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Cover Page Footnote

This project would not have been possible without the assistance and guidance of several people and groups. First and foremost is Nathan D. Hamilton, who provided the opportunity to work on Smuttynose Island and to continue to conduct research on the archaeological collections even after I graduated and moved away. Barry Gaulton lent the use of his considerable knowledge of and collection of literature on historic clay pipes. The faculty and staff of the Shoals Marine Laboratory, especially Willy Beemis and Robin Hadlock Seeley, provided the infrastructural support necessary to make the excavations on Smuttynose Island possible. And finally, Nathan and Stephanie Hubbard and Marty and Jim Oberlander deserve the greatest of gratitude for granting us permission to excavate on Smuttynose Island, thus making this paper possible.

The Use of Tobacco Pipes in Identifying and Separating Contexts on Smuttynose Island, Maine

Arthur R. Clausnitzer, Jr.

Five years of excavation on Smuttynose Island, Isles of Shoals, Maine, have recovered a large number of artifacts related to nearly 400 years of European use and occupation of the island, including over 11,000 fragments of white clay tobacco pipes. Unfortunately, the specific soil conditions on Smuttynose Island often made field identification of different contexts difficult. This article explores the use of clay pipes in separating and identifying different stratigraphic contexts. Also addressed is the utility of various stem-bore dating methods, and the use of identified pipe origins to link specific stratigraphic contexts to known historical occupations of the island. This includes, in particular, the Gulf of Maine cod early migratory fishery period. Finally, this article provides a chronological framework for further study and interpretation of the archaeology of Smuttynose Island.

Cinq années de fouilles sur l'île Smuttynose, dans les îles de Shoals (Maine) ont permis de recueillir une importante quantité d'objets liés à près de 400 ans d'utilisation et d'occupation de l'île par les Européens, dont plus de 11 000 fragments de pipes à fumer en terre cuite fine argileuse blanche. Malheureusement, les conditions de sol spécifiques sur l'île Smuttynose ont souvent rendu difficile l'identification de différents contextes sur le terrain. Cet article explore l'utilisation des pipes en terre cuite fine pour séparer et identifier différents contextes stratigraphiques. L'utilité de méthodes de datation comme le diamètre des trous de fumée et l'identification des origines des pipes pour lier des contextes stratigraphiques spécifiques à des occupations historiques connues de l'île sont également abordées. Cela comprend notamment la période ancienne de pêche migratoire de la morue dans le golfe du Maine. Enfin, cet article fournit un cadre chronologique pour la poursuite des études et l'interprétation de l'archéologie de l'île Smuttynose.

Introduction

The Isles of Shoals (commonly referred to as the "Shoals" by locals) form an archipelago of small islands 10 mi. from the city of Portsmouth, New Hampshire (FIG. 1). They are places of myth and legend, rumored to be the pirate Blackbeard's honeymoon destination, the location of John Quelch's gold cache, and the backdrop for many other tales (Cahill 1984: 37; Jameson 1998: 32–35). Never mind that Blackbeard died two years before the date of his supposed honeymoon and John Quelch was arrested while still in Boston (Beal 2007:106-107; Lee 2002: 122–124); these stories are not the focus of this article, however. This article will address a number of landmark developments in both historical archaeology and in the history of Smuttynose Island: one island of the archipelago. For historical archaeology, these are J. C. Harrington's articulation of a dating method based on stem-bore sizes of clay smoking pipes and Lewis Binford's development of a regression-line mean-dating formula based on Harrington's work (Binford 1978; Harrington 1978). For Smuttynose Island, these developments are the transition from seasonal to permanent occupation and the decline of Smuttynose Island as the political center of the Shoals. The latter date is usually given as 1679 and is often linked to a supposed migration of families from the Maine islands to the New Hampshire islands; the earlier date is assumed to be some time between the late 1620s and early 1630s (Harrington 1985: 129; Rutledge 1965: 9). As the early history of settlement on the island is not well understood, specifying an exact year is impossible so this date range will have to suffice for the moment.

These developments are addressed through the analysis and interpretation of a large collection of white clay smoking-pipe fragments, recovered through the archaeological investigation of Smuttynose Island. Specifically, this article looks at the viability of

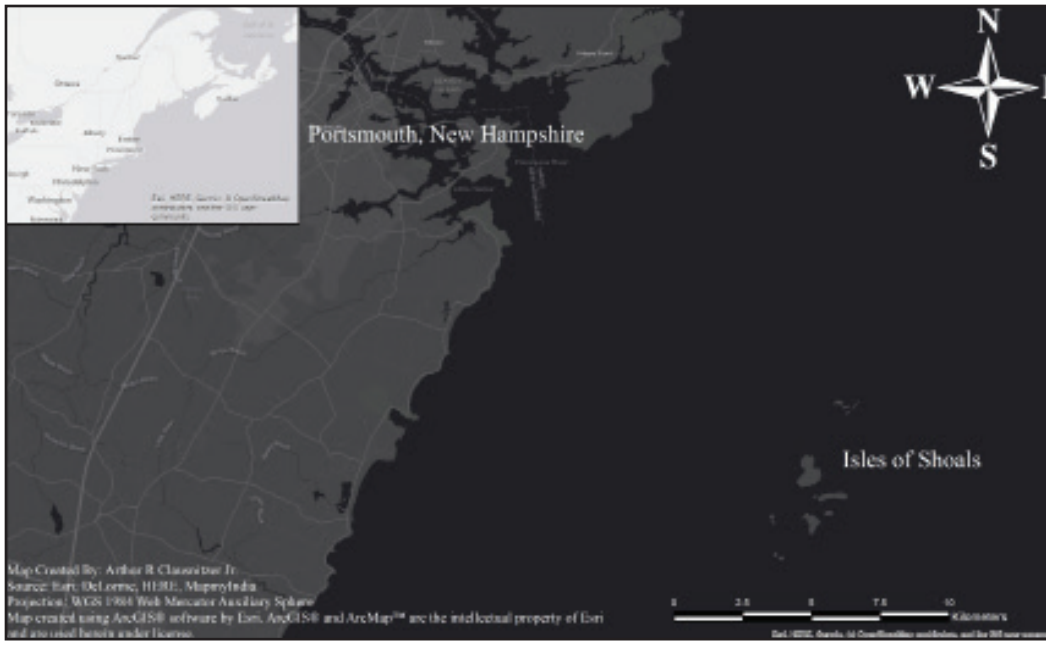

Figure 1. The Isles of Shoals in relation to Portsmouth, New Hampshire (Inset map courtesy of the OpenStreetMap Foundation and Google Earth; base map ArcGIS® World Imagery [copyright © Esri, all rights reserved]; map by Arthur R. Clausnitzer, Jr., 2019.)

using clay smoking pipes and dating methods associated with these artifacts in the identification and separation of cultural strata after the fact of excavation. It also addresses the general viability of stem-bore dating methods in the interpretation of the Smuttynose Island occupation phases. Finally, this work will provide a consistent and detailed chronological framework for interpreting the archaeology of Smuttynose Island.

Background

The excavations on Smuttynose Island have revealed the island has been used by humans since at least 4,200 years ago, although by the time Europeans began using the island there was no sign of any native presence (Levett 1847: 79). Exploration of the Gulf of Maine began in the late 16th century and the first known sighting of the islands was during Samuel Champlain's 1605 expedition (Harrington 1985: 126). More widely publicized is Captain John Smith's description of the islands in his account of New England. Smith goes so far as naming the islands after himself on his 1616 map (Harrington 1985: 126; Rutledge 1965: 4; Smith 1616). Smith's Isles did not persist in common usage, as Christopher Levett referred to the archipelago as the "Isles of Shoulds" in the account of his 1623 exploration of the New England coast (Levett 1847).

While some authors have suggested that there was a permanent settlement on the island as early as Levett's visit, this is not supported by historical documents (Rutledge 1965: 9–10, 14). Settlement probably first occurred in the late 1630s and 1640s, based on the surviving primary documents and the fact that a meeting-house was constructed on Smuttynose Island around 1640 (Harrington 1985: 129; Jenness 1873: 127–132). The population on Smuttynose, based as it was on fishing, probably never grew exceptionally large due to a lack of good land for fish stages and flakes. Popular history has Hog Island (present-day Appledore Island) abandoned in favor of the New Hampshire islands sometime between 1670 and 1685. The

year 1679 is the most commonly cited date with taxes and other political conflicts with the Massachusetts Bay government often being given as the primary motivation for the migration (Jenness 1873: 101; Rutledge 1965: 26–27). There is no historical documentation of this supposed migration; furthermore, deed transactions show that Smuttynose remained occupied into the 18th century. Smuttynose's population was declining at this point, but this was due more to a persistent slump in the fisheries rather than political reasons (Clark 1970: 65). A brief revival occurred in the years after 1750 when Smuttynose was purchased by Samuel Haley, who attempted to develop the island into a self-sufficient fishing station (Morse 1801: 247; Rutledge 1965: 49). His family, in turn, sold it to the Laighton family, who operated the Mid-Ocean House of Entertainment until its destruction by fire in the early 20th century (Rutledge 1965: 49). Since then the island has been uninhabited except for a rotating crew of seasonal caretakers known as the Smuttynose Stewards, who are in charge of maintaining both the island and its two remaining structures.

One of several new and widely available products emerging from the European expansion into North America, tobacco quickly found favor with the population at large (Fox 2015: 64–65). Besides tobacco's connotations of the exotic, allowing the masses of Europe to consume part of the New World, tobacco also had social and pharmaceutical properties that made it desirable, particularly on the working frontier of North American resource-extraction industries. Tobacco was perceived as a little hearth providing warmth and comfort, as well as having the physiological effect of suppressing the appetite (Fox 2015: 3; Jo et al. 2002; Pope 2004: 396). The perception of the smoking-pipe bowl as a little hearth would have been reinforced by the need to light it, which required the smoker to find an ember or lit coal. This normally would have involved going inside; not only would this have gotten the smoker out of the weather, but it would also have presented an opportunity to socialize with his peers (Pope 2004: 397). Smoking was a social activity, as people gathered around to pass a lit pipe and share a drink (Fox 2015: 4, 23–24). Archaeological data from the forges at Fort Pentagoet, Maine and Ferryland, Newfoundland, for example, indicate that they were used by the residents as gathering places where they participated in communal drinking and smoking, leaving hundreds of smoking-pipe fragments behind (Carter 1997: 45; Faulkner and Faulkner 1987: 62). The forge was ideal as a gathering place, as it required a constantly lit furnace, which would have provided heat, as well as a source of ignition for pipes (Carter 1997: 42–43).

Five years of archaeological investigation of Smuttynose Island has produced a surprisingly rich assemblage of artifacts. These date from as early as 4,200 years ago up to the present day and range from stone tools to local Portsmouth Brewery beer bottles. These excavations were conducted for a field school based out of the Shoals Marine Laboratory, a joint Cornell University and University of New Hampshire satellite campus on Appledore Island. Field methodology involved laying out 1 × 1 m squares, both individually and as part of longer trenches. The excavation was carried out in 10 cm arbitrary levels, a procedure chosen due to the relatively poor soil stratigraphic formation and ease of teaching the method to inexperienced students.

In total approximately 55 m² were excavated consisting of 51 (1 × 1 m) excavation units and 16 (50 × 50 cm) test pits. These excavations produced 11,290 fragments of white clay smoking pipes along with thousands of other artifacts. A complete analysis and interpretation of these smoking pipes was undertaken between 2012 and 2013 (Clausnitzer 2013). During that earlier analysis, the excavations on Smuttynose were divided into three areas based on both the archaeology and their relation to present-day features (FIG. 2). Area 1 is the upper landform that forms the present-day yard for the Haley House, an 18th-century dwelling which is one of two remaining structures on the island. No significant 17th-century

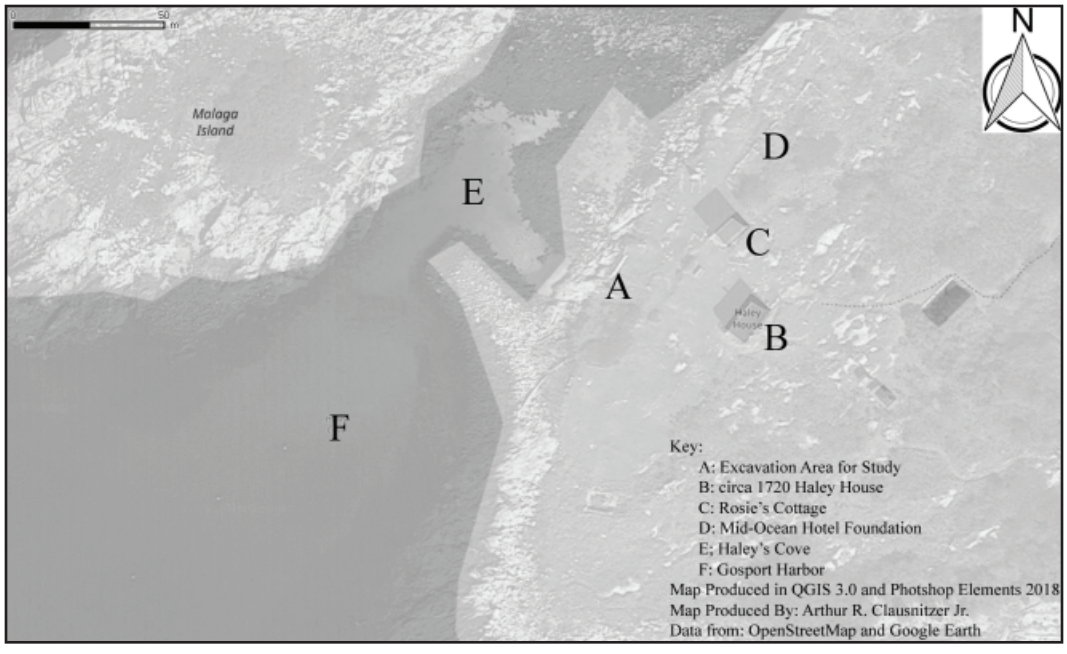

Figure 2. Map showing the southern end of Smuttynose Island. (Base map courtesy of the OpenStreetMap Foundation and Google Earth; map by Arthur R. Clausnitzer, Jr., 2018.)

material was recovered from this area. Area 2 is the southern half of the lower landform and was found to contain a deep and undisturbed 17th-century deposit, including the remains of a structure identified as a tavern by Megan Victor (2012). The material used in this analysis is drawn from the Area 2 assemblage, due to the richness and integrity of the deposits. Area 3 is the northern half of the lower landform. It, too, was found to contain 17th-century material, as well as material related to the nearby Mid-Ocean Hotel. Limited excavation was conducted in this area and there is more evidence of disturbance in the archaeological record.

The natural stratigraphy of Smuttynose Island is often a visually indistinct mass of organic soil from top to bottom containing two or three discrete soil layers. Concerns about the ability of students to recognize these different layers, separated as they were by texture or composition rather than visual attributes, were influential in the choice to use arbitrary levels. A drawback to the use of arbitrary levels is that each excavation level often included two or more depositional levels. These arbitrary layers were maintained even when a visually distinct layer, such as the shell layer in Trenches 116 and 117, was encountered. The artifacts from the different natural stratigraphic layers were not distinguished, creating a mixed context. This mixing of contexts can make attributing specific deposits to specific phases or events in the island's occupation difficult. This, in turn, creates problems in trying to understand the changes in the way that the population of the island lived and worked. As a result, the use of the archaeological record to refine the occupational history of the island is further complicated.

The Artifacts

Of the 6,900 smoking-pipe fragments, approximately 2,600 were selected for further study because they possess a chronologically diagnostic attribute. These were further divided into two different, but overlapping, groups. The first, consisting of 152 fragments,

includes datable bowls, makers' marks, and other diagnostic decorative elements. The second group consists of 2,457 fragments and includes all pipes with measurable stem bores. A complete technical description of these pipes is beyond the scope and goals of this article but a brief overview of these different assemblages is warranted.

Smoking-Pipe Bowls

A total of 55 datable pipe bowls and five additional datable bowl fragments were recovered from the study area. This is a significant portion of the total of 88 datable bowls recovered from all excavation units, speaking to the richness of the deposits and serving as an indication of the level of activity this area saw in the 17th century. For the most part, these bowls were dated via bowl morphology, although a few possessed makers' marks that helped to refine their dating. In addition to dating, bowl morphology and decoration were used to determine the points of origin of these pipes in order to trace trade routes and route changes over time.

Not surprisingly, most of the bowls originated in Bristol and London or have no defi-

Figure 3. Smoking pipe bowls excavated on Smuttynose Island, Maine: (Top) West Country (1610–1630) and (Bottom) Dutch (1625–1660). (Photo by Arthur R. Clausnitzer, Jr., 2013.)

nite point of origin. The morphological analysis also identified a handful of Dutch and, more importantly, English West Country pipes within the assemblage (FIG. 3). This last category is important for two reasons. First, it has implications for the accuracy of the mean stem-bore dates discussed later in this article. Second, the English migratory fishery, for which Smuttynose Island was a known destination, was based in West Country ports. This fishery, which persisted in Newfoundland into the 18th century, had, for all practical purposes, disappeared from the Gulf of Maine by around 1640 (Candow 2009: 420; Vickers 1994: 98). These West Country bowls are, therefore, potential indicators of a migratory presence on Smuttynose Island.

The five datable pipe-bowl fragments are all representative of the type known as "Huntress and Crusader" bowls, nominally dated 1670–1700. These ornate bowls are Dutch in origin and have been found on several New England sites, including Pentagoet and Pemaquid (Bradley and Camp 1994: 99–107; Faulkner and Faulkner 1987: 169–170). Each of these fragments can be safely attributed to different bowls, which allows their inclusion in this study.

Makers' Marks

Capable of providing more precise dating than bowl forms thanks to archival work by archaeologists Adrian Oswald (1969) and others, makers' marks can provide the name of the person who manufactured the pipe, where it originated, and the date it was manufactured. In the sample chosen for this article, there are 56 marks, with the most common being the ubiquitous "LE" mark of Llewellin Evans of Bristol, who made pipes between 1661 and 1686 (FIG. 4; Walker 1977: 1428). A majority of the marks are from the 17th century with only six dating to the 18th century

Figure 4. Makers' marks from smoking pipes recovered during excavations on Smuttynose Island, Maine: top row, left to right: Dutch "Poosthorn" (date unknown), Llewellin Evans (1661–1686), Richard Berryman (1619–1652); bottom row, left to right: Phillip Edwards (1649–1696), Edward Bird (1630–1665), and unknown "IP" mark (late 17th century). (Photos by Arthur R. Clausnitzer, Jr., 2012.)

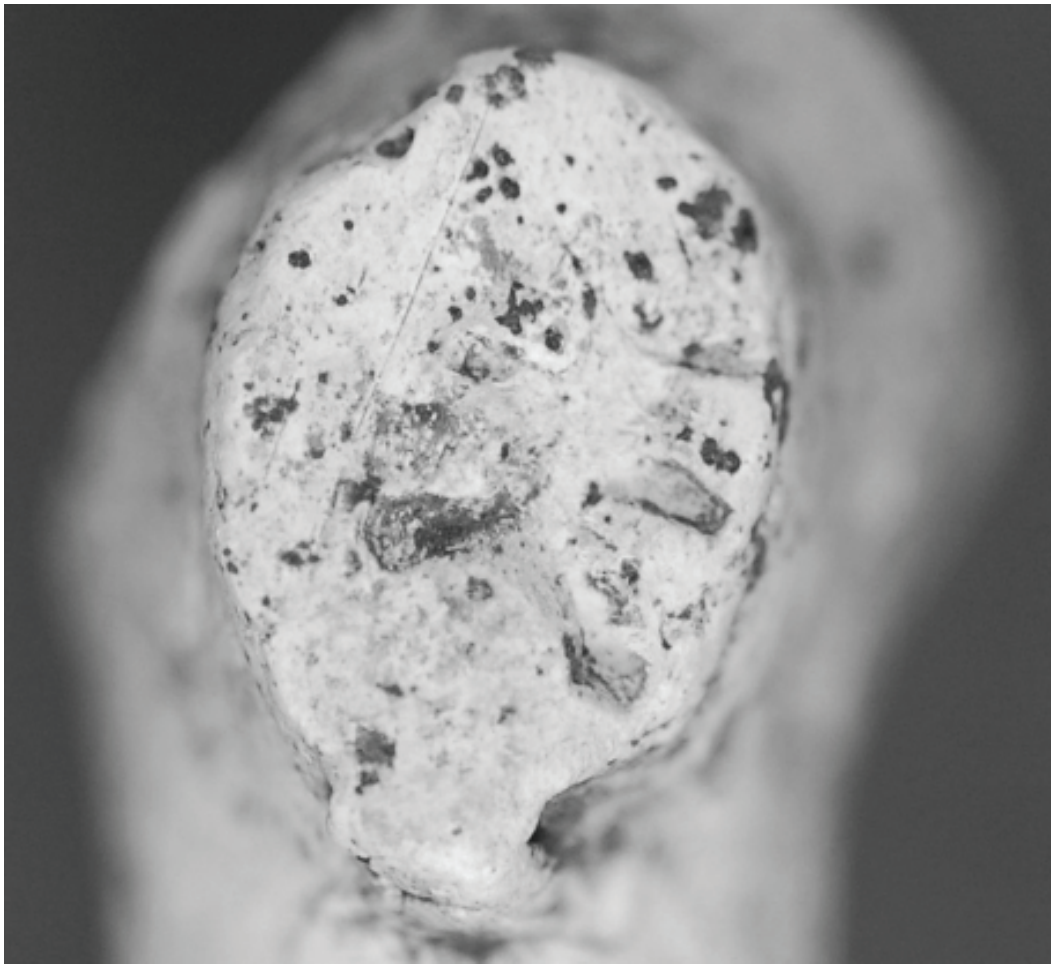

Figure 5. Oakleaf heel mark (1600–1630) on a smoking pipe recovered during excavations on Smuttynose Island, Maine. (Photo by Arthur R. Clausnitzer, Jr., 2013.)

and five dating to the 19th. Furthermore, of the 18th-century marks, four could just as easily date to the 17th century, as they possess *terminus post quem* and *terminus ante quem* dates that straddle the turn of the century.

Most of these marks originate in England with Bristol again being the most common point of origin. The 19th-century marks are primarily Scottish, while there are three Dutch makers' marks. Most interesting is the English West Country mark described as an "Oakleaf," which is also associated with early pipe manufacture in that region (FIG. 5; Oswald 1969: 127). Much like the West Country bowls, these marks are potentially an indicator of a migratory fishery context on Smuttynose Island.

Other Diagnostics

Several fragments possess decorative elements that are, potentially, chronologically diagnostic, although not as useful as pipe-bowl decorations or makers' marks. Most of these fragments were dated based on visual similarity to published pieces. It should be noted, however, that many of these decorative elements, particularly the fleur-de-lis, were used consistently for many years, making any dates assigned to these fragments tentative at best.

Still, they can provide extra data that could support any interpretations.

Mean Dating

Relative dating via smoking-pipe stem-bore sizes began with J. C. Harrington's articulation of a theory that the bore diameters of smoking pipes decreased at a relatively constant rate over time. He developed a histogram to visualize this theory, which divided the 17th and early 18th centuries into five 30–50 year time periods in which a certain bore diameter would dominate all others. He based this histogram on measurements taken from a sample of 330 pipes collected from sites in Virginia (Harrington 1978). In 1962 Lewis Binford converted this histogram into a regression-line formula to establish a mathematically derived mean occupation date, arguing that such a mean date was more interpretively useful, particularly when conducting intersite comparisons (Binford 1978).

The Binford stem-bore dating formula has been a standard of American archaeological analysis since it was introduced despite considerable criticism and the ongoing debate over the accuracy and interpretive value of the formula. Audrey Noël Hume, for instance, was critical of its accuracy and specified a number of requirements and caveats regarding the use of the formula (Noël Hume 1963: 22). Her concerns were echoed by a number of other archaeologists (Alexander 1979; Hole 1980: 287; Oswald 1975; Walker 1965). James Deetz and others took exception with the single date produced by the method; this has led to questions about the actual interpretive utility of Binford and other formula-derived dates (Deetz 1987; Salwen and Bridges 1977). Binford also states that calculating the standard deviation for a pipe assemblage could provide an estimate for the occupation span of a site; this is also subject to some debate. Michael Shott believes that there is a strong, if qualified, correlation between stem-bore standard deviation and occupation span (Shott 2012: 32). In contrast, Kit Wesler takes the opposite view, finding no clear correlation between standard deviations and the period of occupation of a site (Wesler 2014: 178). Wesler also addresses the issue of accuracy in stem-bore and other formula-dating methods; he questions what archaeologists mean when they state that a date is accurate and proposes that archaeologists need to change the way that they present the result of mean-dating formulas (Wesler 2014: 179).

Two other mean-date formulas based on mean-bore measurements and another based on weighted-mean bowl-form dates have been introduced in the decades since Binford's publication. Lee Hanson, Jr., developed a set of formulas that attempted to correct for temporal variations in stem-bore sizes by developing a formula for each of Harrington's time periods (Hanson 1968). Robert Heighton and Kathleen Deagan agreed with Hanson's assertion that stem-bore sizes did not decrease in a linear fashion and calculated a two-part equation to calculate a mean date along a curvilinear regression line (Heighton and Deagan 1971). Seth Mallios adapted Stanley South's mean ceramic formula for use on pipe bowls based on the conceit that bowl-form dating was more reliable than stem-bore dating (Mallios 2005). All of these were applied to the sample from Smuttynose Island in an attempt to assess the formulas for accuracy and their interpretive value in identifying the different phases of occupation on Smuttynose Island. For the purposes of this study, accuracy is a relative measure, based on the degree of variation from a mean date established through a study of the documentary record.

There have already been several studies comparing the relative accuracy of these stem-bore dating formulas. Lauren McMillan (2010), for example, examined numerous sites in the Chesapeake region and found that the Heighton and Deagan formula generally produced the dates most congruent with those established by other dating methods; however, she also found that regional and temporal variation had an effect on which formula worked best on which site, as well as how well stem-

bore dating worked overall (McMillan 2010: 72). Her results are supported by a study by Thomas Beaman (2005), who also found the Heighton and Deagan formula to be the most accurate. When developing his pipe-bowl, mean-dating formula, Seth Mallios compared the results to dates derived from stem-bore measurements; he found that Hanson's formula was most accurate, followed by Binford's, and then Heighton and Deagan's (Mallios 2005: 93–97). Georgia Fox's study of smoking pipes from Port Royal, Jamaica, found Binford dates to be the most accurate, while the Heighton and Deagan formula produced dates that were off by 20 years or more (Fox 1998: 113).

The Smuttynose Island Data

There are several candidates for the documentary mean date, the first and most obvious being the historical mean date of occupation of the island from the time of Levett's visit in 1623 to the destruction of the Mid-Ocean House by fire in 1911. This produces a mean date of 1767. However, this date is inappropriate for several reasons. The occupation of Smuttynose Island is characterized by at least four occupational phases of varying length and intensity. The first phase is the migratory and early residential fishery under the Gorges/Mason proprietorship (approximately 1620–1640). The second is the mid- to late-century residential fishery when the fishermen were economically linked to Massachusetts Bay and New Hampshire instead of England (1640–ca. 1680). The third period is the later residential fishery and Haley period, characterized by a gradual decline in the number of inhabitants on the island and the construction and operation of Samuel Haley's fishing station (ca. 1680–1839). The final period is the hotel era (1839–1911). The chosen sample from Smuttynose is overwhelmingly 17th-century in nature, suggesting it was deposited primarily during the first two phases. Additionally, the Harrington histogram for the collection suggests a peak activity period of 1650–1680, which is well before the historical occupation mean (FIG. 6).

Building from this, it would seem that a mean date of occupation for the 17th century

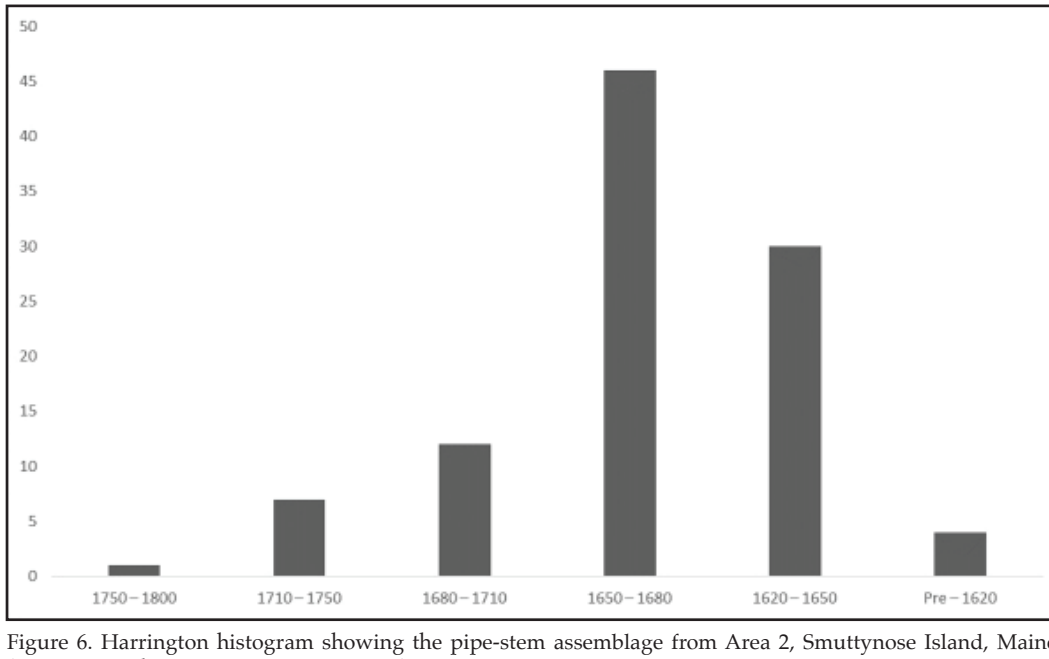

Figure 6. Harrington histogram showing the pipe-stem assemblage from Area 2, Smuttynose Island, Maine. (Figure by Arthur R. Clausnitzer, Jr., 2015.)

would be more appropriate. Despite the presence of pipe bowls that potentially date to the year 1600 and the romantic notions that some authors have of a fishery on Smuttynose from the beginning of the 17th century, the earliest date that can be stated with confidence is 1622. This is based on Phinehas Pratt's observation of fishing ships arriving at the isles in March of that year (Pratt 1858). Determining a *terminus ante quem* year is a little more difficult, in part due to the muddled and folkloric nature of Isles of Shoals historiography. It is usually stated that sometime in the last quarter of the 17th century, the islands on the Maine side of the border, specifically Hog (Appledore), were abandoned in favor of the New Hampshire islands. Lyman Rutledge presents a convincing argument for the year 1679 as the date of this exodus (Rutledge 1965: 26–27). However, there are no primary historical documents supporting such a migration and the explanations given for these migrations are overstated; furthermore, there is deed evidence for the occupation of Smuttynose Island into the 18th century. At the same time, however, the construction of a new meetinghouse on Star Island in 1685 suggests that the political center of the Isles of Shoals had shifted from Smuttynose to Star Island, and the deed evidence does suggest a population decline on Smuttynose Island. Using the dates 1623 and 1685 produces a mean date of 1653.5, rounded up to 1654.

Another candidate for the documentary mean date comes from the identification of the structural remains found in the study area. Megan Victor (2012) describes these as a tavern in her master's thesis but does not provide *terminus post quem* and *terminus ante quem* dates for the structure. Additional research by Arthur Clausnitzer, Jr., undertaken since her analysis, suggests that the structural remnants represent the ca. 1640 meetinghouse. This is based on an analysis of the available archaeological evidence, as well as a ground-penetrating radar survey, both of which indicate the presence of a relatively large structure in the proximity of the excavation units (Clausnitzer 2018; Leach 2013). Documentary support is provided by the July 13, 1661 deed from Edmund Pickeard to Nathaniel Fryer, which states that Pickeard's "flakerown is against the Meeteing house, on the Ysland of Smuttinose" (Pickeard 1892). If this structure is indeed the meetinghouse it can be dated with some confidence from 1640 to 1685, as the structure was noted as being some years in ruins when the residents of Smuttynose Island were summoned to court in the latter year for lacking a proper church or meetinghouse (Williams 2006: 20). This produces a mean date of 1662.5. However, this is the mean date for the meetinghouse only and does not take into account earlier phases of occupation on Smuttynose Island.

Of the three candidate dates, the document-derived mean date of 1654 appears to be most appropriate to use for this study. The occupation mean covers too long a period of time and fails to account for the changes in the occupational intensity throughout the various phases of occupation. The structural mean also proved inappropriate, covering too narrow a time period. As a result, one of the most important phases in the occupational history, which is represented in the archaeological record, would be excluded.

Mean dates are calculated from the archaeological data at three scales: excavation level, trench, and area, with "area" defined as the selected study area. At least three dates were calculated, using the Binford, Hanson No. 1,

Table 1. Pipe-bore mean dating formulas.

Source	**Formula**
Binford	Y=1931.85–38.26X
Hanson No. 1	Y=1891.64–32.09X
Heighton and Deagan	X=(–logY+1.04435)/0.05324 Date=1600+22X

Table 2. Excavation level stem-bore dates.

Trench/Level	N	Average	Binford	Hanson	H&D
Trench 113/114					
1	6	7.5	—	—	—
2	67	6.6	1679	1680	1693
3	77	6.7	1675	1677	1690
4	140	7.1	1661	1664	1680
5	231	7.0	1664	1667	1682
6	191	7.2	1656	1661	1677
7	108	7.5	1646	1653	1671
8	79	7.3	1652	1657	1674
9	1	6	—	—	—
Trench 115					
1	7	7.3	—	—	—
2	90	6.6	1679	1679	1692
3	120	6.8	1671	1673	1687
4	188	7.4	1648	1653	1672
5	164	7.4	1649	1654	1672
6	98	7.4	1647	1653	1671
7	10	6.7	—	—	—
8	3	7	—	—	—
Trench 116					
1	20	6.4	—	—	—
2	118	6.7	1675	1676	1690
3	180	6.9	1668	1670	1685
4	79	7.3	1654	1658	1676
5	80	7.3	1653	1657	1675
6	22	7.9	—	—	—

Table 3. Trench and area scale mean pipe dates.

Trench/Area	N	Mean Bore	Binford	Hanson	H & D	Mean Bowl
113/114	920	7.1	1660	1664	1680	1659
115	612	7.2	1657	1661	1678	1655
116	491	7	1665	1668	1683	1660
117	224	7	1663	1666	1682	—
119	154	7	1663	1666	1682	—
Area 2	401	7.1	1661	1664	1680	1658

and the Heighton and Deegan formulas (TAB. 1). A sample of 50 measurements was used as the minimal number from which a date was calculated. Also, wherever possible, a mean bowl date was calculated using the procedure described by Mallios (2005). A minimum number of five dated bowls is needed to calculate a date using that method based on Mallios's success using a number as low as six in his initial trials (Mallios 2005). Prior testing of this method by the author has shown it to be very vulnerable to biases introduced by mixed contexts at the level scale so its application will be limited to the trench and area scales.

The results of the mean-date formulas at the excavation-level scale are presented in Table 2. Taken as is and without any other supporting data, these dates provide some useful, if limited, interpretive function. Significantly, the dates get consistently older the deeper the deposits get. While the law of superposition indicates that this should be the case, there had been some concerns on Smuttynose Island about the effect of 19th-century landscaping activities on the integrity of the archaeological deposits. The mean-bore dates consistently increase in age from the top to bottom of the deposits, attesting to the integrity of the deposits in Area 2. With the previously discussed problem of mixed contexts within these excavation layers, at this stage these dates can provide little in terms of interpretive value.

Looking at the results of the three bore-derived mean dates, a couple of trends are readily noticeable. First, the Binford formula consistently produced the oldest date for any given deposit. Second, the differences between the dates produced by the Binford and the Hanson formulas are relatively small with the greatest being six years and the difference generally increasing as one reviews the older deposits. Finally, the Heighton and Deegan dates differ from those produced by the other two formulas by a factor of decades. This suggests that the difference between the Binford and Hanson formulas is functionally insignificant, but the Heighton and Deegan formula may contain a bias that results in a significantly different mean date.

Table 3 presents the results of dating at the trench and area scales and includes bowl mean dates when appropriate. These two scales are included since there is little overall difference in the results and it is at these scales where the comparison to the historical mean becomes significant. Once again, the Binford and Hanson dates are fairly close, with the Binford dates being slightly older, while the Heighton and Deegan dates are younger by a decade or more. The mean bowl dates by comparison are slightly more accurate, differing by as little as one year and by no more than five years from the historical baseline.

Disregarding the Heighton and Deegan dates due to their inconsistency when compared with the other results, the mean dates at the trench and area scales cluster in a five- to eight-year period. Despite this consistency in results, the mean dates from these formulas range from three to nine years from the mean historical date of 1654. This margin of error is not surprising, as this has been a recognized and consistent issue with stem-bore mean dates in the Northeast since at least the early 1990s. Bradley and Camp (1994: 104) note at numerous Maine sites, including Fort William and Henry in Pemaquid, the Clarke & Lake Company site, and the Phips, Sayward, and Hitchcock sites, that the stem-bore mean date is often 15 years earlier than the historical mean. Archaeologists in Newfoundland have generally ceased to use Binford dates, as they tend to produce dates that are 15–20 years too young for pre-1650 sites and 15–20 years too old for post-1650 sites (Gaulton 2006: 42).

There are a number of explanations for these results. The first is the presence of unmarked, and therefore unidentifiable, English West Country and Dutch pipe stems in these assemblages. The pipes from these two sources are known to not conform to the Harrington model and introduce biases into the calculations. This is especially a problem on Newfoundland sites, but the presence of

Table 4. Mean ceramic dating information.

Ware Type	Vessels	Date Range
Rhenish brown CSW	5	1600-1800
Borderware CEW	1	1610-1650
Bristol CEW	5	1670-1795
Manganese mottled CEW	1	1680-1780
North Italian CEW	2	1610-1675
North Devon gravel CEW	3	1600-1650
North Devon smooth CEW	14	1600-1650
North Devon sgraffito CEW	2	1600-1650
Portuguese redware CEW	1	1600-1650
Westerwald CSW	3	1650-1775

both Dutch and West Country pipes has been confirmed on Smuttynose Island, and they are probably also found at other Maine locations. The second is the question of site use or, more specifically, the intensity of site use. On Smuttynose Island, at the very least, the Harrington histogram, pipe bowls, and makers' marks suggest that the occupation and use of the island continued to intensify from 1620 to 1680, peaking between 1650 and 1680. As a result there is a distinct bias in the sample toward the latter half of the century. Combined with the errors introduced by the Dutch and West Country pipes, this accounts for the disparities between the historical mean date and the pipe mean dates at the trench and area scale.

In terms of accuracy, the mean-dating results from Smuttynose Island are most similar to those from Port Royal. At both sites the Binford dates were the most accurate; conversely, at both sites and in the Jamestown contexts tested by Mallios, the Heighton and Deagan formula produced dates that differed from the historical mean by a significant margin. This differs from McMillan's results; the wide discrepancy in the accuracy of the various formulas does support her conclusion that regional and temporal variation among sites affects the performance of these formulas. The background processes that led to the creation of the different assemblages, such as occupation span, intensity, disposal patterns, and socioeconomic status, would have influenced the results as well.

As a check on the stem-bore dates, a mean ceramic date was also calculated for a group of 37 ceramic vessel lots taken from the complete Smuttynose Island ceramic assemblage (TAB. 4). *Terminus post quem* and *terminus ante quem* dates were established using information from the Digital Archaeological Archive of Comparative Slavery (DAACS 2016) with adjustments to reflect the peculiars of the Smuttynose Island assemblage; specifically, North Devon wares would appear to disappear from the Smuttynose Island assemblage by 1650 as discussed below. The date derived from this formula is 1661, which matches up well with the Binford and Hanson dates for the trench and area scales.

Identifying Occupation Phases

The analysis of the archaeological materials shows that that the pipe assemblage from Area 2 predominantly represents the first two major occupation phases of Smuttynose Island; namely, the migratory fishery and early residential fishery (ca. 1623–ca. 1640) and the middle residential fishery (ca. 1640–ca. 1680). This is supported by the analysis of bowl forms, makers' marks, and the Harrington histogram. The Harrington histogram further

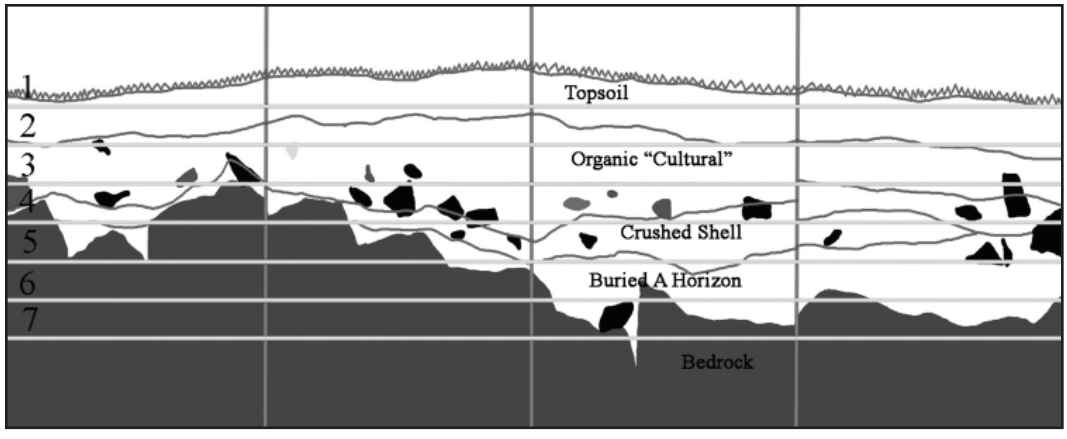

Figure 7. North wall profile, excavation trench 116, Smuttynose Island, Maine, showing stratigraphic layers. (Figure by Arthur R. Clausnitzer, Jr., 2014.)

Table 5. Diagnostics from Trench 116, Levels 4 and 5.

Description	Level	Date Range	Mean Date
Bowl	4	1670-1700	1685
Bowl	4	1620-1660	1640
Bowl	5	1620-1650	1635
Bowl	5	1610-1640	1625
Decorated Stem	5	1660-1670	1665

suggests that use of the island increased rapidly during the first occupational period and peaked during the second before rapidly falling off after about 1680. This is again supported by the pipe bowls and makers' marks, which largely date to the second half of the 17th century and feature few 18th- and 19th-century examples, as well as the mean dates. These results are consistent with the historical record.

Three lines of evidence will be used in determining whether or not the smoking-pipe assemblage can be used in identifying the occupational phases of Smuttynose Island. The first is the excavation level, mean bore dates. The second is the bowl form and maker's mark information. Finally, the stratigraphic profiles of the excavation trenches provide the contextual information missing from the arbitrary excavation layers. Not every stratigraphic profile was drawn or is available for this study, however. Profiles are available for the north wall of Trench 116, which can double as the south wall for Trench 117, and Trench 119. No profile is known to exist for Trenches 113/114 and 115, which, unfortunately, are the two deepest and richest trenches. The lack of north-wall profiles for Trenches 113/114, 115, and 117 make it impossible to track changes in the stratigraphy from south to north.

At first glance, the mean bore dates from the excavation level do not appear to provide much evidence for the separation of occupation phases due to the previously stated issues with context mixing. As the dates were computed for each level, however, a pattern emerged. Twice in Trench 113/114 and once each in the 115 and 116 trenches there is a break in the progression of mean dates where the date jumps by a decade or more. In all three trenches, this occurs between Levels 3 and 4, while the second break in the 113/114

Table 6. Provenience of West Country pipe bowls

Trench/Level	Binford Date	West Country Pipes
Trench 113/114		
1		
2	1679	
3	1675	
4	1661	
5	1664	X
6	1656	X
7	1646	X
8	1652	X
9		
Trench 115		
1		
2	1679	
3	1670	
4	1648	X
5	1649	X
6	1647	X
7		
8		
Trench 116		
1		
2	1675	
3	1668	
4	1654	
5	1653	X
6		X

X=West Country pipe bowls were found in that layer.

Trench is between levels six and seven. These breaks in the dating progression were then compared to the available stratigraphic profile, which is for Trench 116 (FIG. 7).

The break in the dating sequence occurs between Level 3 and Level 4. In Trench 116, Level 4 is a mixed-context level composed predominantly of the organic black "cultural" layer, but also contains some of the underlying shell layer. The origin of this layer of crushed shell is unclear, but it appears to be anthropogenic in nature and possibly represents an attempt to level the ground for the meetinghouse and/or remains of material used in the mixing of mortar for its construction. If this is the case, then this shell deposit dates to a short period of time around the year 1640. Confirming this requires looking at the makers' marks and bowl forms recovered from both Level 4 and Level 5, which also contain the shell deposit.

Unfortunately, between these two excavation levels there are only five diagnostic pipe fragments (TAB. 5). Two of these bowls are from Level 4, and date from 1620–1660 and 1670–1700. The three remaining pieces are from Level 5; two pipe bowls date from 1610–1640 and 1620–1650 and a decorated stem fragment is tentatively dated 1660–1670. Such a distribution can cautiously be seen as support for the interpretation of the shell layer dating to the period around 1640. This is important since the usual assumption is that mixed contexts create an averaging effect on mean bore dates. In this instance, however, Levels 3 and 4 have significantly different mean dates. This suggests that the deposits below the shell layer are older than those above it and that the shell layer itself was deposited rapidly in comparison to other stratigraphic deposits. Use of Smuttynose Island, and the Isles of Shoals as a whole, intensified after 1640; with increased occupation comes increased deposition, which could account for the significant break in the mean bore dating sequence. Combined with evidence from other sources, discussed below, this phenomenon supports the identification of different occupation phases in the archaeological record.

The West Country pipe bowls provide another piece of evidence for the identification of occupational phases. The English West Country was the primary point of origin for migratory fishing voyages in the 17th century; as migratory crews relied on provisioning sources local to their port of origin, smoking pipe bowls of West Country origin are more often than not directly associated with the migratory fishery (Pope 1997). It follows that after the disappearance of the migratory fishery from the Gulf of Maine, West Country pipes would disappear as well. Only one West Country pipe bowl was recovered from Trench 116; however, it was recovered from the level below the break in the mean-dating progression. If the shell layer is attributable to the construction of the Smuttynose meetinghouse and the start of permanent occupation on the Island, this means that the West Country bowl pre-dates both the meetinghouse and permanent occupation. It then follows that deposits in Level 5 and lower are largely, albeit tentatively, attributable to migratory fishing activities.

If this is the case, then the majority of West Country pipe bowls recovered in Area 2 should be in excavation levels at or below the dating progression. Table 6 lists all of the West Country pipes recovered from the study area, with their provenance and dating. With a few exceptions, the West Country pipe bowls come from levels below the break in the mean-date progression and which have mean dates in the 1640s and 1650s. Of the three bowls that occur outside these levels, two occur in a level immediately above the break and the other is from a shallow excavation unit. In all three instances, the excavation levels contained mixed contexts, which is likely the reason for the appearance of West Country pipes above the break.

The available data strongly suggest that West Country pipes are an indication of a migratory/early period fishery context on Smuttynose Island. Additional evidence is needed, however, to strengthen this argument. Based on archaeological investigations into the fishery in Newfoundland, another class of artifact was identified as being representative of the presence of the migratory fishery: North Devon ceramics. Found up and down the eastern coast of North America in 17th-century contexts, these ceramics, especially tall pots and storage jars, are particularly common on Newfoundland sites. They are generally believed to be the consequences of Newfoundland settlers' continued reliance on imported food (Pope 2004: 300, 354–355). Based on the assumption that the Massachusetts Bay takeover of the fishery in the Gulf of Maine also meant a shift from overseas to local food sources, North Devon ceramics will also disappear from the archaeological record of Smuttynose Island at the same time as the West Country pipes.

Seventeen North Devon storage vessels from the study area on Smuttynose Island were identified. The sample consisted of fourteen

tall pots and three storage jars. When the provenance of the individual sherds of each vessel lot was compared with the provenance of the West Country pipes, it was seen that they co-occurred almost universally and were also concentrated in levels below the break in mean-date progression. This remarkable similarity in distribution supports the use of West Country pipes as markers of a migratory-fishery context and suggests that, in New England at least, this may be an indication of an early (pre-1650) occupation.

Returning to the stratigraphy of Trench 116 (FIG. 7), it is now possible to link each stratigraphic deposit to one of the occupational periods of Smuttynose Island. Starting at the bottom of the deposit, the A horizon is the original surface of the island and contains material from the migratory-fishery period. Sitting directly on the A horizon is the shell layer, which also contains material from the migratory-fishery context, as well as the early European occupation of the island, and represents the construction of the Smuttynose meetinghouse. Together these two strata represent the first occupational period of ca. 1623–ca. 1640. The overlying "cultural" layer represents the second period of the ca. 1640–ca. 1685 and later residential fishery. This layer contains material related to the meetinghouse, the activities of residential fishermen throughout this period, as well as limited material from the Haley and hotel periods. The final layer is topsoil, which contains a mix of artifacts from the residential-fishery period, hotel period, and present day.

Discussion

At the beginning of this article four significant historical developments were identified, two in the history of archaeology and two in the history of Smuttynose Island. The issue put forth was whether the two archaeological developments, namely the Harrington method of stem-bore dating and the mean bore dating formulas, can be used to identify two periods in the history of Smuttynose Island: the transition from a migratory to a residential fishery and the decline in Smuttynose's 17th-century population. In the process of doing so, the interpretive value and relative accuracy of the pipe-based, mean-dating methodologies were evaluated.

James Deetz demonstrated success in using Harrington histograms in identifying and interpreting settlement patterns at Flowerdew Hundred (Deetz 1989, 1993: 7–9). Similarly, the creation of a Harrington histogram for the study area on Smuttynose Island demonstrated clear trends in the occupational intensity of the island. These trends articulate surprisingly well with the popular history of the island's occupation, showing a steady increase in the population with a peak in the 1650–1680 period before declining over the following decades. The lack of a second peak in the post-1750 period, which is seen in other areas of the island, suggests that any later activity in this area left little archaeological evidence and was, therefore, of a less intense nature (Clausnitzer 2013).

Lewis Binford developed his regression-line mean-dating formula based on Harrington's data as a more refined method for comparing the dates of different historical sites. In addition to the Binford formula, two other bore-based formulas have been developed, based on different interpretations of the stem-bore phenomenon, while, more recently, a formula based on the weighted means of pipe-bowl dates has also been proposed (Hanson 1968; Heighton and Deegan 1971; Mallios 2005). All four of these formulas were applied, when appropriate, to the Smuttynose Island sample at three different scales of interpretation.

At the two larger scales of area and trench, the difference between the mean dates generated using stem-bore data is not significant, and the dates suffer from known biases in mean bore dates in the Northeast. The mean bowl dates were more accurate, being closer, on average, to the historical mean and having a narrower distribution of dates. At the smallest scale dates were generated for each

excavation level, which has some utility in confirming the integrity of the archaeological deposits. Further analysis of the mean bore dates was combined with data from the stratigraphic profiles and technical analysis of the smoking-pipe assemblage to provide evidence for the identification of contexts related to different occupation phases on the island. This, by extension, allowed for the separation and identification of contexts within the stratigraphic profile. Due to a lack of information on the stratigraphic profiles for some of the excavation trenches, specific strata could only be identified in one trench. However, the consistency of the data across the excavation trenches allows the use of this information as a proxy for the remaining trenches.

Conclusion

The study of clay tobacco pipes may be one of the most pedantic aspects of historical archaeology, as it is often focused on the morphological analysis of pipe bowls and the calculation of mean dates of occupation. This article developed out of one such study as interest grew in the application of such analyses to the separation and identification of cultural contexts related to the occupation phases of Smuttynose Island. The specific context sought was the transition from a migratory fishery to a residential one. This transition is most visibly marked by the construction of a meetinghouse around 1640, evidence for which was recovered during the archaeological excavation. Due to the specific methodology used during these excavations, however, arbitrary layers often combined different cultural contexts, complicating this identification.

Calculating the mean stem-bore dates for each excavation level enabled the admittedly coarse separation of pre-1640 migratory and post-1640 residential contexts. Comparisons of the bowl morphology and makers' mark data supported this separation and comparing this information to the stratigraphic data allowed for the association of natural strata with specific occupational phases. Unfortunately, a lack of stratigraphic profiles for the remaining trenches prevented additional interpretation and confirmation of these associations; however, the consistency in pipe dates among all three trenches should allow the information from the first trench to be used as proxy data for the remaining trenches with confidence.

This use of mean stem-bore dates works because the methodology is being applied to a small-scale, mixed-context dataset. Thus, while this article has identified an interpretive function for mean bore dates, it is dependent on specific conditions and highly situational in its application. Regardless, it illustrates that there is a future in clay-pipe studies outside the morphological and technical analyses most often seen in archaeological literature, as researchers look for new and innovative ways to use stem-bore and other mean-dating formulas. Furthermore, the comparison of the mean stem-bore formulas from Smuttynose Island illustrates the varying accuracy of each, depending on time, place, and numerous other factors. Therefore, while it can be tentatively stated that the Binford formula is the most accurate for northeastern sites, archaeologists should remember that there are other tools at their disposal that may be more appropriate for their specific sites. They also should ask questions about what they hope to gain from stem-bore dating; is an accurate date one that falls within the known or estimated dates of occupation for the site, thereby confirming what is already known, or are they looking for a way to refine the sequence of occupation on the site? The answers to these questions should determine the how and why of applying stem-bore dating formulas to an archaeologist's data.

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