An Analysis of Shell Net Sinkers from Koné Sites

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Introduction

The excavations of Gifford and Shutler (1956) on the island of New Caledonia yielded a vast number of shell net sinkers, which I have had the pleasure of examining in great detail. Due to time constraints, my examination does not include the entire sample of shell net sinkers, but is limited to those found at sites 13, 14 and 26 on the Koné Peninsula. These three sites lie along the western coast of New Caledonia and account for over 800 of the net sinkers recovered by Gifford and Shutler. Of the shell sinkers collected from the three sites, I found myself forced to take only a sample of the shells collected from site 26 owing to the fact that there are over 400 sinkers from this site alone. In regards to sites 13 and 14 the shells examined comprised 100% of the net sinker sample.

Through a closer study of shell net sinkers I have attempted to determine information on the use and manufacture of shell net sinkers, as well as any trends apparent from the deposition, which may indicate the relation of the sites to the fishing industry. The proximity of the sites to the sea is an obvious indicator of the reliance of their residents on fishing. With this in mind, it was my interest to see if there was a change in dependence on net fishing through time. Unfortunately, the skeletal fish remains were particularly scant. The majority of the collection of fish remains are not curated at the University of California, Berkeley, and were therefore not available for study.

It is possible that different types of nets were used for fishing at various locations. Reinman (1967) gives an account of various netting practices, in which he describes a range of styles and sizes, from small dip nets used by individuals, to large drag and set nets used by groups of people. In many instances Gifford and Shutler excavated a great number of shell net sinkers from the same level. One may make a case that the contemporaneous sinkers come from the same net, but this would be conjecture at best, since no complete and preserved nets were discovered.

Because the fish skeletal material was not available, and complete nets were not found, the presence of the net sinkers alone has provided the basis for an examination of several issues pertaining to sites 13, 14 and 26. First among these issues is the above mentioned dependency on net fishing and any changes in that dependency over time. Also, the sinkers provide insight for site specialization, changes in manufacturing technology, possible depletion of the supply of bivalves for use as net sinkers, and occupation of sites through time. Each of these issues will be addressed in regards to the individual sites.

Before reviewing the findings from the sites a few general observations should be noted. Gifford and Shutler determined nearly all of the shell net sinkers recovered from the three sites to be of *Arca scapha*. Modern taxonomy would, however, seem to indicate that they are *Anadara scapha*. This particular bivalve is also present in quantity from the midden samples examined, indicating its additional importance as a food source (see Miller, this volume). Also,

there seems to be a discrepancy in the classification of a few shells as net sinkers. Jens Poulsen (1987) reports evidence from his work on Tongatapu, of a shell used as a coconut scraper, of which there are other examples from Oceania in the ethnographic material. Several shells that fit this type of description have been recovered from sites 13 and 26 and will be discussed later in reference to those sites.

Material Description

I will begin with a description of the materials. The sites will be discussed in chronological order, beginning with the Lapita site, 13, moving to site 14, and in turn to the most recent site, 26. Increasing numbers of shell net sinkers appear in the progression through these sites, with each site displaying unique and distinctive qualities in regards to the sinkers produced.

The examination of the shell net sinkers involved a careful analysis and recording of the presence/absence of the umbo and shape of the manufactured hole. In addition to those attributes, the shells were examined for signs of weathering, edge and hole damage, and type of manufacturing process employed to produce the hole. Also, metric measurements were taken of weight, length, width, and hole size. Most of these observations are straight forward, but a few deserve some clarification. In regard to the notation of weathering, edge damage and hole damage, a degree of personal interpretation is present and should be defined. The issue of weathering concerns itself primarily with water rounding. The net sinkers were labeled as water rounded if evidence of this process appeared on the body to a great extent, or if the edges were rounded from such action. Edge damage includes water rounding as well as modification which may be the result of use. This seems to be apparent on shells with broken edges that have been water rounded. Often it was difficult to determine if the edge damage was caused by use; therefore, edge damage was occasionally noted but not classified as use related. This same difficulty holds true for the aspect of hole damage. The cause of damage to many of the holes is the result of water rounding and is thus determined to be use related, but in many cases the cause of damage was not determined. With this in mind we can turn to the shells themselves.

Location and Distribution

Site 13 yielded 26 shells that Gifford and Shutler determined to be net sinkers. Included in the sample is one shell that appears to be a coconut scraper. The location of the hole on this shell is behind the umbo, through the body of the shell. Evidence of edge damage is present--perhaps from use--though the presence of food remains on the edge was not determined. Also present in the sample is a *Spondylus* shell that Gifford believes to be a net sinker. This is the only *Spondylus* specimen found among the net sinkers and may have been used for some other purpose.

Site 13 should be considered in two distinct parts, identified as 13 and 13A, with an even distribution of sinkers coming from each location. With the exclusion of what appears to be the coconut scraper, the sample size divides into 14 specimens from site 13 and 11 from 13A. The majority of the sinkers come from the upper levels of the sites, the 0-6" level at 13A providing the most sinkers from any level. Of particular interest is a distinct edge damage or modification found almost exclusively at sites 13 and 13A. The posterior edge of more than half of the

sinkers shows damage which may be the result of human manufacture by grinding, or could have resulted from being dragged across a rough reef flat.

Moving on to site 14, the material remains are more abundant. In terms of the sample size, site 14 yielded 216 shell net sinkers from four units. Unit A1-2/B1-2 had the most net sinkers at site 14, accounting for 92 of the shells. There is an obvious proliferation and concentration occurring in the middle levels, from a depth of 18-42". As with site 13, the entire sample of net sinkers was analyzed.

The sample taken from site 26 for analysis is unfortunately less than half of the available net sinkers from the area. Site 26 will be considered in three distinct parts, labeled as: 26A, 26B, and 26C. Site 26A can be covered quickly, as only one shell net sinker came from this location and was discovered on the surface. Locations B and C on the other hand produced a large quantity of sinkers. A sample was taken from each of these locations, from units that showed a distribution of shells from each level and in both cases were the units with the largest number of specimens. Both 26B and 26C show the majority of the sinkers coming from the upper levels. The presence of sinkers drops off dramatically at levels lower than 24-30" at location B and lower than the 18-24" level at 26C. No artifactual remains of any sort are present from the top 0-6" layer at 26B, which seems puzzling. Again at 26B we encounter what is probably evidence of a coconut scraper and several examples were also recovered from location C. Many shell fragments were excavated at 26C, a number of which showed what appears to be use damage.

Attribute Description

Having reviewed the locations and spatial distribution of the shell net sinker sample, the attributes of the individual sinkers need to be addressed. The sizes of the shells, methods of manufacture and use damage all contribute to the analysis of the net fishing industry. Each shell in the sample of 407 specimens was weighed and measured for maximum length and width. The holes in each shell were also measured for maximum length and width. Finally, the shape and location of the hole were recorded for each shell.

Starting with the oldest specimens, those from site 13, a good deal of variation is present in regards to the size of shells being used. The top layer of 13A produced two shells weighing in excess of 50 g. At the same level of 13A we have several more examples of sinkers weighing less than 30 g. This same variation holds true for the lengths and widths of the shells, which comes as no surprise. The entire sample was clearly manufactured by punching out the umbo of the shell. The only shell from site 13 that retains the umbo is the putative coconut scraper. Over 50% of the sinkers show signs of being heavily water rounded and of those shells five have been worm eaten. As noted previously, many of the shells have a regular pattern of edge damage, in fact 17 of the 26 shells show this type of wear pattern. Hole damage is somewhat difficult to determine, but seems to appear in nearly half of the sample, either in the form of water rounding, or unusual breaks or wear inside the hole. The holes themselves are of a variety of shapes, from circular to ellipsoidal, with irregular jagged edges. The irregular shape of the hole is common throughout the other sites, particularly at site 14, which I will turn to now.

The 216 shells recovered from the four units excavated at site 14 were all punched to produce the hole, which occurs through the umbo in all but eight of the shells. Of these eight shells, the hole is close to the umbo, not in the middle of the body as in the case of the scrapers. Also they are not limited to a specific level or area of the site, but are scattered throughout. Likewise, the shape of the holes does not produce any regular distribution patterns. Roughly circular holes are found from early and late levels, however the predominant hole shape is roughly oval and is found on 160 of the shells. Over half of the sinkers, 117 to be exact, show a great deal of water rounding, 25 of which have also been worm eaten. The water rounded shells are not limited to certain levels, but appear at each level, though the 18-24" level from the C and D units shows a particularly high concentration of water rounded shell sinkers. Concerning edge wear, the sample shows very little evidence for use related damage. Forty five shells show some type of wear or breakage which seems to have been the result of dragging nets across a rough bottom surface. Beyond that, a few shells appear to have been damaged upon deposition or recovery. Damage to the manufactured hole is apparent in quite a large number of the sample, nearly 50%. Most of the shells showing use wear to the hole come from water rounded shells.

A great deal of variation exists in the sizes of shells being selected at site 14. For example, specimens under catalog number 21619 (from 30-36" A1-2/B1-2), shows a range in weight from 5-43 g. The size of the punched hole varies throughout the sample, the larger holes tending to come from the larger shells, though exceptions to this occur.

Site 26B also displays punched shells, but the location of the hole shows 26B to be unique in shell net sinker manufacture. Forty of the 84 shells from the unit examined retained their umbo. In most of these cases the hole is just behind the umbo, not on the body of the shell. Many of these shells also have a roughly circular hole shape. One-third of the sample displays the circular hole, nearly all of which are from shells with the umbo present. These shells are found from all levels.

Sixty percent of the sample shows only slight signs of weathering, while 40% show distinct and advanced signs of water rounding. Of the water rounded shells, only two had been worm eaten. Half of the shells seem to be devoid of any use related edge damage. However, over half of the sample shows use related damage to the punched hole.

Observations Concerning Attributes

The metric and discrete attributes discussed above provide the basis for observations concerning the shell net sinkers. The results are outlined by individual site, starting once again with site 13.

The limited sample of shell net sinkers from sites 13 and 13A restricts the interpretations that can be made. The presence of more shells near the surface might indicate a growing importance of netting in the area. The technology of manufacture seems to have been efficient but not concerned with consistency in regard to hole shape. The variation in hole shape probably did not affect the netting practice greatly enough to warrant a change in manufacture. The fact that such a large percentage of shells were water rounded and worm eaten indicates that the shells had been in a beach context for some time and were subsequently collected for use as sinkers. The edge damage appearing on 65% of the shells is puzzling. If they were modified intentionally,

as it appears they were, the reason is unclear. This type of edge damage is unique to the area of site 13 and may have been important to fishing a certain area near this site. The fact that half of the shells show no damage to the punched hole seems to indicate that the shells were not in use for an extended period of time, as water rounding would be present with extended use of the shells. In nearly all cases, shells showing use wear at the hole do not have the regular edge damage distinct to site 13. This may be an indicator that those shells with the regular edge damage may have been used as something other than anet sinkers.

Turning to the results from site 14, several points are of particular interest. First among these is an obvious mix of shell sizes from the same level. The heavy concentration of shells from the middle layers shows shells ranging in size from only a few grams to those weighing over 40 g. This range in size exists at the same time that a great number of water rounded shells were being used as sinkers. The presence of worm skeletons and worm holes in the water rounded shells indicates that the shells were collected from the beach, not live as a food source, but rather specifically for use as net sinkers. Second, there is a high concentration of sinkers in the middle levels, from 18-42". This is probably indicative of the highest concentration of fishing through time at site 14. A great number of the shells from this period show water rounding to the punched hole. The water rounding could have occurred through repeated extended use or from the constant use as a set net, which Reinman (1967:128-30) describes as being common in Oceania. The variation in size of shells may be the result of different types of nets, smaller lightweight shells being used as hand nets and the larger shells being used for the larger seine or set nets. Since the cords or nets themselves have not preserved, this is only a hypothesis. Finally, the top layers of site 14 produced a minimal amount of shells. Only 11 net sinkers were found in the top 18" of site 14, a dramatic drop from the earlier levels. From the 18-24" level alone, there are thirty two shells. This sudden drop would seem to indicate the abandonment of this site as a fishing center after the level four occupation.

Turning to locations B and C at site 26, we see an even greater amount of shell material, also displaying attributes distinctive to the area. Most notably, the shells from site 26 show little water rounding. Most shells from both sites 26B and 26C appear to have been used as a food source and not collected from the beach and used as was the case at site 14. This may be the result of an increased dependence on the use of these bivalves as a food source, or a greater abundance of shells to select from in this area. As was seen at site 14, the shells from the two locations at 26 vary greatly in size. While variation in size is noticeable in reference to a few larger than average shells, the predominant portion of the sinkers weigh less than 30 g at site 26B. Metric measurements from 26C are a little more cloudy. While it appears that once again there is great variation in size of shells, it is not known exactly how much variation existed. This is due to the fact that over half of the shells excavated from location C were broken fragments of net sinkers. These broken fragments appear to have been used as sinkers owing to the fact that most of them show damage to the edge of the punched hole, usually in the form of water rounding. It is unlikely that the shells were broken during or after deposition, since most fragments show signs of use and were deposited in close proximity to one another. At no other location is the presence of broken net sinkers so abundant.

Two points of interest arise in terms of the manufactured holes at site 26B. As was stated earlier, there is a high percentage of circular holes produced in the shells from this site. Many of the circular holes seem to show that the shell was pecked away gradually. This seems

to be the case because of the more regular nature of the hole shape. While most shells from the three sites display a very irregular breakage pattern, these holes closely approximate a circle. One might think that this would be a change in manufacture technology, but this type of hole is found in association with the more irregular oval shaped holes. The nearly circular hole does not appear in the earliest levels of site 26B, however, so it may be indicative of a later change in manufacture which was not adopted in entirety.

There is a broad size range in the produced holes. As is the case with overall measurements of the shells, the large and small hole sizes are often found at the same level. However, unlike the physical nature of the shells which tend to become heavier as they get larger, there is not a correlation that indicates the large holes are produced in the larger shells. In fact some of the larger shells from site 26 have very small holes, though this is not universally the case.

One final point of interest on site 26 is the occurrence of several more coconut scrapers. One shell found at site 26C appears to be a scraper, but is quite unusual. This particular shell (cat. no. 24317, AI), comes from the middle layers of 26C. The interesting point about this shell is the presence of two punched holes; this is the only shell in the collection to display two holes. One of the holes is in the normal location for a shell net sinker, the other is in the position common to the coconut scrapers. Perhaps it was reused for one purpose or the other, though it shows no obvious signs of edge or hole damage.

Discussion

Having reviewed the results of the physical examinations of the shells and noted the trends which seem to be present, the question arises of what this information can tell us about the initial concerns of the research project. That is to say, do the data on the shells indicate an increase or decrease in the use of nets over time, and do the net sinkers show any changes in methods of manufacture, and if so, is this due to site specialization or to greater intensity of occupation at a particular site and level. Initially, I felt there would be clear answers to these issues, and the data would present those answers in a digestible manner. Of course I was wrong. While the data do present some clear trends, I am certain that my discussion of the results will be open to different interpretations. With that in mind I will endeavor to answer the above questions in reference to the specific sites, using the results that have been outlined above.

Site 13 is difficult to interpret, other than to say that net fishing technology had not developed to a great extent at this point in time. The fact that it is the oldest site of the three examined would lend evidence to support this, as would the increase in net sinkers toward the surface layers of the site. So perhaps net sinker technology was advancing toward the final stages of occupation at site 13. The presence of the shells with the regular posterior edge damage comes almost entirely from the lower levels and is not seen at other sites, which would indicate a change in manufacturing process if indeed the edge modification was caused by human alteration. The fact that few to none of these types of shells show water rounding on the hole and their absence from other sites leads me to believe that they may have been used as something other than shell net sinkers. It seems certain that a settlement in such close proximity to the ocean would exploit the benefits offered by the sea. Perhaps the scarcity of net sinker remains from the area would indicate that these people were going elsewhere along the beach to fish, and leaving the nets at

that location. Little else presents itself from the data of site 13, so I will turn the discussion once again to site 14.

The large quantity of shells collected by Gifford and Shutler at site 14 leaves little doubt that net fishing had become an important part of the subsistence pattern for these people. A particularly high concentration of shells in the middle occupation layers tells us that the people from this site depended on net fishing more so at this time than earlier or later times. The site may well have been a fishing center, owing to its location and abundance of shell sinkers. The importance of net fishing at this site is made apparent by the large quantity of dead shells which had been collected and made into net sinkers. The fact that dead shells would be collected from the beach periphery indicates that these shells were purposively selected, and not just used as a by-product after food extraction. This may also indicate a scarcity of bivalves in the area, possibly the result of heavy use and predation of this species as both a food source and tool.

The large number of shell sinkers from the middle layers shows virtually no variation in manufacture technology. The shells were all punched, indicating that this must have been an effective method of manufacture. This seems particularly true since the few fragmented shell sinkers found appear to have been used and not broken during manufacture. The many water rolled and use damaged shell sinkers found at site 14 indicate that the shells were in use for extended periods of time and withstood rough conditions. The situation at site 26 is slightly different, as there are a great number of fragmented shells at that site.

In terms of site 26 locations B and C, many of the same observations from site 14 also hold true. The site yielded the greatest number of sinkers, and is also the youngest of the sites examined. Unquestionably, net fishing played an important role at this site owing to the sheer numbers of sinkers discovered. This may be indicative of a larger population or more site specialization as a fishing center, once again owing to the site's proximity to the sea. Net sinkers are prevalent from the upper layers at both locations and generally consist of shells with little signs of weathering. This may indicate an abundant supply of potential net sinkers, making it unnecessary to collect dead shells. This also might indicate that the shells were not in use for any great period of time, since they would tend to show more advanced signs of water rounding, particularly along the edge of the hole. Suffice it to say there was not a depletion or scarcity of potential net sinkers in the area.

The dependency on net fishing appears to remain constant through the upper layers of site 26, but as was mentioned earlier, there is some change in hole manufacture. Unfortunately, the regular circular holes produced at 26B are not confined to a single level, but are found throughout the top four levels, interspersed with shells displaying the more common type of hole which has a more irregular oval type shape. While the circular hole may indicate a change in manufacture technology, it does not appear that it was significant enough to cause sweeping changes in the production of the net sinker holes.

I had hoped to see the same circular holes at location C, but discovered something quite different. The difference was the lack of holes because so much of the sample consisted of broken net sinkers. Initially I thought this might be a production center and these fragments were rejects from manufacture, something which had not been noticed at the other sites or location B. This does not prove to be the case. Many of the fragments show signs of water-rolled damage on the inside edge of the punched hole, which would indicate that the shell had spent time in the

water functioning as a net sinker. The strange thing about this is that the remainder of the shell sinker is not present. In all cases the fragment is from the posterior end, no anterior ends are present. The fragments are all broken part way through the manufactured hole. This leaves a shell which could in no way have been attached to a line or net. Thus the shells could not have broken during use in the water, as they simply would have fallen off. What happened to the other portion of these shells is unknown, but it seems unusual that this occurs so distinctly at location C of site 26. The fact that the shell fragments are found throughout the levels indicates that these fragments were deposited at this particular location over an extended period of time for a particular reason.

Concluding Remarks

Upon undertaking the examination of what I had originally intended to be the entire sample of shell net sinkers from sites 13, 14, and 26 I expected to find some significant conclusions regarding net fishing in these particular sites. As I began to examine the net sinkers themselves, my head came down from the clouds, so to speak. The technology of net fishing is fairly broad and can be quite complex in regards to specialized nets, and netting practices, but the shell net sinkers themselves are not so diverse. The method of punching method of manufacture produces reliable and effective net sinkers. Therefore any drastic changes in manufacture should not be expected, and in fact are not found with the exception of the circular holes found at 26B. It seems that a net sinker with a rough irregular oval shape hole remained attached and as effective as a net sinker since they are found throughout each level at each site.

The greater presence of shell net sinkers at site 26 follows the general and logical assumption that the use of nets for fishing proved successful, and shows an increase in use at the later occupied sites. Of course the greater number of shell sinkers found at site 26 may be due to the fact that more cubic feet of matrix was screened here than at the other two sites. But if one takes the unit from each site with the most sinkers there is a steady progression from site 13 to 14 to 26, with 26 having the largest sample size from one unit.

The choice of a plentiful bivalve species, such as *Anadara scapha*, for use as a net sinker seems to be quite effective for net fishing, since it was selected for almost exclusively. The shell holds up to use damage, and allows for the production of a usable hole. The data collected thus seems to indicate that the people using these nets had found a good thing and stuck with it.

Finally, in regard to the site specialization issue, it appears that the area near sites 14 and 26 must have been particularly productive during the times where we find the abundance of shell net sinkers. The people who occupied these sites must have relied heavily on net fishing for the capture of fish. The total absence of fishhooks from these sites indicates that netting alone could provide most of the fish needed, or that fishhook technology had not yet come into common practice at these sites. Perhaps the use of nets is simply the best possible means for exploitation of the marine environment near these sites.

While I have not produced any startling conclusions on net sinkers from sites 13, 14, and 26 on New Caledonia, perhaps the sites do tell us something of even greater importance. I believe that the net sinker material indicates a rather static industry, because of the success it

must have delivered. If a process is working effectively, then sweeping changes in the system are unnecessary. The net fishing industry is still used today, using roughly the same technology as exhibited in the archaeological samples from New Caledonia.

A final note should be made at this point expressing the incompleteness of this study. It would be beneficial to examine the fish remains from this site to determine where the nets were being used.[1] They may have been used in the shallow flats or out further in deeper water, which may be determined by the specific habitats of the fish. Also a correlation of net sinker data with other artifactual remains may provide some further insight on site use or possible specialization, if, for instance, net sinkers are the only artifacts being taken from certain units. While this material was outside the scope of my research, which concerned itself only with the examination of specific shell net sinkers, it may prove useful in studying the fishing industry as a whole from sites 13, 14, and 26.

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[1] Editor's Note: Gifford and Shutler collected fishbones from their excavations, and sent them to Dr. Henry A. Fowler, of the Academy of natural Sciences of Philadelphia for identification. Apparently, these samples were never returned to the Lowie Museum, and are missing from the cataloged specimens available for the present study. We made an unsuccessful effort to relocate these samples in 1990. (PVK)