

There's a Gadget for that! Examining changes in fishing tools at El Rayo.

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The transition between the Bagaces and Sapoa periods in Nicaraguan pre-history relates to important changes in the material culture, which some suggest are explained by the immigration of a new population to the area. The extent and type of interaction is unclear. This paper will examine the continuity and changes of ceramic and bone tools seen through this transition period, at the site of El Rayo. Special attention will be given to the three style variations of net sinkers found at the site and the use of bone fish hooks throughout time.

Despite the recent research conducted in the last 10 years, Nicaragua continues to be one of the least known archaeological countries in Central America. To date the largest archaeological project in the country was Proyecto Santa Isabel, Nicaragua (Project SIN) with field investigations conducted by Dr. Geoffrey McCafferty from the University of Calgary between 2000 and 2005. The project looked to identify and explore domestic archaeological sites to evaluate the degree of interaction between Mesoamerica and Nicaragua, as identified through oral traditions as the origin place of the Nicarao (McCafferty 2008).

Archaeological excavations were conducted in 2009 and 2010 at the site of El Rayo, Nicaragua (N-GR-39) as part of the Proyecto Arqueologia Granada, Nicaragua (PAGN) again under the direction of Dr. Geoffrey McCafferty. PAGN hoped to continue the work initiated in Proyecto SIN in the identification and exploration of domestic archaeological sites. The site of El Rayo is located on the Asepe peninsula of Lake Nicaragua (Figure 1), the investigated area covers 37.5 km² and includes three areas of excavation. The excavations at El Rayo recovered two burial areas at Loci 1 and 3 and a domestic component at Locus 2 of the site (Wilke et al. 2011). The

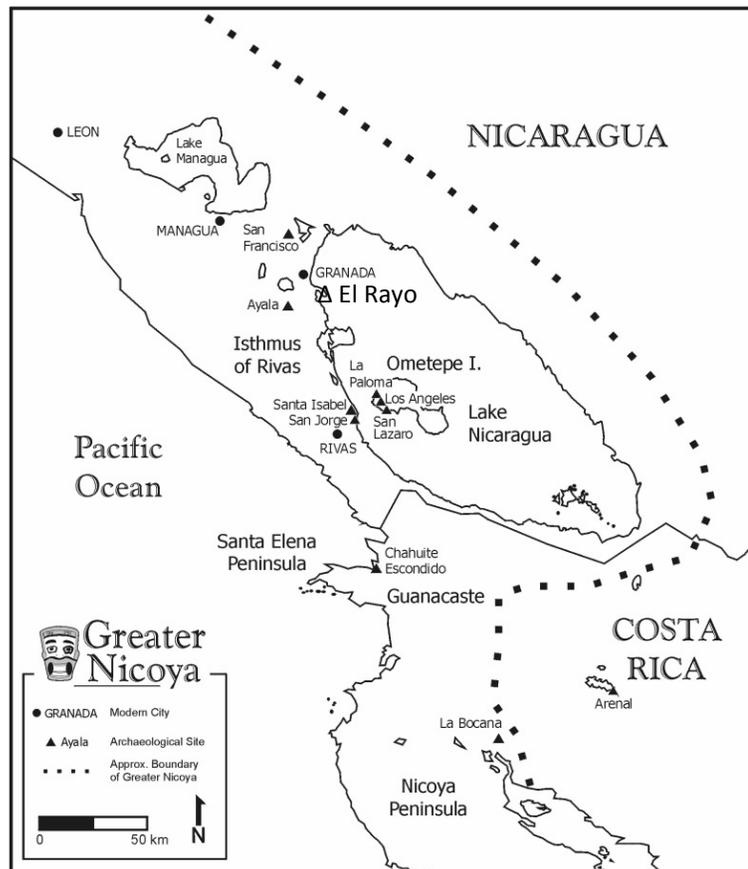


Figure 1: Map of The Greater Nicoya Subarea featuring major archaeological sites. From McCafferty and Steinbrenner 2005:Figure 1

domestic area was radiocarbon dated to the Bagaces (AD 300-800) and Sapoa (AD 800-1200) periods, which correspond to the in-field age estimate of the site based on the ceramic sequence present (McCafferty et al. 2009). This paper will focus on a class of artifacts recovered from El Rayo, specifically examining how these artifacts changed within the domestic assemblage throughout time.

Traditionally artifact analysis within Central America has focused primarily on ceramic analysis, with the goal of establishing a secure chronology (Healy 1980, Lange 1984, McCafferty and Steinbrenner 2005, Norweb 1964, Steinbrenner 2002 to name only a few). This focus has left much of the archaeological record unanalyzed or minimally analyzed, these groups include lithic analysis, faunal analysis, and non-vessel ceramic objects (however see McCafferty and McCafferty 2009). Among the artifact assemblage at El Rayo multiple classes of artifacts were recovered which relate to subsistence practices, this paper will focus on fishing technology and consider two distinct classes of artifacts associated with fishing, how this technology changed through time, along with some possible reasons as to why it changed. Primarily among these artifacts are the ceramic net sinkers found in abundance at the site of El Rayo, and have been found in Nicaragua among domestic assemblages elsewhere (Healy 1980, McCafferty 2008). Bone fish hooks were also recovered from El Rayo and will be considered in this paper. The importance of fishing technology can be seen by the abundance of fish bones, representing over half of the recovered faunal material from El Rayo.

Background of the Typology

Net sinkers are made of broken ceramic sherds, usually reworked to smooth the edges, with notches or grooves allowing for attachment to a net or string, which prevent the net from just floating on the surface of the water when fishing. The net sinkers from the site of El Rayo were made from a variety of different ceramic sherds. The net sinker assemblage was separated into three types which were identified from El Rayo, the end notched, side notched, and end grooved types, with two manufacturing techniques distinguishing the notched and the grooved types. In the notched types the attachment area for the net appears as a slit inserted along the edge of the smoothed sherd, while with the grooved type, the attachment area has been worn down into the surface of the sherd on all sides. Of the 318 net sinkers analyzed a majority (75%, n=240) were constructed from a monochrome sherd, chosen over polychrome sherds. The sinkers ranged in shape from rectangular to round, with the side notched sinkers representing the widest variety in shape (Figure 2). The side notched sinkers were either left angular (n=132) without significant smoothing of the corners or were worked to produce

rounded edges (n=110). The remainder were rectangular in shape and formed the two end varieties of net sinkers (n=67).

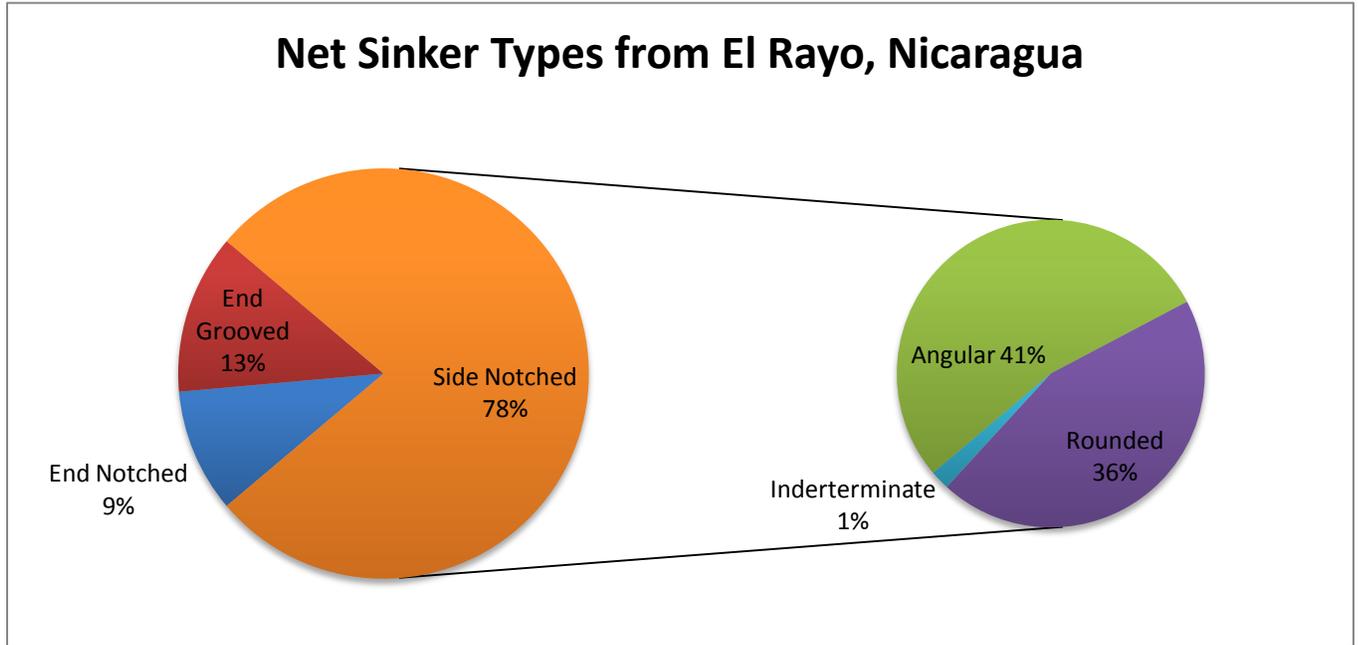


Figure 2: Net Sinkers from El Rayo based on type

Presentation of the Typology

Analysis of the net sinkers from El Rayo was conducted in July and August of 2010 by the author. All net sinkers were sorted into the three types identified in the typology and measurements were taken, when possible, along the width (at the widest point parallel to the rim, when present, otherwise the measurement was taken along the longest side) and the widest point on the shorter side representing the height of the net sinker. Net sinkers which

were severely broken were not measured. Weights were taken for complete, or nearly complete net sinkers (when over 90% of the net sinker present).



End notched (31)

This type of net sinker is characterized by the presence of two sets of corresponding notches at either end of the sherd (Figure 3). These net sinkers are obviously rectangular in shape and are flat. In the El Rayo collection the length of this type of sinker was at least double the

Figure 3: End Notched Net Sinker

width. Complete end notched net sinkers (n=5) from El Rayo range in size from 45 to 144 millimeters on their longest side, and are between 12 and 97 grams in weight.

Side notched (247)

Side notched net sinkers are classified as such because they can be notched anywhere along the side of the sherd and these notches do not need to occur in pairs (Figure 4). The number of notches in this type range from one to four on the complete examples, with two notches occurring in 94% (n=232) of the examples. This type has far more variety than the other two types as shape, notch number and proportion are all more varied suggesting this type was more versatile than the others. Complete side notched net sinkers (n=91) from El Rayo range in size from 42 to 99 millimeters on the longest side, and between 14 and 97 grams in weight.



Figure 4: Side Notched Net Sinker



Figure 5: End Grooved Net Sinker

End Grooved (40)

The End Grooved type is made of large olla rim sherds, which are generally bulkier and fatter than the notched varieties (Figure 5). This type is always classified as rectangular in shape (as with the end notched type). Rather than part of the sherd being chipped away, these net sinkers were formed by the movement of a string or some other thin material over the surface to wear down a groove. The grooves on these sinkers are thought to occur at both ends of the sinker and extend all the way around diameter of the sinker. Only one complete end grooved net sinker was recovered from El Rayo and was measured at 69 millimeters in length and weighed 50 grams.

This single “complete” example from El Rayo could be used to suggest that this type was broken in a higher frequency than the other types or it may suggest that this type was only grooved on one end of the sinker and that this “complete” example does not represent the standard form of this type. If these were generally only grooved on one end they would act

differently in the water, the sinker would fall vertically in the water, rather than lay horizontally with the net.

As with any typology, the one being presented here has a few confusing points which need to be addressed. Distinction between end and side notched net sinkers may be considered an issue, however, I feel that they are distinct in their form resulting in their functioning differently when used. There is some room for error with these two types, as some examples may fall in between, for instance, when the notches are not all present or when not enough of the sinker is recovered to estimate original shape. Complications may also arise between the 'end' types, where the groove may not extend completely around the sinker, or when notches have been made on chunky rim sherds (Figure 6). These gray areas become clearer when the net sinkers have been consulted and compared. In instances where the type is unclear, this has been and needs to be stated.



Figure 6: Net sinker showing characteristics of multiple types

I must also note that more elaborate styles of net sinkers were recovered at the site of Santa Isabel, Nicaragua (McCafferty 2008: Figure 3a), however, because I have not analyzed this material personally, I can only acknowledge that the typology presented here is only the beginning of the variation that exists in Pacific Nicaraguan net sinkers.

Fish Hooks (8)

Eight bone fish hooks (Figure 7) were recovered from El Rayo at the deepest levels of Locus 2. The fish hooks were concentrated (7 out of 8) within the lower levels (6-11) of a single operation, while the last fish hook was recovered 40 metres away and was the deepest fish hook recovered from the site. All fish hooks recovered were broken. The measurements taken for this category are based on what was present, however samples were not complete enough to extrapolate a complete specimen. Fish hooks were identified based on their rounded shape, with four examples the tip of the hook has remained intact, on one the attachment site (to the line) is present. The remaining fish hooks were identified as such based on the slender curved shape of the bone.



Figure 7: Bone Fish Hook

The two fish hooks from the deepest levels (11 and 13) appear to have been made with more detail than those in the higher levels (6-10). One of these examples is notched at the attachment site, while the other has an indent on the inner curve of the hook (Figure 8). The other samples do not include any evidence of attachment sites, however this may be the result of preservation and should not be taken to suggest that these features were not present in the other fish hooks recovered.

Temporal Placement

Inspired by work being done in other types of analysis at the El Rayo site on artifact frequencies through time and questions regarding what artifacts were associated with the transition between the Bagaces and Sapoia periods levels (namely by Carrie Dennett on the relationship between ceramic types), I looked at the frequency of these three types of net sinkers recovered from the different levels excavated within the domestic component of the site at Locus 2. Figure 9 quite obviously shows the development of the types of net sinker, and shows that the side notched type occurs earliest and the end grooved style is the latest to develop. This was unexpected, as I hypothesized that the chunky and seemingly more crudely constructed end grooved type would be the oldest, with the more highly worked notched styles coming in later. In reality it appears that the side notched sinkers are the oldest type of this technology. That being said, however, the less frequent three and four notched styles (n=5) of the side notched type do not appear until the upper levels at Locus 2.



Figure 8: Fish hook with grooved inner edge

El Rayo Fishing Technology at Locus 2 by Level														
Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14
End Grooved	2	2	5	5	5	3	0	1	2	0	0	0	0	0
End Notched	1	1	4	2	1	1	0	0	0	0	0	0	0	0
Side Notched	5	12	34	18	15	8	6	4	2	4	3	1	0	1
Fish Hooks	0	0	0	0	0	0	0	2	0	3	1	0	1	0

Figure 9: Presence of fishing technology at El Rayo by excavation level

Looking at Locus 2 as a whole, we can see the side notched net sinkers are the most popular of the three types, representing 60-80% of the net sinkers at all the various levels of excavation. This type is the oldest and is found only with fish hooks in the deepest levels of the

site. A notable shift occurs between levels 6-9 as we see the side notched sinkers are joined with end notched and end grooved sinkers, with the end grooved being slightly more popular. In addition to this, by level 6 fish hooks disappeared altogether.

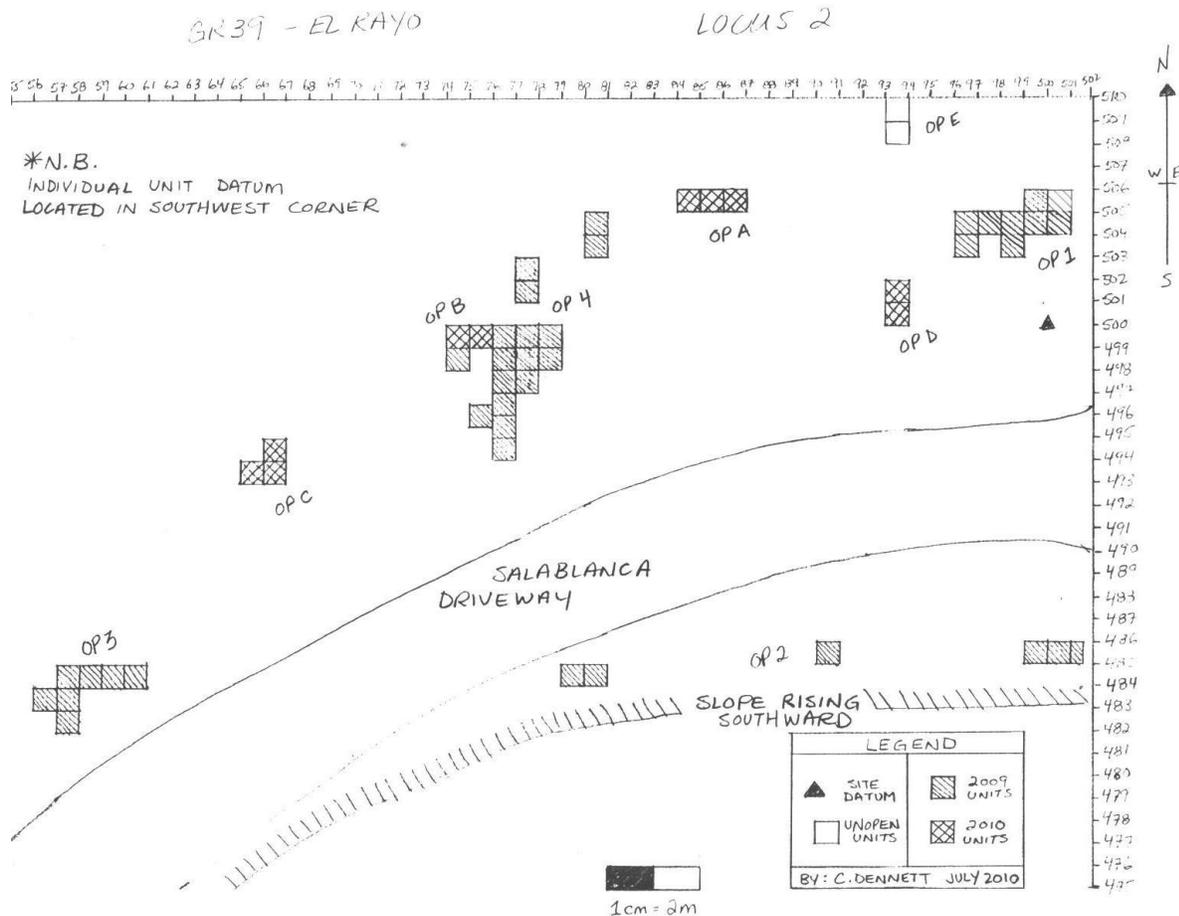


Figure 10: Map of Locus 2 showing different operations. Map drawn by Carrie Dennett

This shift is still present, albeit less drastic, if we break down Locus 2 into its operations of concentrated investigation (Figure 10). Locus 2, Operation 1 shows the clearest evidence for the Bagaces-Sapoa transition based on the ceramic assemblage recovered and analyzed by Carrie Dennett of the University of Calgary (Personal Communication, 2010). The shift in fishing technology is present at Operation 1 and corresponds to the shift in ceramic types associated with the Bagaces-Sapoa transition. Within Operation 1 we can see in Figure 11 that the side notched sinkers and fish hooks precede the end notched and grooved sinker types. The first appearance of these sinker types occurs in Level 6 of these units, this is also the last time we see fish hooks present. This may suggest that the fish hooks were replaced by these new net sinker types. The change in technology seen in fishing tools, specifically with regard to Level 6 occurs just after the Bagaces-Sapoa transition seen in Levels 7-8 (Carrie Dennett, Personal Communication 2010).

<u>El Rayo Fishing Technology: Locus 2, Operation 1</u>															
Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Net Sinkers															
End Notched	-	-	1	2	3	1	-	-	-	-	-	-	-	-	-
Side Notched	-	6	15	5	9	2	1	-	-	1	-	1	-	-	-
End Grooved	1	1	1	-	-	1	-	-	-	-	-	-	-	-	-
Fish Hook	-	-	-	-	-	1	-	2	-	3	1	-	1	-	-

Figure 11: Presence of fishing technology at El Rayo by excavation level at Locus 2, Operation 1

Oddly enough the introduction of the end notched sinker occurs in Level 5 at Operation 3, even though all the levels were identified as Sapoa, again based on the ceramics present as well as a radiocarbon date from Level 10 of A.D. 900-1140 (McCafferty et al 2009). While the transition appears connected based on the levels they were recovered from, there is no temporal correlation between the shift from Bagaces to Sapoa period material seen at Operation 1 and Operation 3.

Significance/Discussion

We can clearly see a change from the primary use of the side notched net sinker along with fish hooks to the exclusive use of net sinkers of more specialized styles. The typology represented here can be interpreted in a number of ways. The technological change in the pre-Columbian tool kit may relate to independent improvement of the fishing technology or the introduction of new tools from external sources, which were chosen based on the efficiency of the tools or the desire to fish for different, possibly larger species.

The later net sinker types are more specialized than the earlier side notched variety, which resulted in the increased variation within the side notched type in the later levels. The end notched and grooved sinkers were likely developed for very specific purposes. The later examples of net sinkers are less uniform in style, with the appearance of two new distinct types along with more variation within the side notched type net sinker. The two new types are uniform in that the end notched sinkers are always rectangular in shape with notches occurring in pairs closer to the end of the sherd and end grooved net sinkers are always grooved nearer to one end of the sherd and are rectangular in shape. This suggests that these styles were designed

in a specific manner. The side notched sinkers become more versatile in their form with the addition of the third and fourth notches seen in a few later examples.

The change in fishing technology may relate to the use of different materials for stringing the net that are stronger and could maintain integrity with the added weight of the later net sinkers, or it may relate to a changing shape of the net itself perhaps to accommodate a desire to catch a new variety of fish. At this point the specific fish species present at the various levels at El Rayo has not been analyzed so this suggestion is purely speculation. The consistent and abundant presence of the side notched net sinker suggests that it remained the dominant type of sinker used, despite its new variation, likely because this style could be altered into multiple forms. While the most abundant side notched net sinkers had two notches, there was no standard format to how many notches were present or more importantly, where they would occur on the net sinkers edges. This would allow the net sinkers to be tied to the net in a variety of ways making the net itself act differently when thrown into the water.

This difference in the behavior of the nets will be the result of the number of net sinkers attached to the net. It is tempting to infer the number of nets represented by the number of net sinkers recovered from the site, however sufficient information to do this extrapolation is not yet available. We must also keep in mind that the number of each type of net sinker may not relate to the number of different types of nets in use at a given time. It is entirely possible that the different types of net sinkers would have been present on a single net. This again, would have been the decision of a highly skilled individual or individuals in order to get the net to move in a way that would allow for greater success in obtaining fish. While the addition of new net sinker types may suggest a new manner of creating new styles of fishing nets, it is equally likely, and rationally more likely, that these new types were added to the existing nets to alter the manner in which the nets worked, rather than changing the entire net itself. I would use the presence of relatively few end notched and end grooved types as evidence for this. If the technology was being changed outright, we should have seen a more distinct battleship curve form to the frequency of the different types.

It is important to remember that the changes made to the form of the net sinkers would alter the way they were used and were intentionally designed in a manner which was effective for a specific purpose, even if that purpose is unclear to us now. For example, net sinkers which would be positioned vertically within the water when attached to a net rather than horizontally would act differently when in use and would have been chosen for or against based on their efficiency by the individuals operating the nets to get the desired results.

The transition from fish hook technology to an explicitly net technology may represent a change in the preferential style of fishing. This could be explained by the fishing of a new type of fish, something larger perhaps, or by the desire to catch more fish at once. An interesting side effect of this transition (from hook to net sinker) is that individuals may have been forced to work together. Torres (2009:123-124) has suggested that fishing nets were operated by anywhere from 2- 10 individuals, depending on the size of the net. This would result in any catch belonging to a group rather than to a single individual. This cause (or result) of this changing technology may have required the reinforcing of social relationships or alterations to the form that these relationships had taken previously, for example, from familial to community based. A similar argument was made for the changing social organization based on the burial placement of individuals from El Rayo, changing from single/ domestic context to public/group/ cemetery context between the Bagaces and Sapoa periods (Wilke et al. 2011). Further work on the possibility of this interaction may hold interesting information regarding the social organization required for the procurement and processing of food. The shift in other cultural practices (along with fishing technologies) may be used as evidence to suggest the shifting cultural forms on a larger scale seen throughout the region during this time period.

Implications for this data go beyond the argument of individual versus group cooperation for the organizational structure within which these tools were used. One might also argue that the change in technology resulted from the influx of new people to the area, who brought with them tools and practices that were similar but not identical to those that were originally present. As such, this object class can add additional lines of evidence to those already in existence for the changes which occur between the time periods, and hint at the nature and extent of these changes for the people who were living in this area.

Conclusion

In a place where ceramic typologies are the most widely studied piece of the archaeological record, information from other categories is often underrepresented in the literature. In this paper, I have discussed the technological change seen within a class of tools based on fishing technologies from the site of El Rayo, Nicaragua. Ceramic objects are often overlooked in the general assemblage discussions, however much information can be obtained from their detailed study and examination. Investigations of tool technologies should be included alongside the ceramic analysis, not only to identify distribution and stylistic variation, but to look at what this paper has examined, the changes in material culture across time periods and the implications they have for the people living at that time on a larger scale. This allows us to better understand the larger extent of cultural changes and consistencies through time.

The disappearance of fish hooks, at the same time as the introduction of the new net sinker types suggests that the hook technology was replaced with the new variation within the net sinker technology. This suggests that the manner in which individuals in the past fished changed. Distinct Bagaces period sites or older Tempisque period sites may show higher frequencies of fish hooks than are present at this Bagaces-Sapoa archaeological site. Distinctions may also be made between the technology present on sites closer to the Pacific Coast and sites closer to the interior lakes of Nicaragua. Furthermore, comparisons could be made regarding the technologies used on the Pacific and Atlantic Coasts of Nicaragua, two areas which are traditionally considered to be a part of distinct cultural zones (as well as comparisons throughout Central America) to determine if basic ways of life share similar technological features. With this paper I hope to begin a dialog regarding additional artifact classes which can be compared cross culturally in order to view the extent of the similarities and differences between the groups of people occupying this region of the world.

At this point, without the aid of additional lines of evidence (species identification within the faunal analysis, larger survey of additional archaeological sites in the region and beyond, ethnographic comparison, etc) I leave this argument with more questions than I had begun with, but I believe I have provided a tool which I hope will be used in future discussions on the matter.

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