, New York City, NY, USA
**Item Number:** 50.1/1621
**Description:** Delaware bark rope
**Image:**

![Delaware bark rope](image1.jpg)

**Institution:** American Museum of Natural History, New York City, NY, USA
**Item Number:** 50.1/2238
**Description:** Delaware Indian hemp specimen
**Image:**

![Delaware Indian hemp specimen](image2.jpg)

**Institution:** American Museum of Natural History, New York City, NY, USA
**Item Number:** 50.1/9896
**Description:** Powhatan, Pamunkey wood net needle
**Image:**

![Powhatan, Pamunkey wood net needle](image3.jpg)
Institution: American Museum of Natural History, New York City, NY, USA
Item Number: 50.1/9906*
Description: Powhatan, Pamunkey string shad net
Image:

Institution: American Museum of Natural History, New York City, NY, USA
Item Number: 50.1/9907*
Description: Powhatan, Pamunkey string herring net
Image:

Institution: American Museum of Natural History, New York City, NY, USA
Item Number: 50.1/9908*
Description: Powhatan, Pamunkey wood net measure
Image:

*Complete examination form included in Appendix B
Institution: American Museum of Natural History, New York City, NY, USA
Item Number: 50.2.598*
Description: Nanticoke wood string net
Image: 

Institution: American Museum of Natural History, New York City, NY, USA
Item Number: 50.2/599
Description: Nanticoke fishing net
Image: 

*Complete examination form included in Appendix B
Institution: American Museum of Natural History, New York City, NY, USA
Item Number: 50.2/600*
Description: Nanticoke string net
Image:

*Complete examination form included in Appendix B
**Institution:** University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
**Item Number:** 29-48-345
**Description:** Nanticoke wood fish trap
**Image:** not available

**Institution:** University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
**Item Number:** 70-90-129A
**Description:** Pamunkey netting needle
**Image:**

**Institution:** University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
**Item Number:** 70-90-129B
**Description:** Pamunkey netting needle
**Image:**
Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 70-90-129C
Description: Pamunkey netting needle
Image:

Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 70-90-129D
Description: Pamunkey netting needle
Image:

Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 70-90-269
Description: Pamunkey (uncertain) netting needle
Image:
**Institution:** University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA

**Item Number:** 70-90-271

**Description:** Pamunkey (uncertain) netting needle

**Image:**

---

**Institution:** University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA

**Item Number:** CG060891-2164

**Description:** Pamunkey (uncertain) netting needle

**Image:**

---

**Institution:** University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA

**Item Number:** 818

**Description:** Mercer County, NJ 2 ceramic sherds

**Image:**
Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 819
Description: Mercer County, NJ ceramic sherd
Image:

Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 820
Description: Mercer County, NJ ceramic sherd
Image:

Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 821
Description: Mercer County, NJ ceramic sherd
Image:
Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 822
Description: Mercer County, NJ ceramic sherd
Image:

Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 823
Description: Mercer County, NJ ceramic sherd
Image:

Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 824
Description: Mercer County, NJ ceramic sherd
Image:
Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 825
Description: Mercer County, NJ ceramic sherd
Image:

Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 826
Description: Mercer County, NJ ceramic sherd
Image:

Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 827
Description: Mercer County, NJ ceramic sherd
Image:
Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 828
Description: Mercer County, NJ 2 ceramic sherds
Image:

Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 829
Description: Mercer County, NJ ceramic sherd
Image:

Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 830
Description: Mercer County, NJ ceramic sherd
Image:
Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 831
Description: Mercer County, NJ ceramic sherd
Image:

Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 832
Description: Mercer County, NJ ceramic sherd
Image:

Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 833
Description: Mercer County, NJ ceramic sherd
Image:
**Institution:** University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA

**Item Number:** 834

**Description:** Mercer County, NJ ceramic sherd

**Image:**

---

**Institution:** University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA

**Item Number:** 835

**Description:** Mercer County, NJ 5 ceramic sherds

**Image:**

---

**Institution:** University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA

**Item Number:** 836

**Description:** Mercer County, NJ ceramic sherd

**Image:**
Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 837
Description: Mercer County, NJ ceramic sherd
Image:

Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 838
Description: Mercer County, NJ ceramic sherd
Image:

Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 839
Description: Mercer County, NJ 2 ceramic sherds
Image:
Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 840
Description: Mercer County, NJ ceramic sherd
Image:

Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 841
Description: Mercer County, NJ ceramic sherd
Image:

Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 842
Description: Mercer County, NJ ceramic sherd
Image:
Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 843
Description: Mercer County, NJ ceramic sherd
Image:

Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 844
Description: Mercer County, NJ ceramic sherd
Image:

Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 845
Description: Mercer County, NJ ceramic sherd
Image:
**Institution:** University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA  
**Item Number:** 846  
**Description:** Mercer County, NJ 7 ceramic sherds  
**Image:**

![Image of 7 ceramic sherds](image_url)

---

**Institution:** University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA  
**Item Number:** 6172  
**Description:** Mercer County, NJ 2 net sinkers  
**Image:**

![Image of 2 net sinkers](image_url)

---

**Institution:** University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA  
**Item Number:** 4035  
**Description:** Mercer County, NJ net sinker  
**Image:**

![Image of net sinker](image_url)
**Institution:** University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA  
**Item Number:** 40-28-53 – 40-28-59  
**Description:** Claymont, DE 7 stone sinkers  
**Image:** not available

**Institution:** University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA  
**Item Number:** 29-112-654 and 29-112-655  
**Description:** Monroe County, PA 2 stone sinkers  
**Image:** not available

**Institution:** University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA  
**Item Number:** 87-39-240 – 87-39-266  
**Description:** Monroe County, PA 27 stone sinkers  
**Image:** not available

**Institution:** University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA  
**Item Number:** 6051  
**Description:** Bucks County, PA net sinkers  
**Image:** not available

**Institution:** University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA  
**Item Number:** 6546  
**Description:** Bucks County, PA net sinker  
**Image:** not available

**Institution:** University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA  
**Item Number:** 5951  
**Description:** Burlington County, NJ net sinker  
**Image:** not available
Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 10130
Description: Burlington County, NJ net sinker
Image: not available

Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 97-563-6531
Description: Delaware stone net sinker
Image: not available

Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 11640
Description: New Jersey ceramic net sinkers
Image: not available

Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 11684
Description: Burlington County, NJ net sinker
Image: not available

Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 9053
Description: Burlington County, NJ net sinker
Image: not available

Institution: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
Item Number: 11693
Description: Camden, NJ net sinker
Image: not available
**Institution:** University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
**Item Number:** 6192
**Description:** Mercer County, NJ 5 ceramic sherds
**Image:**

![Image of ceramic sherds](image1.png)

**Institution:** University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
**Item Number:** 9778
**Description:** Mercer County, NJ stone net sinker
**Image:**

![Image of stone net sinker](image2.png)

**Institution:** University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA
**Item Number:** 9853
**Description:** Mercer County, NJ stone net sinker
**Image:**

![Image of stone net sinker](image3.png)
**Institution:** University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, USA  
**Item Number:** 9936  
**Description:** Mercer County, NJ stone net sinker

**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA  
**Item Number:** 105750.000  
**Description:** Chickahominy wooden awl for net working

**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA  
**Item Number:** 105747.000  
**Description:** 5 Chickahominy netting needles
**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA
**Item Number:** 106569.000
**Description:** Chickahominy netting needle

**Image:**

---

**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA
**Item Number:** 201733.000
**Description:** Chickahominy net needle of ash for sturgeon nets

**Image:**

---

**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA
**Item Number:** 201734.000
**Description:** Chickahominy net needle of ash for shad nets

**Image:**
Institution: National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA
Item Number: 201735.000
Description: Chickahominy net needle of ash for herring nets
Image:

Institution: National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA
Item Number: 201730.000
Description: Chickahominy mesh gauge of red cedar for herring nets
Image:

Institution: National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA
Item Number: 201731.000
Description: Chickahominy mesh gauge of red cedar for shad nets
Image:
**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA

**Item Number:** 201732.000

**Description:** Chickahominy mesh gauge of red cedar for sturgeon nets

**Image:**

![Image of Chickahominy mesh gauge](image_url)

**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA

**Item Number:** 106575.000*

**Description:** 2 Chickahominy fragments of hand made fish-net

**Image:**

![Image of Chickahominy fish-net fragments](image_url)

**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA

**Item Number:** 105745.000

**Description:** 5 Chickahominy wooden mesh gauge for net making

**Image:**

![Image of Chickahominy wooden mesh gauges](image_url)

*Complete examination form included in Appendix B*
Institution: National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA
Item Number: 097760.000
Description: 2 Mattaponi large netting needles
Image:

Institution: National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA
Item Number: 097762.000
Description: Mattaponi net gauge for shads
Image:

Institution: National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA
Item Number: 105739.000
Description: Mattaponi net float of pine bark
Image:
**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA  
**Item Number:** 097761.000  
**Description:** 6 Mattaponi netting needle with line/cordage for shad nets  
**Image:**

![Image](image1.png)

**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA  
**Item Number:** 097745.000  
**Description:** Mattaponi netting needle, net gauge and shad net in course of construction  
**Image:**

![Image](image2.png)

**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA  
**Item Number:** 097117  
**Description:** 2 Nanticoke cylindrical wooden net float  
**Image:**

![Image](image3.png)
**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA  
**Item Number:** 097118.000  
**Description:** Nanticoke oval wooden net float  
**Image:**

**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA  
**Item Number:** 097120.000  
**Description:** Nanticoke netting needle with line/cordage  
**Image:**

**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA  
**Item Number:** 097121.000*  
**Description:** Nanticoke fragment of fish net  
**Image:**
Institution: National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA
Item Number: 033804.000
Description: 2 Nanticoke net mesher
Image:

Institution: National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA
Item Number: 033805.000*
Description: Nanticoke net
Image:

Institution: National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA
Item Number: 117015.000
Description: Nanticoke flat oval net float
Image:

*Complete examination form included in Appendix B
**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA

**Item Number:** 246724.000*

**Description:** Nanticoke netting needle made from white oak with line/cordage

**Image:**

![Nanticoke netting needle](image1)

---

**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA

**Item Number:** 246726.000*

**Description:** Nanticoke pine wood net float, drilled for cord

**Image:**

![Nanticoke pine wood net float](image2)

---

**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA

**Item Number:** 117016.000

**Description:** Nanticoke cylindrical net float

**Image:**

![Nanticoke cylindrical net float](image3)

---

*Complete examination form included in Appendix B*
**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA  
**Item Number:** 117018.000  
**Description:** Nanticoke bag of sand used as net sinker  
**Image:**

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**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA  
**Item Number:** 117019.000  
**Description:** Nanticoke netting needle  
**Image:**

---

**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA  
**Item Number:** 117020.000  
**Description:** Nanticoke netting needle  
**Image:**
**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA  
**Item Number:** 097119.000*  
**Description:** Nanticoke netting needle with mesh gauge and partly constructed net attached  
**Image:**

---

**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA  
**Item Number:** 097119.001  
**Description:** Nanticoke netting needle with mesh gauge and partly constructed net attached  
**Image:**

---

**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA  
**Item Number:** 032455.000  
**Description:** 10 Nanticoke net floats  
**Image:**

---

*Complete examination form included in Appendix B*
**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA

**Item Number:** 032461.000

**Description:** 3 Nanticoke mesh gauges for perch net

**Image:**

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**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA

**Item Number:** 03462.000

**Description:** Nanticoke mesh gauge for herring net

**Image:**

---

**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA

**Item Number:** 032463.000

**Description:** Nanticoke mesh gauge for shad and carp net

**Image:**
Institution: National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA
Item Number: 032467.000
Description: Nanticoke stone used as a net sinker

Image:

Institution: National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA
Item Number: 03249.000
Description: 6 Nanticoke netting needles with line/cordage

Image:

Institution: National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA
Item Number: 032473.000*
Description: Nanticoke fragment perch net

Image:

*Complete examination form included in Appendix B
**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA

**Item Number:** 032490.000*

**Description:** Nanticoke fish fyke

**Image:**

![Nanticoke fish fyke](image1)

---

**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA

**Item Number:** 032491.000*

**Description:** Nanticoke turtle fyke

**Image:**

![Nanticoke turtle fyke](image2)

---

**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA

**Item Number:** 105687.000

**Description:** Pamunkey wooden gauge for net mesh

**Image:**

![Pamunkey wooden gauge for net mesh](image3)

*Complete examination form included in Appendix B*
Institution: National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA
Item Number: 201744.000
Description: Pamunkey stomping [stamping] paddle of black walnut wood for pottery, the design representing a net
Image:

Institution: National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA
Item Number: 204048.000
Description: Pamunkey bowl, tan ware, decorated with impression of minnow net
Image:

Institution: National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA
Item Number: 105686.000
Description: Pamunkey wooden netting needle for sturgeon net
Image:
**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA  
**Item Number:** 204062.000  
**Description:** Pamunkey net design type of paddle for decorating pottery  
**Image:**

---

**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA  
**Item Number:** 105685.000 – 105687.000  
**Description:** 4 Pamunkey wooden netting needles  
**Image:**

---

**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA  
**Item Number:** 204061.000  
**Description:** Pamunkey net design type of paddle for decorating pottery  
**Image:**
**Institution:** National Museum of the American Indian, Smithsonian Institution, Washington, D.C., USA  
**Item Number:** 106561.000  
**Description:** 2 Potomac net needles  
**Image:**
Appendix E

OUTREACH EVENT TIMELINE

November 17, 2018: “Reviving Traditional Lenape Net Making.” Presented at the Immanuel United Methodist Church, Cheswold, DE.

December 3, 2018: “Reviving Traditional Lenape Net Making.” Presented at the Newark Natural Food COOP, Newark, DE.


March 2, 2019,
April 6, 2019,

May 4, 2019: “Preserving Traditional Fishing Net Technology of the Lenape.” To be presented as part of Documenting Delaware’s Historic Architecture and Heritage, University of Delaware, Newark, DE.
Appendix F
Net Workshop Handouts

March 2, 2019

Common Types of Rectangular Nets

**Drift net:** A long rectangular net with weights on bottom and floats on top, that hangs vertically in the water like a wall to catch moving fish

**Seine:** A long rectangular net, similar to a drift net that is drawn together to encircle fish

**Cast nets:** A rectangular or round net that is weighted along the exterior to entrap fish as it sinks

Seine net in use. Image Courtesy of Wiki Commons
**Useful Knots**

*Sheet Bend Step By Step*

1. Pass the thin rope through the thick rope bight
2. Wrap it around the bight and tuck it under itself
3. Hold thick end and pull thin rope to tighten

*Clove Hitch Tutorial*

1. Hang rope from the support
2. Loop around the support with the end
3. Pass it from behind the rope
4. Pull to tighten
5. The knot is complete
Diagrams courtesy of 101Knots

How to Cast on

Option 1:

1. Tie a loop which will act as the first mesh.
2. Starting from the loop made in step 1, use the gauge to tie even openings. This will become the right or left side of your net and thus determines its depth.
3. Thread a rope or rod through the top row of loops and continue to tie meshes horizontally.

Diagrams from *Down East Netting: A History and How-To of Netmaking*, by Barbara Morton
Option 2

1. Using a clove hitch and your gauge, cast meshes onto a rope or rod.
2. Working horizontally, tie even meshes below this row.

Diagrams from *Down East Netting: A History and How-To of Netmaking*, by Barbara Morton
**Useful Resources**

Jann’s Netcraft, [https://www.jannsnetcraft.com/](https://www.jannsnetcraft.com/)

*Down East Netting: A History and How-To of Netmaking*, by Barbara Morton

*Net Making*, by Charles Holdgate

*Nets: How to Make, Mend and Preserve Them*, by G.A. Steven

*The Ashley Book of Knots*, by Clifford Ashley

***YouTube also has a plethora of useful videos. I recommend trying more than one to see which one makes most sense to you. ***
Common Types of Circular Nets

Dip nets: A small round net with a long handle, often used to catch crabs or bait
Cast nets: A rectangular or round net that is weighted along the exterior to entrap fish as it sinks

Clem Carney’s Dip Net and Tools, *Delaware’s Forgotten Folk*

**Useful Knots**
Sheet Bend Step By Step

1. Pass the thin rope through the thick rope bight
2. Wrap it around the bight and tuck it under itself
3. Hold thick end and pull thin rope to tighten

Clove Hitch Tutorial

1. Hang rope from the support
2. Loop around the support with the end
3. Pass it from behind the rope
4. Pull to tighten
5. The knot is complete
How to Cast on

1. Cast meshes onto a ring or hoop.

2. & 3. Continue to tie meshes in a circular. When you have gone around, tie a knot at the bottom of the mesh. This will act as the starting point for your new row.

Diagrams from *Down East Netting: A History and How-To of Netmaking*, Barbara Morton
Diagrams from *Down East Netting: A History and How-To of Netmaking*, by Barbara Morton

**Useful Resources**

**Jann’s Netcraft**, [https://www.jannsnetcraft.com/](https://www.jannsnetcraft.com/)

*Down East Netting: A History and How-To of Netmaking*, by Barbara Morton

*Net Making*, by Charles Holdgate

*Nets: How to Make, Mend and Preserve Them*, by G.A. Steven

*The Ashley Book of Knots*, by Clifford Ashley

***YouTube also has a plethora of useful videos. I recommend trying more than one to see which one makes most sense to you. **
Appendix G

ASSOCIATED ARTICLES AND SOCIAL MEDIA POSTS


