Analysis of Spindle Whorls and Fishing Weights from the Ancient Maya Trading Port of Moho Cay, Belize

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ANALYSIS OF SPINDLE WHORLS AND FISHING WEIGHTS
FROM THE ANCIENT MAYA TRADING PORT OF MOHO
CAY, BELIZE

A Thesis

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
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Master of Art

in

The Department of Geography and Anthropology

by
Kaitlin Samples
B.A. The University of Texas at Tyler, 2017
May 2022
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Abstract

Trading, fishing, and spinning thread were important parts of the ancient Maya world. Iconography and archaeological excavations have shown the importance of the three activities. The ancient Maya had an extensive trade network along the Belize River. The site of Moho Cay was an important trading area within this network. Excavations at Moho Cay show the importance of trade, fishing, and spinning at Moho Cay. The excavations done in 1979, led by Dr. McKillop and the team of Trent University, yielded a large sample of spindle whorls and fishing weights. Analysis of these spindle whorls and fishing weights is the focus of this thesis. Studying the two textiles in conjunction can show the possible relation the two had when being used at the site. Spindle whorls would have needed cotton to spin yarn. The nets and lines of the fisherfolk would have needed cotton yarn to make their nets and lines for the fishing weights to go on. The variation of measurements found in the fishing weights show there was a need for both line and net fishing at the site. The variation of measurements found in the spindle whorls shows the need for different thread and fiber types. Spinning and fishing had ritual, economic, and tributary significance to the ancient Maya. This thesis discusses the data found when analyzing the spindle whorls and fishing weights and goes over what the results of the data could mean for the use of these textiles at Moho Cay. Various sizes of spindle whorls were used at Moho Cay which could suggest the use of different fibers used for spinning. The size of the sample of 25 spindle whorls could also suggest a more standardized production of spinning yarn. Different sizes and weights of fishing weights were found which shows the use of different fishing methods at the site. The amount of size of 124 fishing being excavated also shows a more standardized practice of fishing rather than just for subsistence.
Introduction

The Maya had a dynamic system of trading, fishing, and producing textiles. The cays along the Belize coast were part of an extensive trade network important to the ancient Maya economy. Moho Cay was one of the important trade areas at the mouth Belize River. My research focuses on the spindle whorls and fishing weights that have been excavated at the Classic Maya trading site of Moho Cay. The spindle whorls found at Moho Cay show us the importance spinning would have had on the daily lives of the Maya at the site. There could have been spinning of not just yarn for later weaving, but also for net and line making. The excavation of 17 spindle whorls at Xuencal could suggest the Maya at the site were a part of a larger system of textile centralization (Ardren 2010:274-275). While there is no way to test this theory, it is possible the 25 spindle whorls from Moho Cay could suggest the thread spun was being traded or made for more than just daily purposes (Ardren et al. 2010:286-287). The sample size also shows the yarn spun at the site could have had an impact on the tribute system within the broader Classic Maya world (Ardren et al. 2010:286-287; Baron 2018:110). The spinning of yarn had just as much symbolic importance to the ancient Maya as did its economic and trade value. Spinning for the ancient Maya had a connection with their life cycle (Kamp et al. 2006: 419).

The archaeological deposit of fishing weights at the site shows us how important fishing was at Moho Cay (McKillop 1985:337). Moho Cay was a very important trading port in Belize. Ambergris Cay was and still is an important fishing and trading site. Looking at the modern standardized fisherfolk practices at Ambergris Cay, could suggest there was also more organized fishing going on at Moho Cay (Emery and Graham 2003:83). The fish found at the site also shows the people who lived at Moho Cay included fish as an important part of their diet. Fishing weights were and still are important to any fisherfolk. The fishing weights provide the fisherfolk
with the ability to do different types of fishing, such as net, line, deep sea, or shallow fishing. The research will help give us a better understanding of the fishing and spinning being done at Moho Cay. There were people who lived at Moho Cay long term (McKillop 1980:14). This research will help us see the impact the two textiles would have had on the everyday life of the Classic Maya at the site as well as the broader ancient Maya context.

First, I discuss the ancient Maya site of Moho Cay and its importance (Figure 1). I go over the different excavations that have taken place at the site within this section. In the second section, the historical and iconographic background of spindle whorls is expounded upon. I also share different techniques and styles used for spinning. In a continuation of the second section, I draw from previous excavations in the Maya area where spindle whorls have been found to show the possibility of an organized system of yarn production that could have been taking place at Moho Cay. In the following section, I show the historical, economic, and iconographic significance of fishing and fishing weights to the ancient Maya. I also bring attention to the different areas where fishing weights have been discovered and the different fishing practices the ancient Maya could have used while hunting marine life. Finally, I go over the significance of cotton and maguey to the ancient Maya. I give information on the process of how to produce the two fibers and how the two fibers are used for spinning. In the next part of the paper, I share my goals, methods, and sample discussion. The final sections go over the results, interpretation, and conclusion of my research.
Figure 1. Map of the Maya area showing the location of Moho Cay, Belize. (from McKillop 2021: Figure 1, used with permission).
Moho Cay

Moho Cay is a Classic Maya trading port (AD250-900) located in an area where coastal and river trade is connected at the mouth of the Belize River. Investigations of Moho Cay began as early as the 1870s (McKillop 1980:13; 2004:260). A thorough excavation focusing on the site’s function, subsistence, and trade was done in 1979 by Dr. Heather McKillop and the archaeological team from Trent University (McKillop 1980:1). The location of Moho Cay would have been of great importance to the inland and coastal trade of the Maya who traded at the site (McKillop 2004:257; 2007:17). Moho Cay’s location is seen as a connection point between local and long-distance trade networks (McKillop 1980:3). Previous excavations found various burials and post molds. This research shows the likelihood Moho Cay was not just a trading site but was consistently occupied by fisherfolk (McKillop 1980:233; 2004: 260). One of the main sources of food the Maya hunted offshore of this site was the manatee. Interpretations of the site by archaeologists viewed Moho Cay as a manatee hunting site (McKillop 1980:13-14). Manatee is a source of meat and fat. Their skin and bones are also used for other craft and trading purposes (McKillop 1985:340,346). During excavations at the site of Moho Cay, the team found perforated potsherds and side-notched potsherds (McKillop 2004:268). Perforated potsherd disks are known to be used as spindle whorls (McKillop 1980:136). The side-notched potsherds are known to be used as fishing weights (McKillop 1980:143). The perforated potsherds disks were found on the surface, fill and refuse, of feature four burials (McKillop 1980:136-138, 2004:263-265). The side-notched potsherds were found on the surface, fill, and refuse of feature two burials (McKillop 1980:139-143, 2004:263-265). The context of being found in burials shows the importance of the artifacts to the Maya at Moho Cay. There are other burials in the Maya area that have yielded spindle whorls showing their important ritual significance (Ardren et al.
While Moho Cay still exists today, the ancient Maya site no longer exists as it was destroyed for tourism. The information from past excavations and the 1979 excavation is what we have left of the site’s original context (McKillop 2004:258).
Background of Spindle Whorls

Spindle whorls were important to the Maya textile production of yarn. The spindle whorls were used to keep the spindle rotating (Hammond 1975:361). There are different ways spindle whorls can be made. They can be crafted, cut from recycled ceramics, and even carved stone. Their size and weight can also vary; however, all spindle whorls have a hole that is cut to fit the type of spindle that will be used during the process (Hammond 1975:361). There are different techniques for spinning thread. One possible spinning technique is the use of donut stones as thigh-supported spindle whorls (Tomasic 2012:221-222). In this technique, one would use the donut stone as a support for the bottom of the spindle while spinning the thread.

Other possible ways to spin thread include using a spinning whorl and drop spindle technique. When doing the drop spindle technique, the spinner does not have to use support while spinning the yarn. The two methods for drop spindle technique include a top whorl drop spin, where the whorl is at the top of the spindle, and a bottom whorl drop spin, where the whorl is at the bottom of the spindle. Figure 2 shows a picture of the two techniques sketched by me. The modern Maya uses a drop spindle technique for their spinning. This could show the possibility of the ancient Maya also using the drop spindle technique. There are different styles of spinning direction which include an “S” spun and a “Z” spun technique. The “S” spun technique is the style of spinning thread towards the right. The “Z” spun technique is the style of spinning thread towards the left. (Surrette 2015:38). Figure 3 shows a sketch drawn by me of the different directions the yarn goes when doing an “S” or “Z” spin style.
Figure 2. The Depiction of a Top and Bottom Whorl Using the Drop Spinning Technique. The depiction on the left is a top whorl spindle. The depiction on the right is a bottom whorl spindle. Drawn by me while looking at depictions of top and bottom spindle whorls.

Figure 3. The depiction of how the thread turns when using a “Z” Spun and “S” Spun technique. Drawn by me while looking at the original drawing found in (Surette 2015:39).
Along with the economic significance, spindle whorls may have also had ritual importance. Spinning and weaving has been associated with ancient Maya goddesses such as Ixik Cab and the older form of the goddess called Chak Chel (Ardren 2010:285; Kamp et al. 2006:411; McAnany 2010:117). Spinning was also looked at as a symbolic view of birth, life, and death. In other contexts, the Aztecs used spinning and weaving in important ceremonies for baby girls and other socialization processes (Kamp et al. 2006:419). There could have been different stages a Maya person would go through in the learning process of spinning. In the Aztec Codex Mendoza, there are depictions of young girls learning the art of spinning and more mature women doing the weaving (McAnany 2010:116-117).

The spinning of fibers into yarn is tied into a bigger system of cloth making. Getting the fibers ready and spinning them were the first steps in this process. After spinning the fibers, the thread was then used for weaving. The examples of Maya people learning different steps of the process at different ages could tie into the way the ancient Maya did the entire operation. Because of the importance of fishing at the site of Moho Cay, as well as the size of the sample of spindle whorls excavated, could show the operation of spinning being done at Moho Cay was spinning yarn to create or mend nets and fishing lines. Figure 4 is a depiction of the ancient Maya goddess Chak Chel weaving. This depiction can show the important ties the ancient Maya goddess could have had in the production of cloth-making as a whole operation.
Figure 4. Depiction of ancient Maya goddess Chak Chel weaving. Drawn by me while looking at the original depiction in the Madrid Codex.

At the ancient Maya site of El Pilar, there is a ritual deposit of spindle whorls. Researchers made replicas of the spindle whorls presented to see how they may have been broken (Kamp et al. 2006:415-417). The researchers performed a series of tests on the spindle whorls by dropping them from different heights and locations. None of the spindle whorls broke from the different heights from which they were dropped. The spindle whorls were not flimsy or brittle which led researchers to believe the spindle whorls were purposefully broken by the Maya at the site for a possible ritual purpose (Kamp et al. 2006:420). Another example of ritual importance of the spindle whorls can be found in the fact that there have been spindle whorls excavated from various burial contexts of queens, other women, and also men (Ardren et al. 2010:275; Chase et al. 2008:129; Kamp et al. 2006:19).

At the sites of El Palmillo and Chichén Itzá, researchers found spindle whorls in different contexts (Ardren 2010:275; Carpenter et al. 2012:390-91). At the site of El Palmillo and at 3 residential sites at Copan, archaeologists excavated spindle whorls of smaller sizes and lower weight in some residences whereas they excavated bigger and heavier whorls in other residences.
This data suggested the possibility that different households could have been responsible for spinning certain types of thread for production (Carpenter et al. 2012:391-392; McAnany 2010:117-118).
Background of Fishing Weights

Fishing weights were useful and important to the ancient Maya because sea trade was an important part of the ancient Maya coastal economy. The site of Moho Cay was an important trade site (McKillop 2007:17). There were other offshore sites that relied on trade and fishing in the region of Moho Cay, such as Wild Cane Cay, Ambergris Gay, Cozumel, and Cancun (McKillop 1984:34). Wild Cane Cay was a port for sea trade as well as coastal and inland trade. During excavations at Wild Cane Cay, researchers recovered vertebrae remains of various marine animals including barracudas, snappers, grunts, groupers, manatees, turtles, and reef fishes (McKillop 2007:18). These remains can give us insight into the different marine life the Maya at Moho Cay also hunted.

The iconography of the ancient Maya shows depictions of figures using canoes. One example of this can be found at burial 116, temple 1 at Tikal where the Jaguar Paddler god and the Stingray Paddler god are depicted in a canoe (McKillop 2007:23-24). A Late Classic ancient Maya canoe paddle was recently found at Paynes Creek National Park, Belize, in an excavation led by Dr. McKillop and the team (McKillop 2007:15,22-23). Objects not native to Moho Cay have been found at the site, such as obsidian and mainland chert (McKillop 1984:30). The various traded objects, fishing sites, iconography, and the canoe paddle show how important boat travel, trade, and fishing were to the ancient Maya economically and symbolically. During excavations at Moho Cay, there was a midden found with various forms of sea animal bones such as the manatee, green turtle, shark, and conch (McKillop 1984:26). Most of the remains found were of manatee bones. Manatee was a nearby resource to the Maya at Moho Cay (McKillop 1984:30). With the iconography and the canoe paddle found, one can see the Maya at
Moho Cay could have used canoes for fishing as well as for hunting of the manatee (McKillop 1984:30).

Fishing weights found in the Maya region have different forms of sizes, shapes, and weights, which in turn may imply differences in function. Lighter weights may have been used for line fishing whereas heavier weight may have been used for larger nets or lines in deeper water (MacKinnon 1996:15). There are also different styles of fishing weights found throughout the region. There were end-notched, ceramic pellets, as well as notched stones (MacKinnon 1996:15). Although most of the fishing weights found at Moho Cay are notched potsherds (McKillop 2004:268), manatee bones also were carved into the forms of fishing weights (McKillop 1985:344-345). Fishing is still important to the modern Maya. There are many different forms of fishing done in other cay areas along the Belize coast (Emery and Graham 2003:82). Modern practices may provide insight into the ancient Maya fishing practices that went on at the site.
Cotton and Maguey

The maguey plant, which is part of the genus *Agave*, has been grown in the highlands of Mexico and Guatemala. Maguey can grow in areas where other agricultural plants have difficulty growing (Parsons 1990:2-4). The maguey plant can take a long time to process into fibers. Maguey leaves are thick and can have thorns that need to be removed from the leaf before processing can start. Once the thorns are taken off, the plant is left to dry out and later pounded to loosen the fibers. Once pounding is complete, the leaf is laid on a scraping board where the worker will begin scraping the pieces of pounded pulp from the fiber. Once this process is done, maguey is hung on a line to dry (Parsons 1990:146-160). When processing is complete, the dried fiber is cleaned of debris or dirt. This practice is known as carding fiber. The worker takes a bundle of fiber and begins using a sharp object such as a maguey thorn and scrapes the impurities from the bundle (Parsons 1990:179-180). Once this process is finished, the fiber is ready for spinning. Maguey was not the only crop the ancient Maya used in their utilization of making thread.

Cotton, scientifically known as “*Gossypium sp.*,,” was prevalent in the ancient Maya world. There were many species and variations (Baron 2018:102-103). Decompaction of cotton is done by beating, carding, and combing the fiber until it is at the desired result (Corbett and McCafferty 2002:53). The cotton is picked from its growth area and cleaned of all dirt, seeds, and leaves. A clean area is made on the floor to beat the cotton until the fibers come together. The mass is made at a length the beater desires and is rolled into a ball to be spun (Cordry and Cordry 1941:104-106).
Goals/Objectives

The main objectives for this research will be finding the connection between the spindle whorls and fishing weights at the site, as well as researching how the two items were used. This research is important because it will help add to our knowledge of how the Maya could have operated at Moho Cay. The research will give us insight into their ways of fishing as well as their practices in spinning cloth, which could lead to us gaining more understanding of their trade, economy, and how the Maya connected with other sites inland and along the coast.

In spindle whorls, if there are differences in size and weight, one would expect that to be an indication of different thread fibers being used to spin at the site (Alt 1999:129; Corbett and McCafferty 2002:53). If the spindle whorl is small and light, one would expect it was used to spin something light such as cotton. If the spindle whorl is large and heavy, one would expect it was used to spin a heavy, thick fiber such as maguey (Alt 1999:129; Baron 2018:106). If there is a variation of size and weight but their size and weight are still not heavy enough to be used for a thick fiber, that could suggest there were various forms of cotton being used (Baron 2018:106). The size of the sample of spindle whorls could also mean there was a standardized spinning of these materials at the site. Given some of the research done about the Aztecs and the prevalence of cotton in the Maya world, the findings could also suggest a tribute system (Ardren 2010:275,286; Baron 2018:102).

When looking at the notched potsherds, if there is a standardization of similar size and weight, then the weights may have been used for net fishing, in order for the net to stay evenly in the water (Prowse 2008:72). A weight that seems to be an outlier of the others, could suggest that weight was used for some type of line fishing in shallow or deep water depending on the weight. If the notched potsherds are small or of light weight, they may have been used on lines, or nets
that did not need to sink deeply in the water (MacKinnon 1996:15; Eaton 1976:238). If the notched potsherds are big in size or heavy, one would expect they were used for most of the net fishing or for lines that would have been able to be used in deeper water (Eaton 1976:238; MacKinnon 1996:15). The weight of the notched sherds could also tell us what kind of nets the Maya at the site may have been using. If there seems to be a standardization of lighter weights, then the fisherfolk were using cast or seine nets as those nets best suit shallow net fishing (Eaton 1976:238). With the discovery of the canoe paddle at Paynes Creek Salt Works and the knowledge we have of the ancient Maya hunting manatee, one would expect them to use canoes for their net fishing as well (McKillop et al. 2014:298).

When studying the areas of the ancient Maya, one can see the spindle whorls were used to make a thread that could be used for weaving and making clothing. There are examples of what the ancient Maya wore in the iconography depicted on stelae, pottery, and architecture (McKillop 2004:12-13). In Late Classic Maya depictions, there is an emphasis on giving woven cloth as a tribute to lords (Baron 2018:102,110). These examples of tribute could suggest there may have been a ceremonial system or significance of spinning thread among the Maya at Moho Cay.

When looking at the sizes of notched potsherds found in other areas such as San Juan, Chac Balam, and Ek Luum, on Ambergris Cay, one can see the notched potsherds were used for net fishing (Garber 1995:136). At San Juan, Structure 4 showed net weights scattered on the ground, which could indicate a net had fallen from where it was hanging (Garber 1995:134-136). The discovery of estuarine fish such as barracuda, jacks, grunts, and mangrove snappers at Wild Cane Cay (McKillop 2016:284) suggests there could be some of the fish being hunted near Moho Cay. This find would show further evidence that they would have had a need for both line...
and net fishing. Barracuda is caught with a line and is not a schooling fish. It prefers shallow inshore reef areas (Migdalski 1958:175,177). Grunts are fish that swim in small groups or large schools and can be caught with a line or net depending on species type (Migdalski 1958:275-280). Jackfish travel in large schools that can also be caught with line or net (Migdalski 1958:281-311). The information of how fish are caught today provides techniques of the use of a line to catch some fish and the net to catch others by the ancient Maya.
Methods

The methods for this research were to collect data from the fishing weights and spindle whorls to gain greater insight into how the Maya at Moho Cay may have used cotton and other materials for textiles and fishing lines and nets. I also want to see how the spindle whorls and fishing weights might be connected as they would have had to spin thread materials for net making (Eaton 1976:238; MacKinnon 1996:16).

Spindle Whorls

Data collection included analyzing the spindle whorls. Measurements include weight in grams, total length and thickness in centimeters using calipers, as well as the size of their notch hole. Measuring these four variables gives an understanding of what kind of cloth could have been spun with the specific whorl (Chase et al. 2008:129). The variation in size and weight can give us an idea if one type of thread may have been used. If there are enough spindle whorls with the ability to spin the heavier thread, that could also give us insight into whether they were using the spindle whorls to create cloth for the repairs or even making fishing nets at the site.

The spindle whorls were examined under a microscope to examine their texture and wear patterns. Wear provides insight on how often they used the spindle whorls. One also examined each spindle whorl to see if they were cut from old pottery. What ritual significance did the spindle whorls have at the site? Different kinds of spinning techniques were used at other sites in the Maya highlands (Tomasic 2012:221-222). The different techniques and the way the modern Maya spin thread may indicate what type of spinning technique was done at Moho Cay.
Fishing Weights

Collecting data and interpreting the variables can give results one could interpret as related to fishing. (Prowse 2008:69-70). Measurements were taken of their weight in grams, as well as their length, width, and thickness in centimeters and the depth of the notches on their sides. Fishing weights of the same size and weight may indicate use for net fishing. Heavy weights may indicate the use of deep fishing (MacKinnon 1996:15-16). Each fishing weight was individually examined under a microscope to determine its texture, overall wear, and the wear between the notches. Perhaps some net weights were used more than others. Perhaps there was a specific way that the fisherfolk preferred to have the fishing weights cut.

I did research on different fishing methods, net uses, and what supplies and techniques fisher folk would need. As mentioned earlier, we already know that the Maya were hunting manatees at the site (McKillop 1985:340,346). The other types of fish and marine life found at Moho Cay can show what other kinds of fish or marine life the ancient Maya at the site may have been hunting. We might not be able to know the exact detailed techniques the Maya used for fishing (Knowlton 1966:29). However, the research of the different types of fishing techniques one would use for these certain types of fish or marine life could give us insight into the different techniques possibly being used. Different fish require different types of fishing methods so researching the fish population will give us clues into what techniques they could have used.

Research on how the modern Maya fish and hunt marine life today gives insight into how the practices may be associated with what the ancient Maya. Weather and ocean patterns near the coast can also give knowledge on when the Maya could have fished and hunted manatee. This
information can provide clues into the types of fishing and hunting that would have to be done in this environment (Knowlton 1966:10-11). The complementary research will be helpful in interpreting what the data from the fishing weights and spindle whorls could be showing.
The Sample

At the site of Moho Cay, archaeologists excavated a total of 25 spindle whorls and 124 fishing weights. Both samples were measured in centimeters and grams. Where possible I measured their length, width, and thickness with calipers, and their weight with an electric scale. In the sample of 25 spindle whorls, there are six whole whorls and 19 broken spindle whorl pieces. Although there were some similar spindle whorls, there were also variations of sizes and weight throughout the sample. None was made specifically for being a spindle. All were made from potsherds. Four were slipped. Three out of those four were polychrome. The rest were unslipped. The amount of wear on the surface as well as the notch hole were examined through a microscope. When looking through a magnifying lens one could see the amount of use each of these spindle whorls had over the years.

At different sites, there have been whorls found with different shapes. At the site of El Pilar, whorls were found to have been straight-sided with a slightly rounded bottom (Kamp et al. 2006:415). At the site of Caracol, whorls were found to have different designs as well as shapes (Chase et al. 2008:131-134). The Moho Cay spindle whorls are round with a cut hole in the middle. Although they were of different circular sizes, the hole in the middle was similar in measurement. The size of 3 of the spindle holes were in the range of 0.5cm to 0.6cm, and the other 3 spindle holes were in the range of 0.8cm to 1cm. The thickness of the complete whorls was close with a range of 0.6cm to 0.8cm. None of spindle whorls had any detailed designs. Although a few had been painted. However, this could have been the paint from the ceramic they were originally recycled. Measuring these specific categories will give us insight into how the spindle whorls were cut at this site and how the possible thread could have been used (Chase et al. 2008:129). The two tables below show the information above. Table 1 shows the spindle
whorl hole size and the amount of spindle whorls in the size range. Table 2 shows the thickness range for the spindle whorls.

Table 1. Spindle Whorl Hole Size Range

<table>
<thead>
<tr>
<th>Spindle Whorl Hole Size cm</th>
<th>Total Spindle Whorls</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5cm - 0.6cm</td>
<td>3</td>
</tr>
<tr>
<td>0.8cm - 1cm</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 2. Spindle Whorl Thickness Range

<table>
<thead>
<tr>
<th>Thickness Range cm</th>
<th>Total Spindle Whorls</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.6cm - 0.8cm</td>
<td>6</td>
</tr>
</tbody>
</table>

Elsewhere spindle whorls that weighed 10g or less and have diameters under 3.5cm are thought to have been used for spinning cotton (Chase et al. 2008:129). Spindle whorls with a greater weight than 10 grams and a larger diameter than 3.5cm are thought to have been used for spinning heavier fibers such as maguey (Chase et al. 2008:129). Four of the complete spindle whorls are under the category of spinning cotton with a length and width of 3cm and a weight under 10g. Two of the complete spindle whorls were used to spin something thicker such as maguey or a heavier cotton species with a length and width from 4cm to 5cm and a weight of 14g and 35g. Table 3 shows the data for the weight and length of the spindle whorls.
Table 3. Weight and Length Range of Spindle Whorls

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Spindle Whorls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spindle Whorls with a length/width less than 3.5 cm and a weight less than 10g</td>
<td>4</td>
</tr>
<tr>
<td>Spindle Whorls with a length/width greater than 3.5 cm and a weight greater than 10g</td>
<td>2</td>
</tr>
</tbody>
</table>

There is a possibility of multiple uses of thread at the site. Finding remnants of 25 spindle whorls indicates that spinning is probably something regularly practiced at Moho Cay (Baron 2018:102). The variation of size and weight in the sample shows that there was a need for a light thread such as cotton and a heavy thread such as maguey. However, the thicker thread may be a different species of cotton (Baron 2018:106). Cotton was a common resource throughout the Classic period. There were many species and variations that could be found throughout northern and southern Belize (Baron 2018:102-103). The Maya at Moho Cay may have been spinning cotton for yarn, net making, and other products. The large size of the sample of spindle whorls may indicate there was a standardized production of spinning. Also given some of the research done about the Aztec and prevalence of cotton in the Maya world, the sample could also suggest a tribute system (Ardren 2010:275,286; Baron 2018:102).

In the sample of 124 fishing weights, there are 76 complete weights and 48 fragmented weights. They were examined under a microscope to see their wear and their style of pottery. There was a lot of wear throughout the sample. All notched sherds were made from other forms of pottery vessels that were cut and notched (McKillop 2004:268). Out of the sample, 69 fishing weights were unslipped, 33 were slipped monochrome, and 22 were slipped.
Out of the complete fishing weights 20 weights are in the weight range of 2g to 4g, 20 weights are in the weight range of 5g to 7g, 13 weights are in the weight range of 8g to 10g, 8 in the weight range of 11g to 15g, 7 weights are in the weight range of 16g to 19g, 6 weights are in the weight range of 20g, 1 weight is in the weight range of 30g, and 1 weight is in the weight range of 40g. Table 4 shows the different weight ranges for the complete fishing weights.

Table 4. Weight Range of Fishing weights

<table>
<thead>
<tr>
<th>Weight Range g</th>
<th>Number of Fishing Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-4g</td>
<td>20</td>
</tr>
<tr>
<td>5-7g</td>
<td>20</td>
</tr>
<tr>
<td>8-10g</td>
<td>13</td>
</tr>
<tr>
<td>11-15g</td>
<td>8</td>
</tr>
<tr>
<td>16-19g</td>
<td>7</td>
</tr>
<tr>
<td>20g</td>
<td>6</td>
</tr>
<tr>
<td>30g</td>
<td>1</td>
</tr>
<tr>
<td>40g</td>
<td>1</td>
</tr>
</tbody>
</table>

The measurements of the fishing weights also give a good idea of how many different kinds of sizes there were. Out of the complete weights, there were 34 weights with a thickness of 0.4 to 0.5cm, 30 weights with a thickness of 0.6 to 0.7cm, 9 weights with a thickness of 0.8cm to 1cm, and 3 weights with a thickness of 0.3cm. Table 5 shows the data for the thickness of the fishing weights.

Table 5 Range of Thickness of Fishing Weights

<table>
<thead>
<tr>
<th>Range of Thickness cm</th>
<th>Total Fishing Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3cm</td>
<td>3</td>
</tr>
<tr>
<td>0.4cm-0.5cm</td>
<td>34</td>
</tr>
<tr>
<td>0.6cm-0.7cm</td>
<td>30</td>
</tr>
<tr>
<td>0.8cm-1cm</td>
<td>9</td>
</tr>
</tbody>
</table>
When measuring the notches for complete weights there were 46 weights measuring 2cm, 19 weights measuring 3 cm, 1 weight measuring 5cm, 5 weights measuring 4cm, and 5 weights measuring 1cm. The depth of the notches varied. There were 41 weights with a notch depth of 0.6 to 0.8 cm, 21 weights with a notch depth of 0.9 to 1cm, and 14 weights with a notch depth of 3 to 5cm. Table 6 shows the notch size of the notch measurements and Table 7 shows the notch depth measurement ranges.

<table>
<thead>
<tr>
<th>Notch Size cm</th>
<th>Total Fishing Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>1cm</td>
<td>5</td>
</tr>
<tr>
<td>2cm</td>
<td>46</td>
</tr>
<tr>
<td>3cm</td>
<td>19</td>
</tr>
<tr>
<td>4cm</td>
<td>5</td>
</tr>
<tr>
<td>5cm</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Notch Depth cm</th>
<th>Total Fishing Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3-0.5cm</td>
<td>14</td>
</tr>
<tr>
<td>0.6-0.8cm</td>
<td>41</td>
</tr>
<tr>
<td>0.9-1cm</td>
<td>21</td>
</tr>
</tbody>
</table>

The length and width of the complete fishing weights were also varied. For the length of the weights, there were 40 weights measuring 3cm, 18 weights measuring 2cm, 13 weights measuring 4cm, 4 weights measuring 5cm, and 1 weight measuring 6cm. For the width of the weights, there were 34 measuring 2cm, 28 measuring 3cm, 12 measuring 4cm, and 1 measuring
1cm. Table 8 shows the variation of the length in “cm” of the fishing weights. Table 9 shows the variation in width of the fishing weights.

Table 8. Length of Fishing Weights

<table>
<thead>
<tr>
<th>Fishing Weight Length cm</th>
<th>Total Fishing Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>2cm</td>
<td>18</td>
</tr>
<tr>
<td>3cm</td>
<td>40</td>
</tr>
<tr>
<td>4cm</td>
<td>13</td>
</tr>
<tr>
<td>5cm</td>
<td>4</td>
</tr>
<tr>
<td>6cm</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 9. Width of Fishing Weights

<table>
<thead>
<tr>
<th>Width of Fishing Weights cm</th>
<th>Total Fishing Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>1cm</td>
<td>1</td>
</tr>
<tr>
<td>2cm</td>
<td>34</td>
</tr>
<tr>
<td>3cm</td>
<td>28</td>
</tr>
<tr>
<td>4cm</td>
<td>12</td>
</tr>
</tbody>
</table>
Results

The data gathered of the spindle whorls and fishing weights were analyzed in excel spreadsheets created with all the data. The spindle whorls are reworked pottery sherds with holes in the center. The fishing weights are reworked pottery sherds with notches on both sides. The analysis was focused on the complete spindle whorls and fishing weights alone. Charts and two-way tables of the data of spindle whorls and fishing weights were made to see if there was any association between different measurements. The spindle whorls data, and tables, will be discussed first. The fishing weights data, tables will be discussed second. A description of each table will be given to help with reading the data of the spindle whorls and fishing weights presented.

Spindle Whorls

The first set of two-way tables created was of the spindle whorls. The goal of these tables was to see if there was an association between the weight and size of the spindle whorl and the weight and size of the spindle hole. The description found in the table show light and heavyweight category. The lightweight refers to spindle whorls less than 10g and the heavyweight category refers to spindle whorls greater than 10g. The second category refers to a small and large size. The small and large spindle whorls were looked at by me and separated based on what they looked like in comparison. Table 10 shows there are four lightweight spindle whorls that are small and two heavy spindle whorls that are large.

Table 10. Spindle Whorl Size and Weight Association

<table>
<thead>
<tr>
<th>Weight g</th>
<th>Spindle Size cm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small</td>
</tr>
<tr>
<td>Light</td>
<td>4</td>
</tr>
<tr>
<td>Heavy</td>
<td>0</td>
</tr>
</tbody>
</table>
The description found in the table mentions hole size. The hole sizes of the spindle whorls were looked at by me and separated based on comparison. Table 11 shows there are two light spindles with small holes, two heavy spindles with small spindle holes, and two light spindles with large holes.

Table 11. Spindle Whorls Weight and Hole Width Association

<table>
<thead>
<tr>
<th>Hole Size cm</th>
<th>Light</th>
<th>Heavy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Large</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Fishing Weights

The goal of these two-way tables was to see if there was any association between various measurements such as weight, length, size, and notch depth of the notched potsherds. The table mentions light and heavy weights compared to their size. They were divided into two categories of weights weighing under 10g and weights weighing over 10g. Once divided I looked at their size in comparison to see if they looked small, and large, those that looked somewhere in the middle were put in the medium category. Table 7 shows there are 43 small, light fishing weights, 5 light, medium-sized fishing weights, 16 heavy, medium-sized fishing weights, and 12 heavy and large-sized fishing weights. The results of Table 12 are very highly significant.

Table 12. Fishing Weight Size & Weight Association

<table>
<thead>
<tr>
<th>Size cm</th>
<th>Light</th>
<th>Medium</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>43</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Medium</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large</td>
<td>0</td>
<td>16</td>
<td>12</td>
</tr>
</tbody>
</table>

Table 13 shows there are 24 light fishing weights with a shallow notch depth, 25 light fishing weights with a deep notch depth, 14 heavy fishing weights with a shallow notch depth, and 13 fishing weights with a deep notch depth.
Table 13. Weight & Notch Depth Association

<table>
<thead>
<tr>
<th>Depth cm</th>
<th>Shallow</th>
<th>Heavy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light</td>
<td>24</td>
<td>14</td>
</tr>
<tr>
<td>Deep</td>
<td>25</td>
<td>13</td>
</tr>
</tbody>
</table>

Table 14 shows there are 34 slim and small-sized weights, nine thick and small-sized weights, three slim and medium-sized weights, 18 thick and medium-sized weights, and 12 thick and large-sized weights.

Table 14. Fishing Weight Size and Thickness Association

<table>
<thead>
<tr>
<th>Thickness cm</th>
<th>Size cm</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slim</td>
<td>34</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Thick</td>
<td>9</td>
<td>18</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

Table 15 shows there are 14 slim weights with a shallow notch depth, 24 thick weights with a shallow notch depth, 23 slim weights with a deep notch depth, and 15 thick weights with a deep notch depth.

Table 15. Fishing Weight Thickness and Notch Depth Association

<table>
<thead>
<tr>
<th>Thickness cm</th>
<th>Depth cm</th>
<th>Shallow</th>
<th>Deep</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slim</td>
<td>14</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Thick</td>
<td>24</td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>
Photos

The following pages have photos taken in the DIVA Lab of the fishing weights and spindle whorls. Each set of photos is of the interior and exterior of the objects. Photos of the fishing weights are shown first followed by photos of the spindle whorls. These pictures help one get a better visual representation of the differences and similarities throughout the sample.

Figures 4. and 4.2 show the differences and similarities in size among the fishing weights. The figures show the front and back of the fishing weights. The Catalog Numbers and Positions: Top Row from left to right, (TUD 1012), (TUD 1024), (TUD 1077), Bottom Row from left to right (TUD 1000), (TUD 986), (TUD 976)

Figures 4.3 and 4.4 show three small fishing weights compared with one of the large fishing weights. The figures show the front and back of the fishing weights. The Catalog Numbers and
Positions: Top Row from left to right (TUD 1020), (TUD 988), Bottom Row from left to right (TUD 1023), (TUD 1022)

![Figure 4.5](image1.png) ![Figure 4.6](image2.png)

Figures 4.5 and 4.6 show the variation of colors and more similarities in sizing in the sample. The figures show the front and back of the fishing weights. The Catalog Numbers and Positions: Looking Vertically at the left column top to bottom (TUD 982), (TUD 1016), (TUD 1073), Looking vertically the right column from top to bottom (TUD 1039), (TUD 1076)

![Figure 5](image3.png)

Figure 5 shows all six spindle whorls. Figure 5 shows the differences and similarities in the size and shape of the spindle whorl and spindle hole. The Catalog Numbers and Positions: Top (TUD 212), Middle Left (TUD 1218), Middle Right TUD 1214), Bottom Row from Left to Right, (TUD 1207), (TUD 1235), (TUD 1234)
Figure 5.1 shows the rough edges and similarities in sizes of the spindle holes between the three spindle whorls. The Catalog Numbers and Positions: Top (TUD 1214), Bottom Row from left to right (TUD 1218), (TUD 1234)

Figures 5.2 and 5.3. show the variation in hole size between one of the larger spindle whorls and two smaller ones. The spindle whorl at the top has a smaller hole size than the two at the bottom even though it has an overall larger size. The figures show the front and back of the spindle whorls. The Catalog Numbers and Positions: Top (TUD 212), Bottom Row from left to right (TUD 1207), (TUD 1235),
Interpretation

The spindle whorls and fishing weights excavated in the fill and refuse of feature four and two burials could show there were people living at Moho Cay consistently throughout the year (McKillop 1980:136-143). Tables 1 and 2 show there was not a huge variation in the notch size and thickness of the spindle whorls. Table 3, 10, and 11 for the spindle whorls show weight was a factor in size. However, Table 11 shows the size of the spindles hole is not a determining factor in its weight. Most of the spindle whorls are in half or fragmented. Although the sample of six whole spindle whorls is small, the data reinforces the importance of the weight and size of the spindle for spinning. Also, the fact that there are heavy spindles, as well as light spindles, shows that there was a variation of fiber spun at the site. Whether the fiber spun was light cotton and heavy cotton, or light cotton and heavy maguey is unknown because these fibers were not preserved. All three could have been used since the various forms of cotton and maguey were present in the region (Alt 1999: 129; Baron 2018:1021-103, 106; Corbett and McCafferty 2002:53). The sample shows the importance of spinning thread at Moho Cay. The large sample size of six whole spindle whorls and 18 fragmented spindle whorls suggests an organized industry for spinning as at the Terminal Classic site of Xuenkal where 17 were found (Ardren 2010:274-275,286; Baron 2018:102). Although an ancient Maya fishing net has not been discovered, nets are made from cotton and other fibers. Therefore, cotton spun at Moho Cay may also have been used for making or mending the fishing nets.

When looking at Table 12 for the fishing weights, the data show the fishing weights’ size and weight are closely associated with each other. Table 5 shows most of the fishing weights were 0.4cm to 0.7cm in thickness. Table 14 shows the size and thickness of the fishing weights are associated with each other. Table 6 shows the majority size of the fishing weights notches.
was 2cm in length. Table 7 shows most of the fishing weights notch depth was 0.6cm to 0.8cm. This could mean there was possibly a standardization of how the notches were cut. What was surprising was the absence of significant association among fishing weights in their notch depth and weight as seen in Table 13. Table 15 shows the association between notch depth and thickness. The table shows the fishing weights with shallow notches were thicker, and weights with deep notches were thinner.

The data from Tables 4, 8, 9, and 12 also show there were more fishing weights that were small, and light compared to those that were heavy and large. The data show there was not only a need for multiple sizes and weights, but there was a possible standardized weight, size, and length for specific types of fishing in the area. The amount of small, light fishing weights used show there was could have been more shallow net fishing done with the use of cast nets or seine nets. These data also show there was a possible standardization of how the weights were made. The large number within the sample that are of similar size and weight suggests the weights were used on nets that would have been in shallow water, requiring weights that provide uniformity across the nets’ surface (Eaton 1976:238; MacKinnon 1996:15). However, having large and heavy fishing weights shows the variety of fibers that could have been used for nets and lines, as well as the variety of different types of fishing done at the site (MacKinnon 1996:15-16).

The large size of the sample of all the whole and fragmented fishing weights shows the importance and prominence of fishing done at the site. Modern fisherfolk at Ambergris Cay can be found using beach seining, traps, hook, line, and spearfishing (Emery and Graham 2003:82). The fishing practices at Ambergris Cay may be a possible indication of the types of fishing done at Moho Cay. Modern fisher folk at Caribena Cooperative in San Pedro Belize, located in the southern point of Ambergris Cay, rely on doing certain types of fishing during certain seasons.
Further data also shows the fishing done at these sites would have been for more than just subsistence fishing such as trade, tribute, and support (Emery and Graham 2003:83). Moho Cay was also a once extensive trading site. This complementary data from the modern Maya fisherfolk at Ambergris Caye and the Caribena Cooperative can give us a visual of how extensive the standardization of fishing may have been at Moho Cay. The modern fisherfolks’ practices during specific seasons also show us the different patterns the ancient Maya at Moho Cay may have used when doing their own fishing. The modern fisherfolk of Caribena Cooperative will fish for different species at different times of the month/year. The migratory and breeding patterns of the different fish caught in the area are the reason for this variation of fishing (Emery and Graham 2003:83). The modern fisherfolks’ practice of seasonal fishing and hunting could be an indicator of how seasonal practices were done by the ancient Maya fisherfolk at Moho Cay.
Conclusion

The spindle whorls and fishing weights found at Moho Cay show there was not just fishing and trade at the site but also spinning production being done. As mentioned earlier the research shows how impactful spindle whorls and fishing weights were to the everyday lives of the Classic Maya at Moho Cay. The sample sizes of each textile show the production of spindle whorls and fishing weights at the site of Moho Cay was important to the ancient Maya in that area. The different sizes and weights of spindle whorls show the use of different forms of cotton and maguey when spinning thread (Alt 1999:129; Baron 2018:102-103, 106). The spindle whorls suggest a possible tribute system (Ardren 2010:275,286; Baron 2018:102) that would interplay with both the social and economic lives of the people at Moho Cay. The various sizes and weights of the fishing weights show that the Maya at Moho Cay used different fishing techniques at the site and just offshore from Moho Cay (Eaton 1976:238; MacKinnon 1996:15; McKillop et al. 2014:298). The various fishing weights and the bone midden mentioned previously (McKillop 2004:258) show how diverse the fish population at the trading port was. The bone midden and weights also show how important the various fish and hunting of manatee was to the economic, and trade system for the Maya at Moho Cay.

As mentioned earlier, the ancient trading site of Moho Cay does not exist (McKillop 2004:258). Continuing to analyze different artifacts found at Moho Cay as well as studying the context and research already done at the site can be helpful in telling us more about the possible practices of the ancient Maya at Moho Cay. However, going to modern Moho Cay and attempting to document any new information would not be possible because the ancient context has been destroyed.
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Prowse, Shari L.  

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Vita

Kaitlin Samples from Malakoff, Texas had an interest in anthropology during her time at the University of Texas at Tyler. She was able to volunteer at the Maya Research Program field school, which sparked her interest in ancient Maya archaeology. She was awarded a graduate assistantship to study anthropology at Louisiana State University. She will receive her Master thesis on May 22. Following graduation, she will either begin work on her doctorate or start work at a CRM company in Baton Rouge.