

Title	The archaeology of coastal shell middens in Ireland
Authors	Howle Outlaw, Carolyn E.
Publication date	2023
Original Citation	Howle Outlaw, C. E. 2023. The archaeology of coastal shell middens in Ireland. PhD Thesis, University College Cork.
Type of publication	Doctoral thesis
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Download date	2026-10-30 17:12:01
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The Archaeology of Coastal Shell Middens in Ireland

Volume 1 of 2

Main Text

Thesis presented by

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for the degree of

Doctor of Philosophy

University College Cork

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2023

(Volume 1)

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Acknowledgements

I would like to thank my supervisor and Department Head, Professor William O'Brien, for guiding me throughout the preparation of this thesis. I would also like to thank my fellow students within the Department for their constant support, in particular, Ben Spillane, Roisin Navin, and Stephanie Robinson.

I would also like to recognise the financial support provided by the Royal Irish Academy and the College of Arts, Celtic Studies and Social Sciences at the University College Cork. Both bodies supported field surveys and the latter awarded me with the Excellence Scholarship.

Finally, I would like to express my gratitude to family and friends outside of the Department both at home and abroad for their contributions through support and feedback. These wonderful people include, but are not limited to my grandparents, my college classmates, and my niece and nephew. Special thanks to Michael Outlaw, Dr Virginia Lee, and Elizabeth and Joel Howle.

Dedicated to Minnie Moore Lee, MA, MSN, BSN (1934–2022)

Abstract

Coastal shell middens are an important archaeological resource, with the potential to shed light on many different aspects of human interaction with coastal environments over time. These deposits of discarded shells, charcoal, and other cultural material can be found at various locations along the c.7500km or so of the Irish coastline. They have a long chronology from the Mesolithic through to early modern times, along with a considerable degree of variability in terms of site function, settlement context, and environmental setting. The study of these sites in Ireland has largely focused on the pre-farming (Mesolithic) period as part of a consideration of coastal foraging economies. Current evidence points to a long tradition of utilising coastal resources, which after c.4000 BC was integrated to varying degrees with agricultural activity through changing cultural practices evident elsewhere in the archaeological record. The principal aim of this study is to understand the changing role that coastal resources played through time in Ireland.

Research methods include a review of published and archived sources on shell midden archaeology in Ireland and field survey. The data collected is statistically analysed with a view of understanding relevant changes in artefactual, ecofactual, and structural remains through time. Interpretations are based upon the archaeological data, relevant theories of interpretation, and ethnographical accounts of the use of molluscs and their deposition.

The final analysis examines broad trends through time in relation to the use of coastal resources by humans in Ireland. Other questions addressed include the contribution to diet and nutrition made by coastal resources and their use as economic goods. The liminal character of the coastal zone, historical references to religious and folk beliefs concerning the coast, and inclusions of ritual deposits such as burials are examined as separate from but interwoven with the economic value of the shells.

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Chapter 1: Introduction

1.1 Summary of Topic

Shell middens are essentially waste dumps principally made up of marine shells (Waselkov 1987, 95). These sites are known to be porous, permeable, and alkaline and can contain cultural remains such as artefacts, charcoal, and bones (*ibid.* 139; Stein 1992, 1). Their size can vary from small heaps of a single shell species measuring no more than 0.01m thick to large mounds measuring up to 3m thick (O’Sullivan and Breen 2007, 26 and 40).

These shell deposits are found all around the coast of Ireland from Co. Antrim in the north to Co. Cork in the south. They can date from the Mesolithic through to the Post Medieval period. While the field characteristics of these deposits remained relatively consistent over time, their use and significance has changed in different cultural settings. This thesis seeks to explore the temporal shifts of coastal resource utilisation in Ireland through the comparative analysis of shell middens.

Numerous academic and popular fields around the world are currently engaged in heated discussions on the implications of human interactions with our modern environment. The consequences are evident in archaeology with the continual and rapid loss of sites such as shell middens along the coast. While there are few possibilities to prevent coastal erosion of shell middens, we can work towards better understanding their cultural contexts while they are still extant. This can help us to better understand human interactions with our past environment in order to better understand the present implications of similar interactions.

1.2 Shell Middens in Ireland

The general study of Irish maritime archaeology began with the idea that coastal peoples were marginal and ancient. After many shell midden sites were researched in the nineteenth century, the first Irish MA student to complete a thesis in archaeology, Joanna (*née* Holland) Brunicardi, looked to catalogue their finds in 1912. This thesis included fifty-five sites and, again, interpreted the midden creators as either from the stone ages or ‘ignorant of progress and quite content in their seclusion’ (Brunicardi 1914, 208). The first scientific excavation of a shell midden site in Ireland was performed by the Harvard Irish Expedition led by Movius (1940) at Rough Island, Co.

Down. The most recent in-depth excavations of shell midden sites include work done by Burenhult (1984) at Culleenamore, Co. Sligo, Woodman (1999) at Ferriter's Cove, Co. Kerry, and Lynch (2017) at Fanore More, Co. Clare. A systematic dating program of shell middens was published in 2007 by Milner and Woodman, adding to the admittedly small corpus of scientifically dated sites (Milner and Woodman 2007). No complete catalogue has been attempted since Brunnicardi's work in the early twentieth century.

Over the last century and a half of shell middens being recorded in Ireland, a total of 529 sites have been documented, each containing between one and 22 shell-bearing features. These are distributed along most of the island's coastline. The eastern shorelines between Counties Louth and Wexford have fewer middens, except within the Dublin area. Sligo has the densest area of shell midden sites reported with 100 sites in the county, 70 of which are clustered around Sligo Bay alone. This discrepancy of site distribution may be due to visibility, discovery, and fieldwork pattern in the affected areas. For instance, shell middens have been revealed through commercial excavation in the Dublin area that would have otherwise gone unnoticed due to reclamation or naturally depositional beaches. Such sedimentation may be causing the obscuring of other shell middens on the east coast. Also, while the Sligo (Irish *Sligeach*; 'shelly place') would be expected to have a large number of middens, the concentration of middens around Sligo Bay may be due to the encouragement of public reporting under the Monitoring the Archaeology of Sligo's Coast (MASC) Project.

While Irish shell middens are not confined to sandy coastlines, they are most commonly found in those environments. They are also found in estuaries, riverine areas, and around large lakes. Freshwater shell middens may also be present, such as one reported at Bewley, Co. Waterford (WA011), but there is a paucity of reports of this nature. The absence of such sites in the archaeological record may be due to a limited use of these freshwater molluscs or to a lack of fieldwork designed to target such sites.

Early prehistoric shell middens and other Mesolithic sites are more commonly found in the north-east of Ireland than in the south-west region. This is due in part to isostatic rebound causing early coastal landscapes to be submerged in the southwest and creating raised beaches in the north-east (see Chapter 3). Dramatic Atlantic storms also directly impact the west coast, sometimes causing quite rapid loss of sites through wind and wave erosion. The closer a shell midden is to the sea, the more exposed it is

to ongoing coastal erosion. A total of only four early prehistoric shell midden sites are known from the South East, South West, and Lowland West regions (see section 1.4.2). By contrast, the area around Lough Swilly, Co. Donegal has seven early prehistoric shell midden sites. By the historic period, the distribution of shell midden sites is widespread across the Irish coastline, though the number of sites in the North declines after the Late Medieval period (see Chapter 7).

1.3 Aims and Objectives

This thesis can be broken down into two aims: 1) Compile a catalogue of all shell middens recorded in Ireland at the present time; 2) Understand the changing role of shell middens over time in Ireland. The first aim is focused on data gathering for current and future analysis with a goal of making this information widely available. The second aim focuses on statistical and interpretive analysis of shell midden archaeology.

Aim 1 was broken down into two objectives. The first was to undertake a desktop survey of the known shell middens using published and archival resources available in print and online. These include journal article publications, site-specific monographs, and published regional/county surveys, along with the Sites and Monuments Record (SMR) online databases for the Republic of Ireland and Northern Ireland. Primary excavation records and original SMR archives, housed in the National Monuments Service Archives in Dublin, were referenced for unpublished information. Finds reports related to midden sites were also referenced from the National Museum of Ireland's Archives. The second objective was a field-based survey of sites in coastal landscapes that are within the most at-risk areas for loss in counties Clare, Cork, Galway, Kerry, Mayo, Sligo, and Waterford. These surveys were undertaken to understand the loss of sites and to create a more complete database of information.

The second research aim has two objectives. The first involved a statistical analysis of the site catalogue. This was undertaken to better define shell-bearing features in Ireland through analysis of the available dimensions and morphological features of known deposits, following similar studies undertaken in Denmark, France, and Spain (see Chapter 3). The features defined within these categories were analysed together in this thesis under the term 'shell midden features.' The second objective sought to find trends in artefactual, ecofactual, or structural remains associated with shell

middens of different date across Ireland. This included looking at the number of shell midden features with only one shell type versus various shell types, looking at the presence of other animal remains within the sites, and any indications of food processing on or off site. Similar analysis took place concerning the deposition of artefactual remains within the deposits. Nearby monuments of similar age were examined for trends in middens related to various structures or activities.

1.4 Research Approach

The sources for this study of Irish shell middens include published and archival reports and fieldwork undertaken by the author. The published and archived material was built up from survey or excavation and date between the 1830s and 2022. The Irish evidence is also examined in relation to shell midden studies abroad, using published sources available in print or online.

The creation of the catalogue and database began with reference to published data on the SMR online databases for both Northern Ireland and the Republic of Ireland. By searching for ‘midden’ sites in the Republic’s database and then for other coastal habitation sites in the Northern Irish database, approximately 470 sites were recorded. Other sites were discovered through a search for mentions of similar midden and coastal habitation sites in national and regional archaeological journals, such as the *Proceedings of the Royal Irish Academy*, *The Journal of the Royal Society of Antiquaries of Ireland*, and the *Journal of the Cork Historical and Archaeological Society*. The National Monuments Service’s Database of Irish Excavation Reports was also searched to reveal sites not yet added to the SMR.

The various published sources were combined for each site. The archives of the National Monuments Service (NMS) and the National Museum of Ireland (NMI) were then used to supplement this data using unpublished information on file such as unprocessed site reports, full length excavation reports, and stray finds reports. These were further supplemented, when necessary, with direct queries to researchers where possible.

The data for a sample of sites within chosen landscapes was further supplemented by field survey. These included gathering of GPS coordinates, dimensional measurements, photographs, and a sample count of shell species and inclusions. Previous work as the site supervisor of a shell midden excavation on Achill Island in

2018 led to the creation of an effective sampling strategy for noting shell species. Areas measuring 1m by 1m in plan or section, or 1m in length if the depth in section were shallow, were randomly selected within the midden area and the number of each species and any inclusions were noted. This was done for every 10m of midden. All bone and artefact inclusions were noted wherever found with location measurements and photographs. Any stray finds that were recorded during fieldwork was reported to the NMI while any new sites were reported to the NMS.

1.4.1 Theoretical Background

The database created for this work was built over three phases as the theoretical background of methods developed. The first phase of data collection took place with a more cultural-historical process in mind with descriptive statistics. This was primarily based upon the hope for self-evident trends to become known through observations of the data. The second phase collated presence/absence of data and, where available, numerical data into a database format for the addition of more descriptive statistics. The desire to follow the recent movement away from the dependence upon ‘bright line’ cut offs lead to a review of Bayesian theory and methods (Greenland *et al.* 2016; Otárola-Castillo and Torquato 2018; Wassertein and Lazar 2016; Wassertein *et al.* 2019). This coincided with a desire to better define chronological trends. This led to an even more in-depth data collection method with more focus on chronological indicators and radiocarbon details. This revealed the large discrepancy in the detail and value of data collected and reported by previous works. This has obvious implications to the value any analyses performed on the data, but the use of Bayesian theory allows for this understanding to be considered by using data which may otherwise have been thrown out completely.

Bayesian theory is grounded in the understanding that investigative research is based upon a finite and imperfect set of data, no matter how large a sample is available and gathered (Gannon *et al.* 2019). The inherent bias and subjectivity within such imperfect data and within the choices made concerning its investigation is built into the *a priori* parameters of Bayesian statistics. The primary analysis tool used for this study is descriptive statistics.

1.4.2 Data Collection and Analysis

As discussed in Section 1.3, data was primarily gathered from secondary sources with the addition of surveys undertaken by the author within endangered areas. The secondary sources including field surveys conducted by others, excavation reports, and published articles. These sources are disparate in terms of the detail and value of data reported. Some sites are only noted as existing in a location with no information about their content or size. Others give minimum number of individuals (MNI) or number of identified specimens (NISP) for molluscs and bones identified to species. Most, however, exist between these two extremes, allowing for a limited, yet generally robust dataset of primary molluscs identified to at least genus and the same for bones along with at least two dimensions of the shell deposit itself. All data was recorded for every site to a level standardised prior to the collection.

Molluscs

Shells are discussed using common English names which can include multiple scientific species within a single category (limpet, for instance, can include *Patella vulgata* or *P. aspera*; oyster can include *Ostrea edulis* or *Anomia ephippium*). This decision was due to the general lack of scientific species identification in the literature and the theoretical understanding that folk taxonomies and popular usage are often more reflective of human decision making than the scientific distinctions (Begossi *et al.* 2008). While we cannot know the exact distinctions and groupings made between all shell species by the people of Ireland since the Mesolithic, modern understandings of these species are a starting point for exploring their significance in the past. These categories also allow for a more robust dataset without single species identifications causing arbitrary outliers which can either be explained because such a species was only included in sites rarely or were only identified by investigators rarely. While the former could indicate interesting results, the latter is more likely (see Appendix 1 or a further breakdown of which species may be included in the various common English categories). Where possible, shell species binomials are used in comparative tables and in case studies.

Shell counts gathered during the author's survey were counted as NISP due to the nature of data collection. Traditional methods of MNI such as the counting of apertures for gastropods and the maximum of left or right umbo counts for bivalves are not

applicable to counting shells along a section face in the field. Some of the methods used for MNI are usually found to be under representative (Waselkov 1987, 160) and the NISP counted in the field may in fact be an appropriate estimate, though a slight over-estimation is overall assumed. These counts were then used to determine dominant species and were transferred into a presence/absence database for analytical comparisons with other sites. Shell species were identified using the *Handbook of the Marine Fauna of North-West Europe* (Hayward and Ryland 2017). From secondary sources, the counts given are usually MNIs from samples or presence/absence. In some instances, reports gave weights rather than counts.

Bones

Terrestrial mammals are divided by species, though discussed using common English names. The only variation to this is the commonly combined sheep/goat, which can rarely be differentiated due to their similarities. Fish, birds, and cetaceans are grouped within these aforementioned categories. This is a decision solely based upon the lack of specialist reports to include species differentiation between various fish, birds, and cetaceans. All species of crabs were also included within the bones database. Where the species are given, these are listed in a notes column within the database.

Bones, like shells, were counted as NISP during the author's survey due to similar constraints. What bones could not be identified by the author were identified by Róisín Nic Cnáimhín, based in the Department of Archaeology, University College Cork. Again, most secondary sources gave MNI, though some also gave NISP and some only listed presence. For similarity of methods, presence/absence is used in the database, though dominant species are indicated where possible based on counts given.

Plant Remains

Charcoal is generally taken to be a characteristic feature of shell middens created by human agency. This may be why it is so often reported even when the range of shell species present is not. Details of all available charcoal identifications are included in the site catalogue entries. Less frequently reported plant remains such as cereals and nuts are indicated as present/absent inclusions. Where these remains are found in caches, this is noted in the Catalogue as these are more reliable inclusions than single grains due to the permeability inherent in the sites (see Chapter 3). These cereals and

nuts are usually smaller than the charcoal remains and may go unnoticed in coarser excavations or during unintrusive surveys, which likely means that these inclusions are underrepresented in the data.

Artefacts

For the purpose of the database, presence/absence is recorded for artefact categories. These categories include ceramic, glass, metal, lithic, stone, bone/horn, shell, and leather/textile. These are then further subdivided into more specific artefact types such as glass subdivided into bottle glass, beads, or other fragments. These categories are used for further defined presence/absence recording. Artefacts reported to the National Museum of Ireland (NMI) were dated by museum staff for inclusion in catalogue entries.

Dimensions

The maximum recorded measurements of shell midden length, width, and thickness are recorded where known for each site. The maximum measurement was recorded rather than the minimum or average, because of the known erosional and compressional forces acting upon the sites making even the maximum measurements more likely to be under representative. These measurements are used to estimate area and volume for the sites. Maximum measurements for each dimension along with the estimated volume were all compared to determine cut off points for larger shell middens versus smaller shell deposits (see Chapter 3).

Location

The coordinates used for shell midden sites were based upon the Sites and Monuments Records of Ireland and Northern Ireland where available. If no coordinates were available, locations were estimated based on available descriptions, such as nearby monuments or landmarks. If coordinates are estimated, this is indicated in relevant catalogue entries and in Appendix 3. For comparative purposes, six locational categories were created based on topographic information and erosional factors. These categories include North (Ulster), Highland West (Sligo and North Mayo), Lowland West (South Mayo, Galway, and Clare), South West (Kerry and Cork west of Cork

City), South East (Cork City and East Cork), and East (Waterford in the south to Louth in the north) (Figure 1.1).

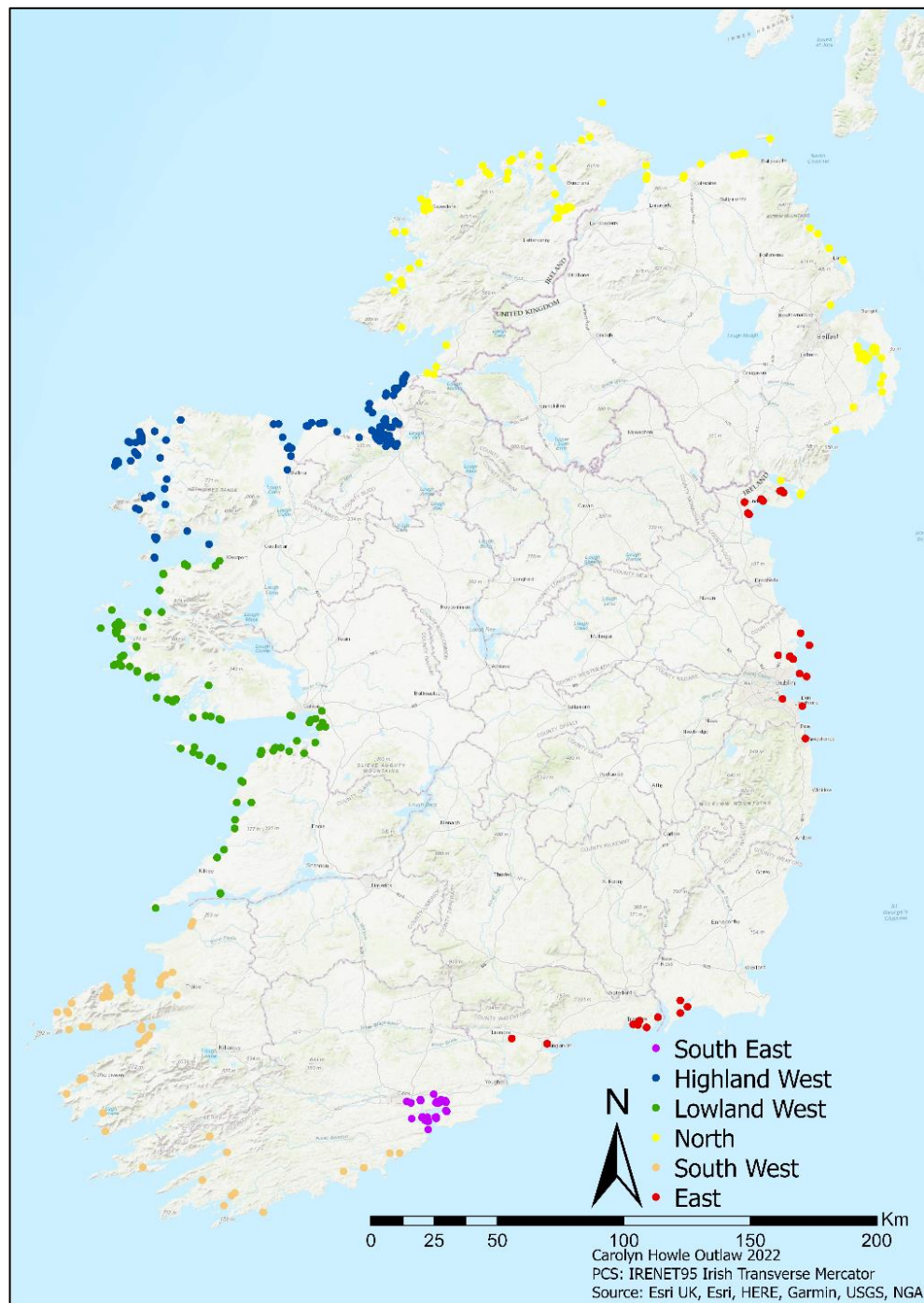


Figure 1.1: Locational categories used in the study as applied to the distribution of Irish shell midden sites.

Dating

Deposits with dating evidence were grouped into eight primary periods: Mesolithic (8000–4000 BC), Neolithic (4000–2500 BC), Bronze Age (2500–500 BC), Iron Age (500 BC–400 AD), Early Medieval (400 AD–1100 AD), Late Medieval (1100–1550 AD), Post Medieval (1550–1850 AD), and Early Modern (1850 AD onward). Sites with evidence that bordered or spanned any of these time periods were defined as Mesolithic/Neolithic, Neolithic/Bronze Age, Bronze Age/Iron Age, Iron Age/Early Medieval, Early Medieval/Late Medieval, Late Medieval/Post Medieval, or Post Medieval/Early Modern. The dates chosen are based upon general consensus on the chronology of prehistoric and historic Ireland, though these dates cannot be assumed to be exact. Where scientific dating allowed, calibrated date ranges in years are also presented for the sites.

Radiocarbon dates are recorded with as much information as is available. This information ranges from detailed deposit and sample descriptions with lab numbers and raw dates to vague statements that a radiocarbon date produced a calibrated date within a specific period. Very few sites included information on isotopic ratios and no information was available on nitrogen values for marine diet indications. Where only calibrated dates are given, calibration curves and corrections are typically not discussed. Only raw dates can be used for radiocarbon modelling. Marine dates were corrected with a ΔR value of -148 ± 35 based on six samples from around the coast of Ireland (Harkness 1983). Raw radiocarbon dates are expressed as ‘BP’ and calibrated dates as ‘BC’ or ‘AD’ following international convention (Bayliss *et al.* 2007, 7).

Dates were judged as directly dating the midden depositional event on a case-by-case basis (Baylis *et al.* 2011). Most dated material from within a shell deposit itself is considered to directly date the depositional event as molluscs and animals are assumed to have been killed shortly before being disposed of. Charcoal is slightly more problematic as the tree could have been felled years prior to its burning. Human remains are likewise problematic as loose bone may have been disinterred from elsewhere, though articulated remains may give a clearer indication if these remains were deposited within the midden and not cut into it. Plant remains such as cereal grains and hazelnut shells are more reliable dating sampled if found within a cache. Dates which are trusted less include human remains that lacked evidence of the marine influence on their dietary carbon, unidentified bones, and unidentified charcoal species (as the old wood effect can cause major shifts in dates).

1.5 Thesis Layout

This thesis is broken down into four parts labelled parts A–D. Part A contains an introductory overview of the topic. Chapter 1 provides an Introduction. Chapter 2 is a broad history of shell midden research, with a look at how shell middens have been studied more generally worldwide and more specifically in Ireland. Chapter 3 is then centred on The Archaeology of Shell Middens with in-depth information concerning methods for defining, studying, and understanding shell middens in the archaeological record.

Part B includes chapters 4–8 which present investigative analysis of broad time period trends within Irish shell middens. Chapter 4, ‘Shell Middens and Marine Resource Use in Early Prehistory,’ looks at trends and key sites for the Irish Mesolithic and Neolithic (8000–2500 BC). Chapter 5, ‘Shell Middens in Later Prehistoric Ireland,’ investigates patterns of shell midden use through the Chalcolithic, Bronze, and Iron Ages (2500 BC–400 AD). Chapter 6, ‘Coastal Economies in Early Medieval Ireland,’ delves into continued shell midden creation through the Early Medieval Period (400–1100 AD). ‘Late Medieval Shell Middens’ (1100–1550 AD) are analysed in Chapter 7. Finally, Chapter 8, ‘Interpreting Shellfish Consumption in Post Medieval and Early Modern Ireland,’ discusses practices of shell midden creation after 1550 AD and related recorded traditions.

Part C concludes the main text of the thesis with Chapter 9, ‘Discussion,’ and Chapter 10, ‘Conclusion.’ The discussion synthesizes the Irish evidence in order to compare and contrast the trends in shell midden use over time. The sites are also contextualised in reference to similar sites in Europe and throughout the world. Concluding remarks are given concerning each section of Part B and ends with a general understanding of the current threat Irish coastal heritage is under.

Part D includes the full Catalogue of Irish shell middens which formed the primary data source for the main thesis text. It also includes appendices of shell species nomenclature (Appendix 1), radiocarbon dates (Appendix 2) and locational information for each site (Appendix 3).

Chapter 2: A History of Shell Midden Research

Introduction

The following chapter introduces the history of shell midden research in the world in general and in Ireland in particular. Section 2.3 then gives an overview of modern shell midden research in Ireland. This section focuses on theoretical issues encountered in modern research while further information on methodological approaches which may be used to overcome these theoretical biases are addressed in Chapter 3.

2.1 Shell Midden Studies: A Worldwide Perspective

Shell midden research began in the eighteenth century with naturalists from various fields trying to understand the origins of the massive mounds of shells found around the coasts of the world. Many believed that these mounds were natural deposits left by receding seas (Waselkov 1987, 139; Stein 1992, 1). Peter Kalm, a Swedish botanist sent to study in North America in 1748 by Carl Linnaeus, argued that these deposits could be either natural or cultural rather than there being only one explanation. Joseph Banks, a British naturalist and botanist, also argued for a cultural origin in 1769 after observing the Māori midden sites (Waselkov 1987, 139). The cultural midden paradigm was not truly accepted until the nineteenth century.

One of the most key areas of study in establishing the human origins of shell middens was the Ertobølle in Denmark. Other significant studies of the nineteenth century included works in the Northwest of North America and the Brazilian *Sambaqui* (Álvarez *et al.* 2011, 3). The Ertobølle *kjøkkenmøddinger*, or kitchen middens, were first studied by Japetus Steenstrup in 1837 (Waselkov 1987, 139) and the 'First Kitchen Midden Commission' was formed in 1848 to focus research on these sites. This commission consisted of the zoologist, Steenstrup; the geologist, Johan Georg Forchhammer; and the archaeologist, Jens Jacob Asmussen Worsaae (Milner 2012, 224). By the end of the nineteenth century, it was generally agreed that shell middens were a cultural phenomenon (Vanuxem 1843; Lyell 1849; Chadbourne 1859; Tait 1869; Brinton 1872; Wyman 1875; Putnam 1883; Moore 1893; Waselkov 1987, 140). Contemporary discussions concerning the antiquity of man led to attempts to quantify the length of time required for these large middens to accumulate (*ibid.* 141). This then

led to shell middens becoming a common area of study within archaeology (Álvarez *et al.* 2011, 1).

Around the time of the first shell midden excavations and investigations, the three-age system of archaeology was being refined and disseminated. This system was first suggested by Titus Lucretius Carus in the first century AD. Lucretius organized artefacts chronologically without reference to provenance by sorting them first by material (stone is earlier than metal) and then by quality of craftsmanship (lower quality tools are older than those of higher quality). In 1825, when working as the head of the antiquarian collections at what is now the National Museum of Denmark in Copenhagen, Christian Jürgensen Thomsen noticed patterns based on provenance as well as material. He found that lower quality tools were being found in the same context as high-quality tools and that stone was sometimes found together with metal. This new, context-based system was revolutionary for the understanding and use of topological chronologies (Gräslund 1987).

2.2 Early Shell Midden Research in Ireland

The first Irish shell midden excavation took place in 1860 under the direction of George Henry Kinahan and Dean William Buckland (Brunnicardi 1914, 201; Milner and Woodman 2007, 102). Kinahan was a professional geologist and surveyor, and Buckland was Dean of Westminster with an interest in geology and palaeontology. Their excavation was later published by Johanna (*née* Holland) Brunnicardi in 1914. Harte (1866), an architect and surveyor, was the first researcher to publish on Irish shell middens. He was the county surveyor for Co. Donegal which gave him access to many archaeological sites ('Dictionary of Irish Architects' 2018). His shell midden account focused on the middens around Lough Swilly and their removal by local farmers (Milner and Woodman 2007, 102). Atkinson (1873) then published on the shell middens found within Cork Harbour. Atkinson went into detail concerning the size and shape of the sites including their maximum and minimum depths and their horizontal extents. He also listed molluscan species with some attempt at paleoenvironmental reconstruction.

The three-age context-based system was not fully accepted in Irish antiquarian communities until the mid-nineteenth century, though the Irish had an early subscriber to the system in George Petrie (Mitchell 1985, 116). Even as late as 1928, Robert A.

S. Macalister understood Ireland as having its own system separate from the continental European three-age system. Macalister defined his chronology based on megalithic monuments rather than on tools and artefacts. His time periods included Beachcombers (at the time of the European Mesolithic), Protomegalithic (European Neolithic and Early Bronze Age), Deuteromegalithic (European Middle Bronze Age), and Epimegalithic (European Late Bronze Age and Early Iron Age) (Macalister 1928, ix). With the term ‘Beachcombers,’ Macalister is referring directly to the creators of shell middens and separating them from later periods entirely (*contra* Brunnicardi 1914; Milner and Woodman 2007; Howle 2017).

Approximately ten years after Atkinson, William Knowles (1885) published his first report on an Irish sand-hills site. Knowles published in *The Journal of the Royal Historical and Archaeological Association of Ireland* concerning the prehistoric settlement evidence at White Park Bay, Co. Antrim. Knowles then published four reports concerning artefacts collected from the sandy coastlines of Ireland, particularly within shell middens (Knowles 1889, 1895, 1901; Knowles and Newton 1891). Knowles focused on the sand hills, because he was primarily a collector of stone tools, and he associated the shell middens and associated ‘black occupation layers’ with the ‘Beachcombers’ of the Stone Age. Macalister continued this association in his Irish chronology in 1928. After his first 1885 publication, Knowles’ next publications on the antiquities of the coast were published as part of the *Proceedings of the Royal Irish Academy* as a series of four reports ‘on the Prehistoric remains from the Sandhills of the Coast of Ireland’ (Knowles 1889, 1895, 1901; Knowles and Newton 1891). He visited sites in Counties Antrim, Clare, Derry, Donegal, Down, Dublin, Galway, Kerry, Mayo, Meath, and Sligo. These publications were the first attempt at a comprehensive collection of coastal settlement sites of Ireland. This work only missed visits to the coastal counties of Cork, Louth, Waterford, Wexford, and Wicklow (see Catalogue). These visits and minor excavations of shell middens and other coastal settlement sites contributed to Knowles’ large collection which contained a total of approximately 27,000 artefacts, the majority of which were stone artefacts from these coastal sites (Woodman *et al.* 2006, 3). These reported visits are also the only record of some shell middens that are no longer extant (e.g., Carrickanee (DL029) and Sandhill (DL054), Co. Donegal; Ceathrú An Teampaill (GA064–66) and Greatman’s Bay (GA073), Co. Galway; Ballybunnion, Co. Kerry (KY001); Ross, Co. Mayo (MO011); Breeoge, Co. Sligo (SO088)).

Knowles' contemporaries, Leonard Hassé and Archdeacon Robert Wynne also published reports on objects identified from the sand-hills (Hassé 1890; Wynne 1893; Hassé 1894). Hassé published reports on Portstewart and Grangemore, Co. Derry in 1890 and then on Dundrum, Co. Down in 1894. Hassé also accompanied Knowles, Mr Thomas Plunkett, and Rev. Buick to Bundoran, Co. Donegal in 1887 (Knowles 1889, 182). Wynne discussed the shell midden at Ballybunion, Co. Kerry. The presence of fire-cracked stone led Wynne to experimentally bring water to a boil using heated beach stones (Wynne 1893, 79). Many of the coastal and shell midden sites identified by this group of antiquarians were revisited by their contemporaries (e.g., Hewson (1938), Knowles (1889 and 1901), and Patterson (1893) all visited Dundrum, Co. Down (DW007)).

Brunicardi (1914) was the first Irish master's student to complete a thesis in archaeology and the first woman to submit a research thesis in Ireland or Britain. This thesis focused on coastal shell middens in Ireland (McCarthy 1988, 1). She completed this work through the University College Cork, cataloguing 56 shell middens along the coast. During her study, Brunicardi visited three sites for survey herself (Brick Island (CO005), Brown Island (CO006), and Glengarrif (CO030), Co. Cork). The other 53 sites were discussed through reference to the research of Knowles, Kinahan, and others. These sites included one in Co. Antrim, five in Co. Clare, two in Co. Derry, seventeen in Co. Donegal, two in Co. Down, one in Co. Dublin, seven in Co. Galway, three in Co. Kerry, four in Co. Mayo, one in Co. Sligo, one in Co. Waterford, and one in Co. Wexford (Brunicardi 1914 *passim*). By comparing these sites with modern hunter-gatherer communities creating middens in South America, North America, and Australia, Brunicardi concludes that the Irish middens date from the Palaeolithic through the Neolithic and were built by those within a stunted, fringe society of these early time periods. A lack of substantial structural features, little pottery evidence, lack of a flint trade between regions, and a reliance on stone tool technologies all suggested to her that the shell midden creators were without civilization and progress. She stated:

‘The conclusion which I would deduce from the foregoing facts is, that the shore-dwellers of Ireland were a distinct race in themselves, probably a degraded one, who lived almost entirely on shell-fish, and migrated from place to place in search of food, staying a longer time in some places than in others, according as food supplies and other necessities of life were plentiful.’ (Brunicardi 1914, 210)

Other antiquarian studies of shell middens included Ussher (1886), Leonard (1868), Patterson (1893, 1894), Bigger (1896), Windle (1911), and Hewson (1935, 1936, 1938) (Brunnicardi 1914; Murray 1999; Milner and Woodman 2007, 201; and McCarthy 1988, 1). As mentioned above, Patterson (1893) and Hewson (1938) both visited Dundrum, Co. Down. Patterson's 1893 publication was focused on this site and his 1894 work centred on Rosapenna, Co. Donegal.

Ussher (1886) discussed artefacts that were found within shell middens that were, at least spatially, related to raths at Whitechurch, Co. Waterford. Though he went into more detail concerning the middens than Robarts (1913), his focus was on connecting the middens with the monuments. Like Ussher (1886), Bigger's (1896) focus was more on the monuments than on the middens themselves, though he does go into some detail concerning the artefacts found at Dog's Bay, Co. Galway.

Leonard (1868) discusses the midden found on Omey Island in detail with reference to stratigraphy and extent. He suggests that the middens may be related to a possible early medieval monastery dedicated to St. Fechin, which would indicate a more modern date than the commonly assumed Stone Age association.

Windle's publication in *The Journal of the Royal Society of Antiquaries of Ireland* in 1911 was similar to those disseminated by Knowles in that he discussed various sites he had visited rather than focusing on one. These sites were all in Co. Donegal. Hewson (1935, 1936, 1938) was even more in line with Knowles in his three-part series 'Notes on Irish Sandhills' where he discussed multiple sites from Co. Antrim and Co. Down.

2.3 Irish Research in the Modern Era

A 'New Era' (Mitchell 1985, 156) of Irish archaeological excavation was brought in with the scientific methods of General Pitt-Rivers (1827–1900) used by Hugh Hencken and the Harvard Irish Expedition in 1932 at Ballinderry, Co. Westmeath. Irish archaeologists, Estyn Evans and Oliver Davies also introduced more scientific measures to their excavation at Goward, Co. Down in the same year (*ibid.*, 156–7). The first scientific excavation of a shell midden in Ireland was under the direction of Hallam Movius at Rough Island, Co. Down in 1936. Movius' excavation was also undertaken as part of the Harvard Irish Expedition (Movius *et al.* 1940).

Prior to this thesis, approximately 500 shell middens have been identified along the Irish coastline (Woodman and Milner 2013, 37). Of these, 118 have been excavated to date. Eighty-two years after the first scientific excavation of a shell midden in Ireland (see Movius *et al.* 1940), there have been many improvements to methodology used and understanding given to shell middens. Unfortunately, there are also assumptions originally brought forward by nineteenth century antiquarians which have remained prominent within much of the research completed over the years. One of the most common, deep-seated biases involves the initial assumption of a Mesolithic date for shell middens. When middens are not Mesolithic in date, they are often interpreted as remains from a time of desperation or from a society isolated from Ireland's general population. Due to this 'desperation resource' narrative, shell middens are often dismissed. There are no current researchers looking at Irish shell middens as a specific study area across the island and throughout time. Most other shell midden research has been incidental either due to commercial development-based excavation or research concerning a monument. This points back to the focus on monuments of early research. Even when shell middens are found on these sites as secondary discoveries, they are often disregarded with little to no investigation or further consideration.

Woodman of University College Cork and Milner of University of York often worked together on Irish shell midden sites. Their collaboration included the paper, 'Deconstructing the myths of Irish shell middens' (Milner and Woodman 2007), which contains the only discussion on Irish shell middens in Milner's collaborative book *Shell Middens in Atlantic Europe* (Milner *et al.* 2007). This paper notes and examines the tendency for these sites to be connected to the Mesolithic or to Famine Period desperation (Milner and Woodman 2007, 101). To combat this, the authors conducted a dating program which provided evidence that most shell middens in Ireland date later than the Mesolithic (*ibid.* 102) with only approximately nine known from this time period by 2007 (*ibid.* 108). There is also no evidence found linking the consumption of shellfish with desperation (*ibid. passim.*).

Three chief early supporters for the Mesolithic and/ or marginal lifestyle association with shell middens were Knowles (1885, 1889, 1895, and 1901), Brunnicardi (1914), and Macalister (1928). Knowles was influential for his work focusing on shell middens for collecting purposes and his wide-spread recording of these sites. Even when faced with Hassé identifying metal associated with a shell midden at Grangemore Co. Derry, he dismissed this as intrusive finds from the nearby railway (Knowles and Newton

1891, 618–619). Brunnicardi was the first researcher to catalogue shell middens, but she dismissed later sites as part of a fringe society holding on to pre-civilized lifeways (Brunnicardi 1914, 210). Macalister was one of the most prolific archaeologists of his time and he was a strong proponent for shell middens as evidence of the earliest Irish settlers as seen in his chronological scheme (Macalister 1928, ix). Perhaps it is in part due to the profound influence these researchers had; that this idea of Mesolithic ‘strand loopers’ remains in the popular and academic imaginations.

Since the 1960s, another theoretical model developed that influences the way many researchers look at middens. The model is called the Optimal Foraging Theory based on cost-benefit principles (Zeder 2012, 244–5). In this paradigm, hunter-gatherers choose their prey based on highest nutritional value for the least amount of work. Because molluscs are relatively low in calories, one of the most common nutritional ‘currencies’ used (*ibid.* 250), they are often considered of low value to the hunter-gatherer and seen as a supplemental resource or one only to be used when better food sources are scarce (*ibid.* 253–254). Though these assumptions are flawed (*ibid. passim.*), they remain endemic in shell middens studies.

Ferriter’s Cove, Co. Kerry (KY030) shell analysis, the first in-depth archaeological molluscan study in Ireland, calculated calories and proteins for the shells available (McCarthy 1988, 117–21) even though McCarthy admits that calories would not have been a major factor in resource selection (*ibid.* 22). Based on the Ferriter’s Cove midden, McCarthy concluded that one man would have been able to receive enough daily calories for two days from shellfish and that, depending on the estimate of necessary protein, a man could achieve protein requirements for 26–204 days (*ibid.* 121). It is understood that shellfish alone could not sustain a group of hunter-gatherers, but these groups were not only eating molluscs. This type of research based on calorie and protein calculations skew how shell-abundant sites are interpreted.

A focus on monuments has led to the discovery of many shell middens. One of the most well-known shell midden sites was only discovered in the process of excavating a promontory fort: Dalkey Island, Co. Dublin (DU009). This is one of the most complex midden deposits ever excavated in Ireland. There were four middens dating from the Mesolithic through to the Early Medieval Period with burials within, above, and below these midden deposits. One of the most interesting aspects of this site is the intentional deposition of periwinkles within a skull which was placed into a limpet midden, a possible link to the rituality of middens (Leon 2005, 8). Unfortunately, this

incredible source of information would never have been discovered without the monument focus. Luckily, the excavators involved did not dismiss the middens and the information remained documented for future study (as Leon showed in his 2005 re-examination).

The middens around Culleenamore, Co. Sligo are another example of middens specifically excavated for their possible connection to monuments. This research was centred around understanding the landscape of the Carrowmore Passage Tomb Cemetery. Over 3000m of midden deposits were noted dating from the Neolithic through to the Iron Age. Because of the research purpose of the excavation — to understand the local people who may have built the megalithic tombs — the middens were investigated thoroughly and documented (Burenhult 1984). Again, these middens may not have been investigated had it not been for their connection with the tombs even though thousands of metres of this site type were visibly eroding from the shoreline (Fitzpatrick 2002).

In 2007, Milner and Woodman said, ‘unlike some other parts of Europe, shell middens in Ireland have been given little attention’ (Milner and Woodman 2007, 109). They suggest that this is due to the biases discussed above (*ibid. passim.*). The ‘previous standard’ of shell midden research in Ireland has been to look at middens as evidence of the Mesolithic or in relation to monuments (‘in response to clearly articulated and theorised research questions’). Since not all excavators are interested in the Mesolithic and not all middens are found in relation to monuments, they can often be ignored.

Since the 1970s, all excavations are required to publish a summary after the completion of every licensed work to the *Excavation Bulletin*, now online. This resource allows researchers to understand the importance given to different features uncovered at various sites. Due to the general dismissal of shell middens, many commercial monitoring schemes have described middens as insignificant. Two small middens, and a linear stone dump and rough stone floor, were identified at the urban site of Merlin Park, Co. Galway in 2002, but ‘none of the features revealed could be described as highly significant.’ They suggested continued monitoring during construction, but this suggestion was made in hopes that larger sites were found (Fitzpatrick 2002). Similarly, construction at Ardfert Community Centre, Co. Kerry (KY005) was allowed to continue in 1997 after some shell middens, wall foundations, an area of burning, a stone-lined drain, a timber post, and two pockets of animal bones

were found because ‘none of the features noted were obviously of much archaeological importance in their own right’ (Bennett 1997). These two examples are two extremes, but they indicate the dismissal of shell middens still occasionally seen in archaeology.

Chapter 3: The Archaeology of Shell Middens

Introduction

This final introductory chapter addresses the definitions, methods, and environmental factors critical to the understanding Irish shell midden archaeology. The chapter begins with an in-depth analysis of the terminology associated with Irish shell middens. Problems are addressed with such terms and new categories are suggested for future research. This is followed by an overview of archaeological theories used in shell midden research. The environment is then discussed in section 3.3 followed by a review of the taphonomic and formation processes which affect shell middens, much of which is affected by the environment. Archaeological visibility (section 3.5) is also affected by environmental, taphonomic, and formation factors. Methods used to date shell middens are then addressed in section 3.6 and the chapter concludes with an overview of the significance of shell midden research.

3.1 Defining Shell Middens

Since the earliest research into shell middens began in the 18th century (see Chapter 2), scholars have sought a concise definition of this site type. During the debate to determine whether or not large shell mounds were natural or manmade, Vanuxem described the oyster mounds on the east coast of the United States as having ‘the nature of a mass or heap composed of shells whose valves were separated before being thrown together,’ an important taphonomic observation (Vanuxem 1843, 22) (see Section 3.4). While mounds of gastropods could in no way be defined in the same manner, we could derive a more general definition as being ‘a mass or heap composed of shells whose [fish have been extracted] before being thrown together’ (*ibid.*). Similar conjectures were put forward by Lyell (1849) and Tait (1869). These researchers, and others of their time, also noted the existence of other cultural debris such as bones and artefacts as being indicative of these culturally formed shell mounds (see Section 3.5 for further study of cultural versus natural shell deposits). This definition evolved in the 1980s with Waselkov’s conclusion that a shell midden is ‘a cultural deposit of which the principal visible constituent is shell’ (Waselkov 1987, 95). Similarly, O’Sullivan and Breen defined the ‘small heaps’ and ‘massive mounds’ of shells found in Ireland as

‘essentially dumps of food waste and other debris’ (O’Sullivan and Breen 2007, 26 and 40).

The nomenclature of this site type can also reveal past attempts to define them. The first large scale study of these sites in Denmark named the sites *kjøkkenmøddinger* which translates to kitchen midden. This term, like ‘shell midden’ in Denmark today, almost exclusively referred to the large, oblong mounds along their coastline while smaller sites may be deemed ‘shell bearing’ (Gutiérrez-Zugasti *et al.* 2011, 80). The term ‘kitchen midden’ was used by many through the early 20th century in Ireland and Britain to refer to shell deposits of all sizes as the interpretation of these middens was focused on the use of shellfish as a food source (see Chapter 9 for other modern interpretations). Due to the expanding interpretation of these deposits as more than just food-based refuse, the term ‘shell midden’ was instead applied to describe the content types rather than an implied interpretation. The word midden is itself an interpretive word deriving from the Danish word *mødding*, meaning ‘muck heap.’ The English word can be used to refer to dunghills or refuse heaps, maintaining the ‘muck’ in the name (Oxford Dictionaries 2019a). The modern cultural implications of such terminology are problematic as deposits traditionally thought of as ritualistic such as burials have also been found within middens (Álvarez *et al.* 2011, 2–3). An example of this was uncovered at Dalkey Island, Co. Dublin (Liversage 1968) (DU009).

Shell middens can vary in size from small, diminutive shell deposits to vast mounds of shells (Ambrose 1967, 169; O’Sullivan and Breen 2007, 26). Due to this size variation, other countries have joined Denmark in creating differing nomenclatures to distinguish between the largest of the sites and the smallest. In France, *amas coquillier* is a mound bigger than 2m³ and a *lit coquillier* refers to a horizontal shell deposit. In Spain, a similar distinction is made between the big shell middens and shell horizontal layers. It is suggested that such a distinction has not been made in Britain, Ireland, and Portugal due to a lack of published comparable data (Gutiérrez-Zugasti *et al.* 2011, 80).

No movement has been made to rename these sites due to the term’s ‘heuristic and operative value’ (Álvarez *et al.* 2011, 3), but a standing definition should incorporate what the site name may not in allowing a broader interpretive scope while maintaining definitive boundaries of site composition. The definition proposed here, and that which is used throughout this thesis, is as follows: shell middens are cultural deposits made up primarily of shells which may also include other depositional inclusions. This

includes sites where the presence of shells may not be the dominant interpretive aspect of activity on the site but are a primary constituent in individual deposits (*contra* Woodman and Milner 2013, 37).

Defining features of these sites include high porosity, permeability, and alkalinity. They also often have a high chance of being directly affected by an associated water body (Stein 1992, 1). They must contain shells but may also contain other cultural remains such as charcoal, animal bone, articulated and disarticulated human remains, and artefacts (Waselkov 1987, 139). Shell accumulations, whether natural or cultural, are primarily a collection of local marine fauna which cannot be ignored when interpreting the site in favour of the cultural factors (Ambrose 1967, 178). This defining feature should, instead, help balance any interpretations given to the sites.

3.1.1 Issues with Defining and Naming Shell Middens

In an attempt for precision, some researchers in Ireland have begun to forgo naming smaller deposits on larger sites as ‘middens’ in favour of describing the shell inclusions as part of the general context. This is, however, still not consistently done and no set distinction has been established as to what size constitutes a smaller deposit. This means that some sites which may have analytical value have been missed while others with less potential have been grouped with more complex sites. A broader term is needed to include all shell-bearing deposits while more restrictive terminology can be applied to better categorise the sites for comparative analysis.

The problem of terminology and definition of ‘shell middens’ is not unique to Ireland and has been around since the 18th century when the debate began to determine whether or not large shell mounds around the world were natural or manmade. Vanuxem (1843, 22) described the oyster mounds on the east coast of the United States as having ‘the nature of a mass or heap composed of shells whose valves were separated before being thrown together,’ an important taphonomic observation. Similar conjectures were put forward by Lyell (1849) and Tait (1869). These researchers, and others of their time, also noted the existence of other cultural debris such as bones and artefacts as being indicative of these anthropogenic shell mounds.

The nomenclature problem does not stop at interpretive biases. As mentioned above, Irish ‘shell middens’ can vary in size from small, diminutive shell deposits to vast mounds of shells (Ambrose 1967, 169; O’Sullivan and Breen 2007, 26). Due to

this size variation, other countries have joined Denmark in creating differing nomenclatures to distinguish between the largest of the sites and the smallest. In France, *amas coquillier* is a mound bigger than 2m³ and a *lit coquillier* refers to a horizontal shell deposit (Dupont 2006). In Spain, a similar distinction is made between the big shell middens and shell horizontal layers (Gutiérrez-Zugasti 2009). Other researchers around the world have created distinct classifications befitting of the archaeological record within their region. Marismas Nacionales on the Pacific Coast of Mexico has four types of sites based not only on shape, but also on species inclusion (Claassen 1998, 10). Interpretations and morphology have been used in numerous ways throughout the United States; McManamon (1984) classified shell deposits in Massachusetts based upon interpretations of use and other activities at the site, while Widmer (1989) used a mixture of morphology and interpretation to classify deposits in Florida (Claassen 1998, 11-12). More recently, Marquardt (2010) has brought attention to the inconsistent terminology used in the south-eastern United States which, like in Ireland, cause interpretive biases. He called for a reanalysis of the sites using sedimentary studies to clarify taphonomic processes that created the modern morphology of the deposits.

It has been suggested that no attempt at distinctive categories of ‘shell middens’ has been made in Britain, Ireland, or Portugal due to a lack of published comparable data (Gutiérrez-Zugasti *et al.* 2011, 80). It has also been suggested that no new name is needed for ‘shell middens’ as the term has ‘heuristic and operative value’ (Álvarez *et al.* 2011, 3). A literature review of these Irish ‘shell middens’ indicates, however, that it is time for a re-evaluation of the terminology and categorisation of these deposits, and for a clear definition to be laid out and standardised.

3.1.2 Creating a New Terminology

Defining features of these sites include high porosity, permeability, and alkalinity. They also often have a high chance of being directly affected by an associated water body (Stein 1992, 1). They must contain shells but may also contain other cultural remains such as charcoal, animal bone, articulated and disarticulated human remains, and artefacts (Waselkov 1987, 139). Shell accumulations, whether natural or cultural, are primarily a collection of local marine fauna which cannot be ignored when

interpreting the site in favour of the cultural factors (Ambrose 1967, 178). These defining features should, instead, help balance any interpretations given to the sites.

Tracing known attempts at defining ‘shell middens,’ that given by Vanuxem (1843, 22) above may be a clear place to start, though his definition is only applicable to deposits of bivalves. A more general definition derived to include other shellfish species could be ‘a mass or heap composed of shells whose [fish have been extracted] before being thrown together.’ With the recognition of other cultural debris being found within many of the deposits, Waselkov (1987, 95) suggested the definition of ‘a cultural deposit of which the principal visible constituent is shell.’ O’Sullivan and Breen (2007), in a conditional and heavily qualified return to the ‘kitchen midden’ paradigm, defined Irish sites in particular as ‘essentially dumps of food waste and other debris’ (*ibid.* 40). They clarify throughout the publication, however, that the shellfish can be used ‘for food, fishing bait or even industrial reasons’ (*ibid.* 26) and that the deposits themselves could be used ‘as occupation sites, and even burial places’ (*ibid.* 40). Based upon these previous definitions and the specific sites known in Ireland, the definition proposed here is ‘deposits of human origin comprised primarily of molluscan shells, often containing other environmental materials and cultural artefacts.’ This definition is not dependent upon any interpretation beyond identifying the site as archaeological in nature and does not specify a particular shell-to-sediment ratio. This also influences the nomenclature proposed below.

Many countries around the world have adopted the term ‘shell matrix’ to replace the term ‘shell midden’ (Claassen 1998, 11; Morrison 2013; Rosendahl *et al.* 2014; Kenady *et al.* 2018; Villagrán 2019). This term implies a high shell-to-sediment ratio which many Irish sites lack. Just as the term ‘shell midden’ has created an inherent interpretation of all shellfish remains to be secondary refuse deposits, ‘shell matrix’ may also lead to the molluscs being relegated to part of the background sediment rather than a primary cultural component to be studied as a matter of regular practice. The ‘functionally neutral term’ (Claassen 1998, p. 11) proposed for Irish sites is ‘shell-bearing features.’ These may be the defining feature of a site, or many small deposits may be part of a large and complex site. The next step for a classificatory scheme for these Irish shell-bearing features, was to analyse the morphology and archaeological descriptions of the known deposits.

Within the c.525 coastal sites in Ireland with shell-bearing features, approximately 850 unique deposits are recorded. Of these deposits, 462 have recorded measurements.

Just under a third (32.7%), or 151, of these have all three-dimensional measurements recorded, 179 (38.7%) of them have a known length and thickness measurements, 62 (13.4%) of them have a known length and width, 18 (3.9%) only have recorded lengths, and the remaining 52 (11.3%) only have recorded thicknesses. These recorded measurements vary from implausible extremes — a deposit at Ardfry, Co. Galway was recorded as 800 m long in 1992 (Conroy and Alcock, 2017) — to potentially negligible — one of the deposits at Ferriter's Cove, Co. Kerry had a recorded volume of 0.01m³ in 1985 (Woodman et al., 1999). After normalising the data using logarithmic transforms, 9 shell-bearing features were discovered to be extreme outliers (z-scores >3). This brought the sample size down to 453 with 147 (32.5%) recorded with three dimensions, 176 (38.9%) with known length and thickness, 61 (13.5%) with length and width, 18 (4%) with lengths, and 51 (11.3%) with thicknesses.

The remaining shell-bearing features with at least two recorded dimensions, 384 (84.8%), were compared with the boundary of 10m² used in Denmark; 157 (40.9%) features met or exceeded this area (Figure 3.1). Of those with three recorded dimensions, 147 (32.5%) features, 87 (59.2%) met or exceeded the French 2m³ volume boundary (Figure 3.2). Altogether, a total of 165 (43%) features with at least two recorded dimensions meet or exceed either the area or the volume boundaries or both (Figure 3.3). This almost even split, seems to indicate that these differentiating measurement boundaries are suitable to Irish sites as they are both established elsewhere along the Atlantic façade. The various sizes are not restricted to specific regions or environments suggesting that these boundaries are applicable to sites throughout Ireland and not based upon regional variability (Figure 3.4). Most Irish middens are found in section faces with limited data available for the extant width beneath topsoil or the width which has been lost to erosion. Therefore, it may be advisable to further divide the smaller sites in particular. This, as explained below, is accomplished through the nature of the smaller examples as either a small shell-bearing *fill* or a shell bed.

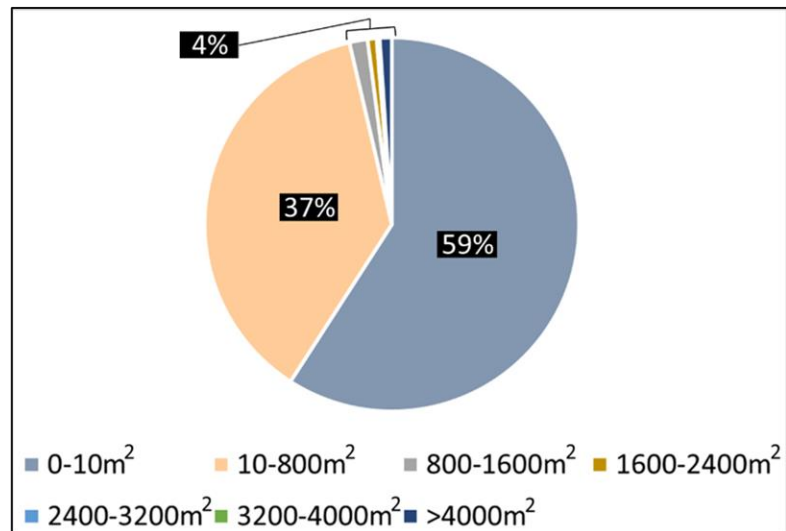


Figure 3.1: Pie graph of area distribution of Irish shell-bearing features (n=384).

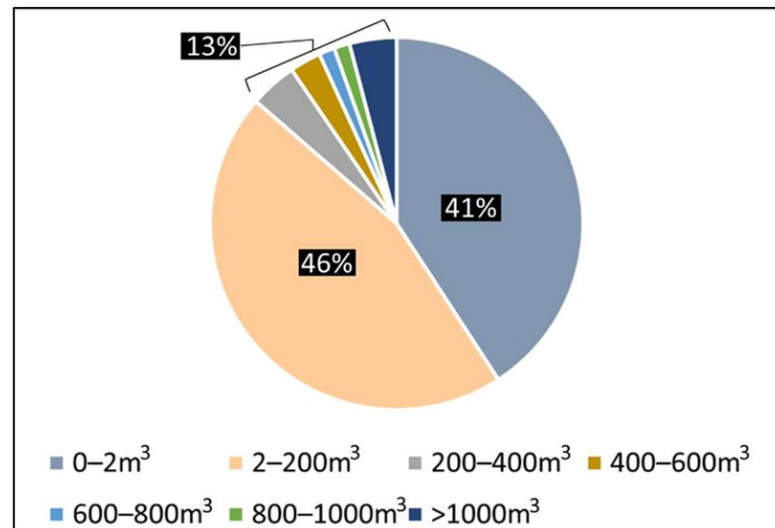


Figure 3.2: Pie graph of volume distribution of Irish shell-bearing features (n=147).

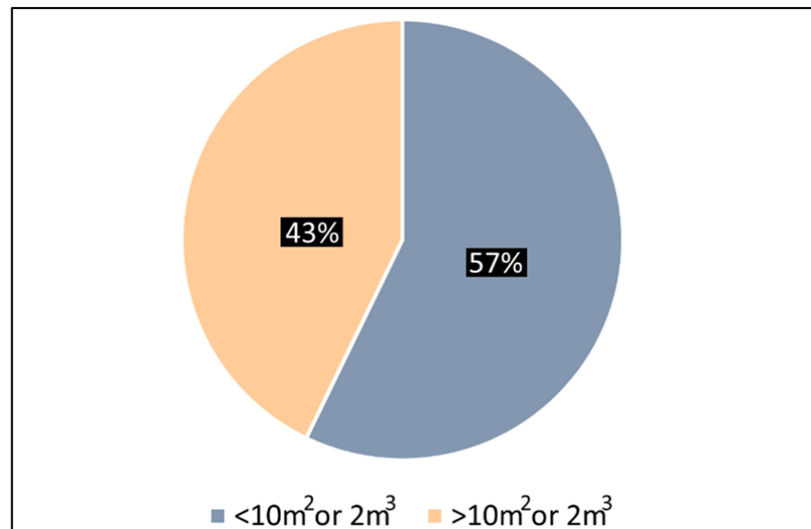


Figure 3.3: Pie graph of the distribution of Irish shell-bearing features above and below the area and volume boundaries (n=384).

Thirty-nine shell-bearing features have been recorded as fills of ditches, pits, or hollows. Seventy-one have been recorded variously as shell layers, beds, deposits, and spreads. Six have been identified as mounds, heaps, or dumps. Ten have been grouped as part of habitation/occupation debris. Thirteen were recorded as hearths with substantial amounts of shell. All other recorded shell-bearing features have simply been deemed ‘middens’ in the literature. This leaves over 600 shell-bearing features within a single category with a great deal of inter-category variation. To deal with this and to assert recognition within the categories of the known types of Irish shell-bearing features, differentiation needs to be made beyond feature size to include morphological and/or interpretive descriptors.

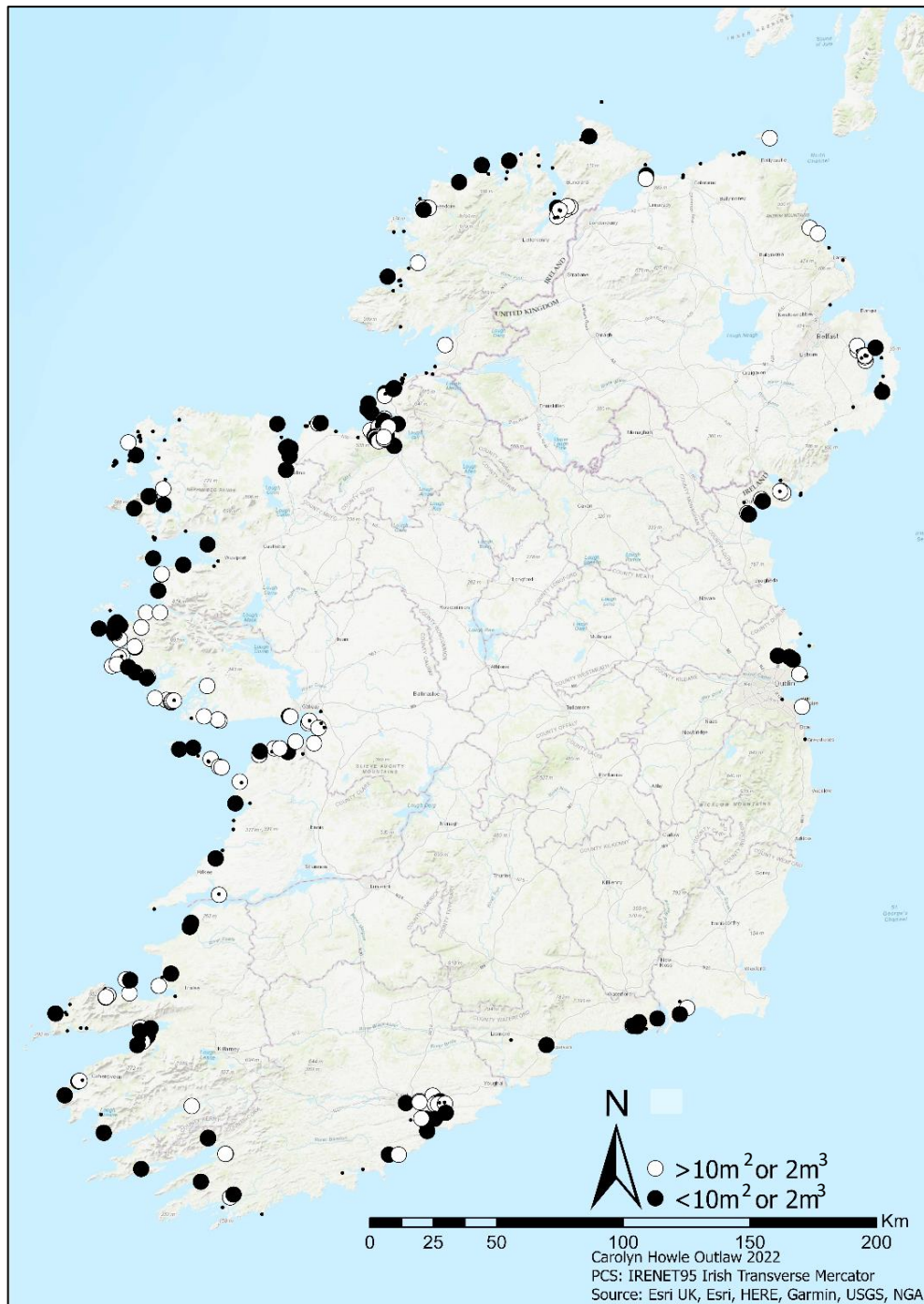


Figure 3.4: Map of sites containing features above and below the area and volume boundaries.

Six categories are proposed for Irish shell-bearing features. Four of these are based on size and morphology and the remaining two are based upon feature interpretation. The morphological categories, which will be the most widely applicable, are large or small shell-bearing *fills* and shell-bearing surface features including ‘shell mounds’ and ‘shell beds.’ Where shell-bearing features are found disturbed within

undifferentiated habitation deposits, the feature may be generally recognised as ‘shell occupation debris.’ Further, where the shells are interpreted as part of a hearth deposit, the feature may be termed a ‘shell-bearing hearth.’ These final two descriptors should be applied with caution as using interpretive terms has caused the ‘normative’ thinking (after Claassen 1998, 11) which a change in nomenclature is meant to counter.

The exact definitions of and appropriate use of the terms are as follows:

1. Shell-bearing *fill*: a shell-bearing feature which forms part or all of the fill of a cut, whether cultural or natural. The term ‘fill’ should be replaced by the type of cut, for instance, the fill of a pit containing shells would be termed a ‘shell-bearing pit’ when referring to the feature as a whole.
 - a. Large shell-bearing *fill*: has an area greater than 10m^2 or a volume greater than 2m^3 .
 - b. Small shell-bearing *fill*: has an area less than 10m^2 or a volume less than 2m^3 .
2. Shell-bearing surface features: mounded shell-bearing features which form a deposit upon a separate surface, whether cultural or natural.
 - a. Shell mound: has an area greater than 10m^2 or a volume greater than 2m^3 .
 - b. Shell bed: has an area less than 10m^2 or a volume less than 2m^3 .
3. Shell occupation debris: disturbed, undifferentiated habitation deposit(s) containing shells regardless of size. This term should only be used if the shell-bearing feature cannot be determined as a separate fill or deposit.
4. Shell-bearing hearth: a hearth in which a large number of shells are an integral part of the burning feature. This term should only be used if the shell-bearing feature cannot be differentiated from the hearth feature.

Based upon both size and morphological description, 152 known shell-bearing features would be categorised as shell mounds and 166 would be categorised as shell beds. Some of these may be better judged in the field as to whether or not they should be grouped with mounds or beds as their sizes only narrowly differentiate them. For instance, by definition, Glenree, Co. Donegal is a shell mound as it has a volume of 11m^3 . Its area, however, is only 0.44m^2 . This may be due to erosion, or it may be that this site is better categorised with the smaller shell beds. There are also examples of deposits which almost qualify as shell mounds but are here categorised as shell beds perhaps due to erosion or other factors. One deposit at Caraun Point, Co. Mayo, for

example, has a recorded area of 9m² and volume of 1.7m³, only 1m² and 0.3m³ from being defined as a shell mound.

Only 89 shell-bearing deposits are dated from the Mesolithic through the Early Modern period. This includes 58 shell mounds and 31 shell beds. Both size categories are spread relatively evenly throughout the time periods. Thirteen early prehistoric (8000–2500 BC) shell-bearing features are here categorised as shell mounds and seven are categorised as shell beds. Eight shell mounds and six shell beds date to late prehistory (2500 BC–400 AD). The Medieval period (400–1550 AD) included 20 shell mounds and eleven shell beds. More recent (after 1550 AD) deposits included twelve shell mounds and seven shell beds.

Shell-bearing fills have been recorded within pits, souterrains, fosses, and other ditches. Of these, 13 have been categorised as small and six as large. Only one of the large shell-bearing fills is significantly larger than any of the rest: An Carn Buí, Co. Donegal with an area of 174m². The next largest is only 13m², a fill recorded at Liberties of Carlingford, Co. Louth. The general trend towards smaller deposits being associated with cut fills may be due to truncation of the top of the cuts or of any mounds which may have formed above the cuts. Shell-bearing fills only make up five of the known dated shell-bearing features. All five are small fills, including one ditch fill and four pits. The shell-bearing ditch dates to the Early Medieval (400–1100 AD). Two of the shell-bearing pits date to the Mesolithic (8000–4000 BC) and another two date to the Late Medieval (1100–1550 AD).

There are nine shell-bearing deposits with at least two known dimensional measurements which cannot be identified separately from other occupational evidence based upon recorded information. This includes four deposits which make up part of recorded hearths. Two of the hearths date to the Mesolithic period (8000–4000 BC) and are part of the complex site of Ferriter's Cove, Co. Kerry, which contains 22 unique shell-bearing features. These two shell-bearing hearths are the only scientifically recorded examples of shell-bearing occupational debris; all others are recorded by antiquarians or informants. Given the lack of scientific investigation at many of these sites, these categories may be results of recording bias rather than true distinctions. Many of these sites are no longer extant and thus any shell-bearing features which may have been distinct from habitation floors and hearths cannot be further investigated. Only future recording practices with more care for stratigraphic distinctions will be able to determine the functionality of these particular categories.

The definitions and terminology proposed here are designed for flexibility as continued research takes place. In fact, it is hoped that with increased investigation, only categories (1) and (2) will be required for analytical purposes. The terms introduced here allow for the systematic distinction of shell-bearing features based upon clearly outlined archaeological characteristics as they are currently known while minimising normative assumptions placed on the interpretations of the features. If applied to as many features as possible, these new definitive distinctions will allow for improved comparative analyses of features and sites with comparable size, morphology, and interpretation compared to studies conducted on all shell-bearing features grouped together. The additional detail of recording opens the Irish field for a deeper understanding of molluscan use and deposition through time and space, finally allowing the study of these shell-bearing features to take back its place on the world stage.

These categories are not, however, used within this thesis. This is due to the operative value still inherent in the term ‘shell midden,’ especially when building the first comprehensive database of such sites. Instead, the shell midden sites are divided into ‘shell midden features’ for analysis. Future research should strive to use the terms suggested above. The definitions, however, are used as the basis for this study and midden dimensions are presented in relation to the proposed boundaries.

3.2 Methods and Theories of Investigation

Ambrose sought to define the different theoretical approaches to understanding shell middens in 1967 in order to encourage some standardisation of minimal recording. He noted three schools of thought: The Quantitative Approach (Section 3.2.1), The Structural View (Section 3.2.2), and The Ecological View (Section 3.2.3) (Ambrose 1967). Since this publication, the quantitative, structural, and ecological approaches have all remained present in the theoretical background of shell midden studies with an increased use of scientific methods such as isotopic studies, radiocarbon analysis, and microscopic growth layer studies to support the different interpretations. To these approaches, one would add an Ethnoarchaeology Approach (Section 3.2.4) as a great deal of our current understanding concerning shell middens comes from ethnographic comparisons.

3.2.1 Quantitative Approach

The Quantitative Approach, also termed the Californian School due to continuous study of shell middens in this state for over fifty years, was based upon the assumption that with careful sampling, the full midden could be understood as a whole. Innate in this hypothesis was the assumption that middens were generally homogenous even if stratigraphic lenses were visibly present within them. This led to studies concerned with midden accumulation, time, and population size. As the years progressed, the necessity within this approach for strong sampling procedures led to improvement of such techniques. Though the assumed homogeneity is no longer accepted within shell midden research, the aims of calculating population and diets through their study has remained in modern work and the improvement of sampling strategies has allowed for more detailed analysis.

The primary benefit to shell midden research arising from the Quantitative Approach was the development of marine molluscan studies within archaeology (Ambrose 1967, 170–6; McCarthy 1988, 6–8). For researchers within the Quantitative Approach branch of study see Statham (1892), Nelson (1909), Gifford (1916), Cook (1946), Cook and Treganza (1947), Treganza and Cook (1948), Cook and Heizer (1951), Ascher (1959), Greenwood (1961), and Gould (1964). Such focus on the molluscan species and their analysis rather than a narrowed vision towards artefacts within the deposits is still a predominate feature of shell midden research.

3.2.2 Structural View

The Structural View was followed by researchers who were concerned with stratigraphic changes seen within shell middens. This can be seen as a research movement by the 1950s, though earlier researchers noted stratigraphy within the sites and tried to record same (Uhle 1907; Davison *et al.* 1927; Webb and De Jarnette 1942; O'Rourke 1945; Mitchell 1947). With the understanding that middens were not homogeneous, as was assumed in the Quantitative Approach (Section 3.2.1), analysis was geared towards sampling within individual stratigraphic units. This meant that if a midden was truly homogenous less samples were needed than if the site was complex and variable. These studies still looked at understanding population size and diet with volumetric comparisons of different deposits. This removed the assumption, also, that one midden was made by one group of people, which was an important step in

understanding shell middens (Ambrose 1967, 176–8; McCarthy 1988, 8). For researchers within the Structural View branch of study see: Bullbrook (1953), Willey and McGimsey (1954), and Davidson (1964). The Structural View is still very much present within current research as investigators still struggle to understand stratigraphy within middens (Stein 1992; Balbo *et al.* 2010; Duarte *et al.* 2019).

3.2.3 Ecological View

The Ecological View was centred upon the fact they are primarily a collection of local marine fauna. Ambrose (1967, 178) argues that Steenstrup was the first to practice an ecological approach to shell middens with species listing and environmental reconstruction attempts in 1837, though this view as a theoretical movement was concentrated in the 1950s and 60s. Local molluscan populations are determined by local environments. This means that if the local environment changes due to temperatures, storms, large-scale erosion, or sea level rise (see Section 3.3), then the shells available for a local midden will change. Shells, like bones, horns, and scales, are organic matter which change through age and environmental pressures. The former correlation and the latter biological understanding can be used to establish chronologies, recreate palaeoenvironments, and understand cultural influence (*ibid.* 178–9). For researchers within the Ecological View branch of study see Coe and Fox (1942), Greengo (1951), Groot and Sinoto (1952), Boucot (1953), Willey and McGimsey (1954), Olsen (1957), Kidder (1959), Matteson (1960), Golson (1961), Powell (1961), Hancock and Simpson (1962), Ryder (1963), Johnson (1964), Purdy (1964), and Ewers (1967).

Relative chronologies can be built based on known environmental changes such as a move from salt water to fresh water due to shifting waterbodies. Middens in this area that contain primarily saltwater molluscan species would predate such an occurrence while those with freshwater molluscan species would postdate the change. Such a regional change in environments was noted by Kidder (1959) in Japan and used to establish relative chronologies between shell middens in this area. He also noted that due to the changing position of the shoreline, the older middens containing more saltwater species were further from the modern shoreline than the more recent, freshwater middens. This distance from modern shorelines has been used in a similar way concerning shell middens in Ulster. Middens resting on raised beach surfaces,

further inland were dated to the Holocene marine transgression (Prior 1966; Mitchell, F. 1990, 82). The study of shell midden chronology has since grown with an increased number of scientific methods to determine age and seasonality (see Section 3.6).

Coastlines can affect the shell species available within the local environment such as rocky shores versus sandy shores influencing molluscan populations. For example, limpets prefer to graze along the intertidal region of rocky shorelines while cockles prefer the intertidal region of sandy shores (Murray 2000, 336 and 345). Some of the original research into environmental reconstruction through comparative shell species appearances, counts, and measurements were originally applied in riverine and estuarine environments. For instance, Matteson (1960) used an understanding of freshwater shell species' niches to recreate the general size and appearance of the local stream.

The final area of study within the Ecological View looks at cultural influence over harvesting choices. This could be studied through seasonality (see Section 3.6) to understand potential harvest times. A comparative study of size/age-frequency distributions can also be indicative of cultural over-exploitation if, over time, smaller and younger shellfish are harvested due to a lack of larger and older specimen. A modern experiment was performed by Hancock and Simpson (1962) on a cockle population before and after harvesting which showed that harvesting had greatly reduced the average shell sizes within the population.

3.2.4 Ethnoarchaeology Approach

Ethnography has not been separate from the former three theoretical views; in fact, Nelson, Gifford, and those who expounded upon their methods often cited ethnographic accounts for population estimates of archaeological middens (Ambrose 1967, 171 and 175). A movement towards using an Ethnoarchaeology Approach was seen in the 1970s and 80s. This was in large part due to Binford's work with the Alaskan Inuit and interpretations of hunter-gatherer archaeological sites based upon his observations (Binford 1968, 1978, 1980, 1983). Researchers using this method would often cite Binford's observations when interpreting their own sites (see Wiessner 1983; Conkey 1984; Schrire 1984; Sackett 1985). Ethnoarchaeological approaches use analogy between modern hunter-gatherer societies and archaeological remains to interpret the latter (Charlton 1981). There are inherent problems within

direct ethnographic comparisons due to required assumptions of human consistency and parallel adaptations through time and space (see Henshilwood *et al.* 2003; Smith 2017; Johnson, M. 2019). With an understanding of these limitations, this approach is still used with some success today (see Meehan 1982; Estévez *et al.* 2007; Godino *et al.* 2011; Allen 2012; Ainis *et al.* 2014).

3.2.5 Methodological Overview

Ambrose's call for standardization is still being sought by others such as Colley (2005), Gutiérrez-Zugasti *et al.* (2011), Howle (2017), and Allen (2017). Within reports on Irish shell midden analysis, the data is recorded and published with varied attention to details such as shell species, counts, inclusions, and even potential stratigraphic variability (harking back to the early Quantitative Approach). This is due to two primary factors: an overarching assumption that we know what there is to know about shell middens, and that they are often discovered on commercial sites with limited recognition (Gutiérrez-Zugasti *et al.* 2011, 74). This thesis aims to synthesize both the published and unpublished data in order to resolve some of these issues.

A minimum recording for shell middens during modern survey should include GPS coordinates, dimensional measurements, matrix descriptions, shell species identification and sample count, and inclusion identification of charcoal, bone, and artefacts. If features such as pits or hearths are visible or lenses of burnt material and other stratigraphic distinctions are seen, these should also be noted and photographed or drawn to scale. Excavation allows for a fuller analysis and should include more extensive detail (Gutiérrez-Zugasti *et al.* 2011).

When the sites are small scale and at risk of imminent destruction through erosion or human interference, full site excavation should be striven for. Unfortunately, this is not always feasible for larger sites. There are methods, however, which can gather enough information to make sample excavations useful and meaningful. Most modern excavations have combined the use of sample trenches with augering and/or coring (such as seen in Stein 1992; Woodman *et al.* 1999; Cannon 2000; Rathbone 2015). This allows for the excavator to understand the depth and extent of middens without excavating the entire site (Stein 1992, 26). It can also be used to determine ancient sea levels and original ground surfaces (*ibid.* 32; Woodman *et al.* 1999, 169).

Geophysical surveys are another method used to determine the extent and depth of middens in conjunction with sample excavations. Based on past attempts, the best geophysical methods to examine shell middens include electrical resistivity, seismic refraction, and GPR. Where there is no water logging, magnetic methods may also be of use (Stein 1992; Woodman *et al.* 1999; Napora *et al.* 2019, *ibid.*). When used in conjunction with trial excavation and augering or coring, geophysical surveys can be a true asset to any excavation.

Stratigraphy is often difficult to decipher within shell middens. This is partially due to the uneven accumulation of middens at various rates through time (as noted by researchers in the Structural View (Section 3.2.2)). Some sites have also had most of their stratigraphy destroyed through processes such as bioturbation. Other sites have simply had very few deposits accumulate distinct from the shells making up the bulk of the remains (Mellars 1987, 134; Waselkov 1987, 144). These factors led Mellars (1987, 134) at Oronsay, Scotland to declare that ‘any aspiration to achieve precise stratigraphic control over the entire range of deposits in a shell midden site should probably be regarded more as a doctrine of perfection than as a practical reality in excavation terms.’ Because of these complications, most shell midden sites have been excavated using spits of various sizes which allows lab analysis to aid in determining any potential chronological differences such as the changing through depth of artefact changes, geochemical differences, and shell and animal bone species (Burenhult 1984; Mellars 1987; Stein 1992; Woodman *et al.* 1999; Murray *et al.* 2011).

When it comes to taking samples within a shell midden excavation, flexibility is key. This is due to the inherent complexity of the sites (Waselkov 1987, 151). In order to guide this flexibility, excavations at Goleta, California, United States, used rough field sorting allowing excavators to be aware of content as work progressed. Changes in methods, timing, and other field factors could then be advised. To conduct this method, an overestimated sample of 500g was collected and a person familiar with the fauna sorted the shell species in the field. When laboratory analysis was performed on similar samples, this rough procedure correlated well with the more refined sorting (Greenwood 1961, 417–9). This method of sampling was first seen in Structural View analyses (Section 3.2.2) which sought more samples at complex sites and less at more homogeneous sites.

Scientific standards of excavation recording should be maintained regardless of the site type. This is especially important at shell midden sites on soft coastlines which,

due to erosional factors (see Section 3.3), may collapse during excavation as seen at Ballymulholland, Co. Derry (Mallory *et al.* 1988, 105) and Oughtymore, Co. Derry (Mallory and Woodman 1984, 51). This should include section drawings, plan drawings, feature drawings, and photographs along with context or feature based recording. The recording system itself is dependent upon the site director but should be consistently maintained throughout the excavation. Due to the importance of sampling at shell midden types, samples should be recorded with certain specific details. This includes detailed three-dimensional coordinates of sample locations, beyond general grid square identifications. The samples should also be marked on relevant drawings and photographs. This will allow for the contexts of samples to be better understood in the lab after re-examination of stratigraphy.

Lab analysis of samples should include zooarchaeological analysis of bones and shells, artefact analysis, and flotation for macroplant remains at a minimum. Other lab-based analysis that can aid midden interpretation include radiocarbon analysis, stable isotope analysis, and soil chemical analysis (Stein 1992; Mannino *et al.* 2003). The analysis of the shells can move beyond species identification, counts, and metrication to include these radiocarbon and stable isotope as well as micro-analysis for age-at-death studies and growth layer analysis. This growth layer analysis as well as stable isotope analysis can be used to determine seasonality (see Section 3.6). Age-at-death determination and metrication can aid in understanding intensification (as noted by the Ecological View (Section 3.2.3)).

3.3 Environment

Shell midden sites are primarily found along the world's coastlines, making a study of coastal geomorphology and dynamics critical to understanding them. The human/coast dynamic was summarised well in *Environmental systems: an introductory text*:

‘The coastal zone... has considerable significance for these people [living near the coast], who may be engaged in a variety of activities — dwellings, food production, industry, communication and recreation, for example.... Yet environmental processes in the coastal zone create a variety of hazards... such as flooding, erosion, [and] storm damage’ (White *et al.* 1998, 365).

Though this text was meant to describe the processes which might affect those currently living on or near the coast, it is still applicable to the archaeological remains

left behind after these people have since moved away from the coastal area. Shell middens are susceptible to flooding, erosion, and storm damage (see Section 3.4). This was evident during field survey at Dunnamark, Co. Cork (CO045) which had trees growing through the eroding face which was within a few centimetres of daily high tide.

Flooding can be caused by several factors including temporary sea level rise caused by a rise in barometric pressure due to storms, heavy rainfall in an already waterlogged area, and unusually high tides such as seen in Charleston, South Carolina, United States in 2015 (US Department of Commerce 2019). Even if a rise in water along the coast does not fully flood the midden sites, they can cause leeching of the sediments and alter these porous sites stratigraphically, moving small inclusions and creating false lithostratigraphic boundaries (as seen in Stein 1992).

Erosion affects all coastal sites even on healthy coastlines as sediments from one shore are constantly deposited on another. Beaches shift between depositional and erosional environments based on the local nearshore geographical formations created during the process. Hard coastlines also erode, though at a slower pace than soft, sandy shores. Undercutting of rocky cliffs is common with larger rocks being deposited beneath or on another beach when currents are strong enough. Unconsolidated cliffs have a similar undercutting pattern, though at a much faster rate, and can cause collapse and deposition of large quantities of material into the ocean which could also mean rapid deposition of such materials on another beach, possibly covering midden sites rather than eroding them (Griffiths 2015). These processes are all based on wave action, but wind action also caused sediment erosion and deposition as can be clearly seen in machair areas where sections of blowouts may appear one day and be covered again the next (see Halpin 2008; Griffiths and Ashmore 2011). Erosion, the leading cause of shell midden destruction, alters their topography, vegetation, and content of these sites and destroys many others and is the leading cause of their destruction (Stein 1992, 61; Milner 2012, 228).

Increased rains and shifts in barometric pressure can influence water inundation on sites. These factors are often associated with storms which also bring increased winds and stronger currents, moving substantial amounts of much heavier material than would normally affect a coastline. This can increase erosion and cause structural damage to the strongest of structures. Other natural, irregular phenomena that can increase both erosional and depositional forces and affect the integrity of shell middens

include earthquakes and related tsunamis. The effect of earthquakes on coastal sites was assessed in Chile in 2018 which showed that these forces can cause differing scales of uplift and subsidence of coastlines (Reyes *et al.* 2018). In Ireland, the Lisbon 1755 tsunami affected the southwestern shoreline of Ireland and other areas of western Europe (NOAA Pacific Tsunami Warning Center *et al.* 2011).

After the last glacial retreat approximately 13,000 years ago, the land masses around the world that had been weighed down by these masses of ice began to rebound through isostasy, a process still taking place today (Perlman 1980; Mitchell, F. 1990, 52–3; Mitchell, F. and Ryan 1997, 81; Edwards and O’Sullivan 2006, 286). Areas covered by the heaviest sections of glaciers have been rising, while areas on the opposite sides of these landmasses have been sinking resulting in both submerged and raised beaches (McErlean 2011, 72). While this is an oversimplification of isostatic rebound, its implications are evident for its effects on the Irish coastline, where the south and southwest of Ireland has been sinking between 0.4–0.5mm/yr. over the last 4000 years and the north has been rising at a rate of up to 0.7mm/yr. (Edwards and O’Sullivan 2006, 17).

Not all environmental factors are caused by natural influences. As mentioned, healthy shorelines allow for the free and natural erosion and deposition between beaches based on wave and current reactions to the shape and steepness of the shores. Humans, however, have altered these processes. Human activities are known to accelerate natural erosion (Wildesen 1982, 64–5). These activities include the re-development of ports and harbours, the use of beaches for shellfish farms, urban expansion near coasts, tourism developments, gravel quarrying, shell quarrying, and farming practices such as animal grazing (Edwards and O’Sullivan 2006, 11; O’Sullivan and Breen 2007, 243; Milner 2012, 226–7; Woodman and Milner 2013, 40) (some of these factors are further discussed in Section 3.4).

One overarching human factor affecting coastal stability is climate change which brings rising seas, increased and more intense storms, water acidification, and shifts in current patterns. In order to fight the effects of global warming, engineering works will be put into place which could both directly and indirectly alter coastal sites (O’Sullivan and Breen 2007, 243). Structures such as seawalls can cause ‘coastal squeeze,’ increasing wave and current energy in the area. ‘Soft’ engineering such as beach feeding can also bury, modify, or destroy sites (Edwards and O’Sullivan 2006, 12–3). The associated energy crisis and economic concerns will lead to other developments

such as offshore platforms, pipelines, and wind turbines which will further impact archaeological sites either through additional direct destruction or indirect erosion caused by alterations in sea currents (O’Sullivan and Breen 2007, 243–4).

In 2019, the Irish Department of Culture, Heritage and the Gaeltacht published their first adaptation plan for best dealing with built and archaeological heritage with the effects of Climate Change. This aims to help inform policy and the public concerning sustainable plans that allow for built and archaeological heritage to be preserved for the future within climate change initiatives. This includes disaster preparation training for cultural heritage, a promotion of techniques which address conservation in relation to climate change, increase research, recording, and rescue excavations, and using heritage as a tool to boost climate change education (Daly 2019). Prior to this initiative, the last attempt to assess and offset climate change dangers to coastal heritage was directed by the Heritage Council and Fáilte Ireland in 2009: ‘Climate Change, Heritage and Tourism: Implications for Ireland’s Coast in Inland Waterways’ (Kelly and Stack 2009; Milner 2012, 229).

3.4 Taphonomy and Formation Processes

Given that most of what makes up a shell midden includes biological material (see Section 3.1), it is important to understand taphonomic processes concerning shells and bones alongside other site formation processes. These processes may bias the interpretations of these sites or may have, in fact, created them. The definition of taphonomy used in this discussion comes from Lyman (2001, 3) which states that taphonomy is concerned with ‘what happened to the remains of organisms after death and prior to recovery – it is about the *transition of organic remains from the biosphere to the lithosphere*’ (emphases in original). This includes both cultural, c-transforms, and non-cultural, n-transforms (*ibid.* 5; Renfrew and Bahn 2012, 58; see also Schiffer 1987). It is important to understand these processes not only to understand the affect they may have on the provenience of individual organic materials and bulk samples, but also to help determine whether a shell deposit accumulated culturally or naturally (Claassen 1998, 54; Allely *et al.* 2021) (see Section 3.5).

Knowledge of the c- and n-transforms undergone by artefacts and general site formation processes is also critical as inclusions of nonorganic material is common with the sites. Scholars often discuss artefact formation processes as beginning with

discard; though, when it comes to refuse deposition, these processes may begin with the act that caused the disposal such as accidental breakage. Site formation processes can include taphonomy and artefact transforms but will be discussed here as all processes which affect every inclusion within the midden simultaneously such as bioturbation, compression, and porosity.

3.4.1 Taphonomy of Shells

The basis of all shell middens is the cultural accumulation of shells after their use and discard. For most shells, this process begins with collecting and includes the extraction of the fish from the shell. It can also include cooking, though this process may be done after the fish has been extracted from the shell or the meat could be eaten raw. In the possibility that shellfish were extracted for dye (see Chapter 7) or bait (see Chapter 9), cooking will also most likely not occur. Cooking processes included boiling — usually with pyrolithic technologies (see Chapter 9) — or roasting directly in a fire or within a vessel. The former leaves little trace on the shells themselves but may leave more artefactual evidence with fire cracked rocks. The latter may burn the shells and leave traces of charcoal on them, which will affect the ways in which the shells survive and react to their depositional matrices. In general, the heating of shells will affect the integrity of the shell structure and heavily burnt shells are particularly perceptible to fracturing and a loss of colour (Claassen 1998, 61–6).

When extracting the meat, there are also processes which may leave visible marks upon the shell remains. Dog whelks have often been identified within middens with their spires crushed for ease of extraction (Murray 2000, 376), though the separation of spire from body whorl is the most common natural fragmentation pattern as well (Claassen 1998, 56). The opening of bivalves will often mean disposal of the half-shell not containing the meat prior to the disposal of the meat-containing half, which means bivalves would not be deposited articulated (*ibid.* 74). When collecting limpets, a common gastropod within Irish shell middens, an elongated pebble was often used (or in more recent times, a coin (see Chapter 8)), which could crack the edges of one side of the shell. This process leaves most of the shell intact for meat extraction purposes (this can be seen in Coleman 1938, 40; Liversage *et al.* 1968, 119; Mitchell 1972, 151).

Shells may also be added to the midden unintentionally. Studies have shown that shells which attach themselves to seaweed may be incidentally collected and discarded

(McCarthy 1988, 119; O’Sullivan and Breen 2007, 41). Shells that often live in close proximity may also be collected together, though only one species is the target. This often occurs with shells that look similar such as dog whelks, periwinkles, and top shells (see Chapter 8). Carnivorous shells, such as the dog whelk, may also be collected whilst eating other shellfish, which would not only cause the incidental inclusion of the prey, but would leave predatory bore holes on this inclusion (Claassen 1998, 30).

After the midden has formed, the shells can go through further transformations due to sun or water exposure. If the shells are exposed on the surface for extended periods of time, the sun can cause them to undergo photodegradation, causing visual bleaching and a chemical breakdown to the stability of the shells (Kirk-Othmer 2007, 485–8; Oxford Dictionaries 2019b). Groundwater or regular inundations of seawater can cause chemical dissolution, further affecting the structural stability of the shells. Water saturation can also cause colour bleaching, increased fragmentation, and a chalky surface on the shell through acid dissolution (Claassen 1998, 59–60), a problem which may increase with Climate Change (see Section 3.3). This saturation can also cause leaching, affecting the appearance of stratigraphic layers (Stein 1992, 11–5; Claassen 1998, 11–5). Roots growing through these shell deposits also release a chemical which works to dissolve shells and cause further fracturing through this dissolution as well as through the physical process of root growth (*ibid.* 57).

A hypothesis has been put forward to suggest intentional fragmentation of shells within cultural sites perhaps similar to that seen within other Irish Bronze Age deposits (Waselkov 1987, 146; McCarthy 1988, 115; Stein 1992, 284) (see Chapter 5). Experiments undertaken by Muckle (1985) showed that fracturing due to initial tossing only breaks the shells into large pieces and smaller fragmentation must be explained through other means. This, then does not rule out intentional fragmentation, though the other chemical and physical actions acting upon the shells, may also account for highly fragmented shells and care should be given to these taphonomic factors prior to asserting intentionality.

3.4.2 Taphonomy of Bones

Due to the relationship inherent between many shell middens created by food refuse and the eating of other meats, bones are often found within these sites. Similar to the shells, it cannot be assumed that all bones within midden deposits were waste materials

from food processing. Bone artefacts may have been discarded after their purpose was served. Animals may have been used for hides or died naturally nearby and disposed of in the midden. Understanding taphonomy can aid in our understanding of the purpose behind bone deposition within the middens. The environment created by the calcium carbonate of most shells themselves and the often alkaline chemical by-products of shell dissolution, helps preserve bones in a country with otherwise degrading acidic soils and similarly degrading sandy coastal areas (Davis 1987, 27; Woodman *et al.* 1999, 85; Lyman 2001, 421).

Similar to the shellfish within the sites, animals are usually ‘harvested’ for their purpose. Wild animals are hunted depending on availability, cultural preference, and hunting abilities. Domestic animals are raised for their purposes based on cultural preference (Davis 1987, 22). Humans may choose to kill young animals, whose bones are less dense and may not survive as well, or they may choose to kill full grown animals who may be too large for the entire carcass to be carried away (Lyman 2001, 126–32). This is why, after an animal is killed, there is then another choice to be made: whether or not to bring the entire carcass back to the site of consumption or to bring only choice pieces of the meat, a process known as selective transport (Gifford, D. 1981, 410; Lyman 2001, 224). For instance, the bones recorded at Illaunloughan, Co. Kerry (KY053) were interpreted as representing on-site butchery due to a study of this particular taphonomic process (Marshall and Walsh 2005). It should be noted, however, that differential bone deposition can also occur due to non-human predators and scavengers (Davis 1987, 24). Further butchery is often undertaken at the site of consumption, or the animal can be cooked and processed whole. Butchery marks may be studied to confirm the tools and methods used (Lyman 2001, 297–306).

After the animal carcass has been prepared, cooking may take place if the meat is to be eaten. With extreme heat, bones may become black through carbonization or white after becoming completely calcined. Extreme heat can also cause bones to shrink and fracture due to water loss and the burning away of all but the mineral layers of the bone. The bones themselves may be roasted and further fragmented for marrow extraction (Davis 1987, 26; Lyman 2001, 385).

Fragmentation of bones may occur due to butchery, extreme heat, trampling, or other animal activities such as dog disturbance (Davis 1987, 28; Lyman 2001, 324). It is well recorded that human bones have been intentionally fragmented for deposition during the Irish Bronze Age (Brudenell and Cooper 2008; Cleary 2018). Like shells,

this intentional fragmentation may have also played a role in the depositional factors of animal bones.

Disarticulation is common in shell midden deposits due to butchery, disposal practices of animal bones, and selection of specific bones for tool making (Lyman 2001). Non-cultural factors may also cause disarticulation such as scavenging or bioturbation (see Section 3.4.4). Typically, the only articulated bones found within middens are that of human remains, which do not face the same pre-burial taphonomic processes, but often face the same post-deposition processes.

3.4.3 C- and N- Transforms of Artefacts

Artefacts can be disposed of in middens for various reasons discussed in more detail in Chapters 4–8 for different time periods. These may include deliberate deposition of complete single objects, intentionally fragmented objects, or hordes of complete or fragmented objects. They may also include disposal of material which has lost its value due to breaking, loss of cultural appeal, or lack of function (such as debitage which was never used). It is not in the scope of this section to address each of these depositional modes, but instead to look at the processes which may affect the artefacts after deposition.

Stone tools are one of the most durable artefacts within the archaeological record. They can still, however, show traces of weathering such as patination, abrasion, or burning. Patination is the discoloration of the lithic material due to loss of surface water. This discoloration is often white and chalky to the touch. This process will also make the lithic more brittle, which could cause breakage (Woodman *et al.* 2006, 97). Abrasion of a lithic artefact occurs due to movement which causes dulling of the edges. In the case of wind gloss, a shine will also appear on the surface. Burning can alter the colour of the stone such as burnt flint which can appear white, grey, or pink. Burning can also cause cracking with an increased brittleness due to water loss (*ibid.* 98).

The effects of weathering on pottery and other ceramics are dependent upon the quality of the original firing. Well fired clay can be almost as durable as lithic artefacts, breaking for the same reasons of burning and abrasion. Acidic soils can slowly disintegrate the surface of even the most well fired clays, but most shell midden deposits have less degrading, alkaline conditions. Porous or poorly fired clay materials

are more likely to break down due to either humid or extremely dry conditions (Renfrew and Bahn 2012, 60).

Metal artefacts of bronze and iron face severe oxidation and corrosion due to chemical reactions with the air and water in the environment. Gold, silver, and lead will survive for longer in the archaeological record, but the former in particular is quite malleable and its shape can be easily altered due to abrasion or the pressure of overburden. Permanent saltwater inundation can help to preserve some metal materials due to the forming of hard, metallic salts such as carbonates around the exterior of certain metals. The metals can then be revealed and preserved through electrolysis. Though, if the metals with these metallic salts are left to dry, further corrosion could destroy the remaining metal, which can often occur in middens if salt water is only occasionally present within the deposit (Renfrew and Bahn 2012, 61).

3.4.4 Site Formation Processes

Some of the primary characteristics of middens both aid and hinder site preservation. The preservation of many of the ecofacts and artefacts on the site is supported by the high pH of the midden, but the thinner, more spread-out edges of middens can be more susceptible to information loss due to lower pH levels (Waselkov 1987, 156). The pH of the shells and their dissolution by-products can also react with the acidity of iron in sediments, creating an 'iron pan' beneath or within midden deposits in areas of high iron content (Claassen 1998, 87–8). This can also have a direct effect on the condition of iron artefacts within the middens.

The high pH and other chemical factors of shells also make them ideal for fertilizing cultivation soils, a trend known from at least the Anglo-Norman Period and there is some evidence to suggest that it predates the Norman arrival to Ireland (Cooper and Davis 2004, 8–12). The burning of shells to create lime for a similar purpose is also well documented from modern times and shell middens were ideal sources of such material (Harte 1866; Claassen 1998, 66; Cooper and Davis 2004, 12–5; Milner 2012, 226; Woodman and Milner 2013, 40 and 102; Hardy 2017, 264). Shells were similarly quarried as binding agents for paths and roads (Claassen 1998, 66; Milner 2012, 226; Woodman and Milner 2013, 40).

Another characteristic of middens which affect site formation is their porosity. Vacant space between shells can mean that smaller objects migrate downward causing

early dates to be attained for older layers. The most susceptible finds to this movement include seeds and grains, small animal bones, and minute artefacts such as beads and needles (Waselkov 1987, 147; Stein 1992, 240; Claassen 1998, 86–7; Murray *et al.* 2011, 6). Shifting of midden material can also occur due to water inundation and wind forces (Claassen 1998, 88; Renfrew and Bahn 2012, 61). Specimen location disturbance is considered by Wildesen to be the worst impact to occur at a site after complete destruction (Wildesen 1982, 62).

These disturbances can be further exacerbated by overburden which can not only cause creep, slump, and artefact migration but can also cause compression fractures of both ecofacts and artefacts (Wood and Johnson 1978, 349; Claassen 1998, 57; Hardy 2017, 266–7). This is caused by increased deposition above the original midden deposits including natural sand inundations or continued cultural deposition (Griffiths 2015).

Erosional processes have been discussed in Section 3.3 and will not be discussed again here except to mention their inherent implications to the loss of archaeological data. The final site formation process to be discussed, then, is that of faunal- and floralturbation. Animals can shift and further damage shell midden sites and inclusions through burrowing, scavenging, and digging. Plants can shift the sites through root growth and damage inclusions through secretions of acidic chemicals. Burrowing animals in Ireland include rodents, rabbits, hares, insects such as ants, and earthworms. These will often mix the soil and move inclusions through their burrowing. Roots will create similar disturbances to burrows. Root casts and krotovina — tubular features left by burrows — can sometimes indicate that these processes have affected the site but are not always visible in midden deposits. Treefall can also leave holes and large areas of damage at sites (Wood and Johnson 1978, 318–32; Claassen 1998, 78–82).

3.5 Archaeological Visibility

Due to the environmental factors discussed in Section 3.3, shell middens are often uncovered through erosional processes (Halpin 2006; Milner 2012). Milner states that ‘the irony is that many coastal sites are discovered because they are in the process of being destroyed’ (*ibid.* 226). Even when they are discovered through excavation rather than through erosion, a lack of proper recording for these sites can affect their standing in the archaeological record. This is partly due to problems of defining the sites or

deposits (see Section 3.1) and the various complications within stratigraphy and survival of remains due to taphonomic and site formation factors. However, there is also a general dismissal concerning their importance outside of Mesolithic research (Edwards and O’Sullivan 2006, 4–5; Hardy 2017, 260). This means that as the sites erode, their archaeological value is lost without proper recording (Milner and Woodman 2007, 101). This may be a self-perpetuating problem, because without interest generated through archaeological recording, no interest will be generated to resolve the issue and record further details.

Shell middens could also not be recorded due to confusion over natural versus cultural deposits, a problem which has been seen in shell midden research since the eighteenth century (Waselkov 1987, 139; Stein 1992, 1). Storms, animals, and earthquakes can all create shell deposits with no human input (Claassen 1998, 53). The study of taphonomy and site formation processes can aid modern researchers in deciphering differences in natural versus cultural accumulations. For instance, heavy abrasion and rolling may indicate that wave, tide, and current action brought the shells to the shoreline, though this process can occur after human deposition (*ibid.* 58). Disarticulation is often used to interpret cultural deposits, though this can also be due to high water energy, scavenging at the time of death, and bioturbation (*ibid.* 74). In general, it can be difficult to tell. Even when cultural material is seen within the deposits, as these can be transported naturally to the site (*ibid.* 76–8). This complication can lead some to report all instances of shell deposition (see Cuppage *et al.* 1986; McCarthy 1988, 139–42) while others may regard them as natural and not warranting archaeological recording (see Fitzpatrick 2002).

3.6 Shell Midden Chronology

Until the introduction of radiocarbon dating and other scientific dating techniques, all sites were dated using relative associations. Radiocarbon analysis is now considered the best way to date shell middens. Today, the modern understanding of the marine reservoir effect allows for marine specimens to be used with more accuracy. Accelerator Mass Spectrometry (AMS) methods allow for smaller sample sizes. Secure dating is important within these longstanding sites due to the fact that the use and cultural context of the middens, though seemingly homogeneous (see Section 3.2), have most likely changed over time (Ambrose 1967; Waselkov 1987, 143; O’Sullivan

and Breen 2007, 110; Woodman and Milner 2013, 37). Secure contexts can be difficult to ascertain because of the porous nature of middens and the dynamic nature of their environments. If the excavator is certain of contextual information with the positive identification of larger objects or through an association with clear *in situ* features such as hearths, then chronological data can be gathered with more confidence and can be used to better understand these sites. Multiple dates from different vertical and horizontal positions should be analysed as deposition can occur at various times over a single occupation surface which will later overlap horizontally and appear to be one continuous midden (Liversage *et al.* 1968; Woodman and Milner 2013, 39; Hardy 2017, 265).

Stratigraphy, with all of its complications, and associated artefact typologies are still used on many sites for dating purposes. Many sites, however, lack diagnostic artefacts in order to date sites using this typology-based dating method (Milner and Woodman 2007, 102). At British Camp, Washington, United States, the south-eastern portion of the site was found to be more recent than similar depths and similar lithostratigraphic layers elsewhere on the site, indicating that layers cannot always be correlated for dating based on depth or superficial descriptive characteristics (Stein 1992, 125). There are also inherent dangers to relying on associations due to the porosity and matrix mixing seen in these deposits.

Radiocarbon analysis can always be used to date shell midden sites because the primary materials at these sites are always organic remains. The most commonly dated ecofact is charcoal. If charcoal is chosen for dating purposes from secure contexts, then it must be typed and aged prior to analysis in order to avoid the ‘old age’ effect. Not all sites contain charcoal and, therefore, other organic remains must be used to date the midden (Woodman *et al.* 1999, 102). The ‘old age’ effect is less of a consideration when dating bones unless affected by carbon offsets due to ‘old wood’ being used as fuel to cook or burn them. Bones can also be affected by the ‘marine reservoir’ effect. This causes spuriously old dating results due to marine carbon levels. If animals had a diet heavily dependent upon marine resources, this effect must be considered (Claassen 1998, 93; Woodman *et al.* 1999, 11). In order to know whether or not a marine diet could be affecting a certain sample, a stable isotope analysis must be undertaken. There are calibration curves to correct for the ‘marine reservoir’ effect, but the dates produced after calibration and regional delta-R value corrections often have a broad range. At Kilnatierny, Co. Down, calibration caused the dates to span

approximately 800 years between 4760 and 4050 BC (Murray *et al.* 2011, 36) To combat this issue, multiple samples should be dated; and it is best for these to be analysed statistically through careful Bayesian modelling.

Thanks to more recent advances in radiocarbon dating techniques, shells can be dated. This allows for middens with or without other ecofactual content to be radiometrically dated for more scientific chronologies. Dates from shells are also affected by the ‘marine reservoir’ phenomenon. Atlantic shells are typically around 395 years too old (Woodman *et al.* 1999, 12). Thanks primarily to shell midden research, there are calibration curves specifically for the subpolar north Atlantic (Harkness 1983; Blake 2005; Reimer *et al.* 2013). Uranium-Series dating can also be used to directly date shells but given its lack of use in Irish shell midden archaeology and its infrequent use in archaeology as a whole, it is not addressed here (Roberts and Jacobs 2010, 353–4).

Another advancement in shell midden chronology in particular is seasonality studies. Shells, pigs, birds, fish, seals, hazelnuts, antlers, mammalian teeth, wood, and population compositions have all been used to estimate the season in which shell middens were in use. The reason this topic is studied so fervently is due to seasonal implications. If a site has evidence of year-round use, it suggests a permanent settlement was either on site or nearby and that substantial structures should be expected in the area. Seasons can also affect cultural activities such as the well-known equinoctial and solstitial celebrations (Monks 1981, 179).

The best interpretive framework for seasonality studies includes the use of calendrical estimates rather than general seasons. Calendric divisions, such as months, are a more consistent and standard measurement of time than generalized seasons (Monks 1981, 178). One issue that cannot be overcome when interpreting the seasonality of a site is the factor of storage. The season of death is all that can be determined for any sample. If that sample is then stored and utilized at a later time of the year, there is no way to tell. This must remain an error in our site interpretations (*ibid.* 183; Stein 1992, 8).

One of the oldest and still most widely used methods of determining seasons is to note the presence or absence of seasonally available resources such as hazelnuts and migratory birds and fish (Monks 1981, 180). When utilizing this technique, information concerning sample size and the number and types of seasonal indicators used should be explicit (*ibid.* 183). One of the downfalls of this method is the lack of

calendrical estimates possible with the data available. Another is that the absence of evidence in archaeology is at best questionable due to preservation and recovery biases (*ibid.* 182).

Growth lines found on fish scales, otoliths, and opercular and vertebral centres are also accurate ways to identify season of death. Scales and otoliths, however, are not as clear in older specimens (Monks 1981, 199). The growth layers within molluscs can also be referenced. These must be interpreted with an understanding of microscopic growth breaks caused by factors such as extreme temperatures, storms, attacks, or other abnormal conditions (*ibid.* 203; Waselkov 1987, 161; Mannino *et al.* 2003, 672). Molluscs and fish have a similar age restriction in that growth decreases in older specimens. In contrast, juveniles grow very rapidly (Monks 1981, 202). External microscopic mollusc analysis is best done using solid cross sections, thin sections, and acetate peels from cross sections (*ibid.* 204). Internal analysis should use sections from the umbo to the margin (*ibid.* 208). Both methods are best analysed through comparison with control samples (*ibid.* 205) and have an accuracy of ± 1 month (*ibid.* 207 and 209).

Many seasonal indicators are interpreted based on known isochronal births of species (Monks 1981, 185). For instance, wild pigs are typically born between March and May (Mallory *et al.* 1988, 112). If pig remains are aged using indicators such as epiphyseal fusion or tooth eruption and wear, an estimate of the month in which the specimen died can be made (Monks 1981, 185–7). Unfortunately, this estimation is broad and dependent upon uncertain variables such as time of birth and different indicators of age at death (Mallory *et al.* 1988, 112). Tooth wear, which can range in accuracy from 3 to 6 months, is particularly not recommended for aging a specimen (Monks 1981, 189 and 197). This method can be affected by decreases in eating during winter and mating seasons (*ibid.* 196).

Antlers are a seasonal indicator because of their growth and shedding at set times of the year. Most of the research concerning antler seasonality focuses on caribou and is not applicable to the red deer commonly found on Irish sites. If antlers are to be used, the pedicles or unshed antlers are best (Monks 1981, 198). This is because once antlers are shed, they can be gathered and utilized at any time after their loss (*ibid.* 190–1).

Wood can be used for seasonality, but growth rings are needed and most preserved wood samples at midden sites are burnt. The best species for this analysis are not those

best for dating sites (Monks 1981, 210). Another possible indicator is bone, but not enough information is currently known about the seasonal growth of bones to make this a reliable source (*ibid.* 198). The only other seasonal indicator that does not require chemical analysis is population composition. The age and sex of populations change seasonally depending upon seasons of birth and mating. The recovered assemblage, however, cannot be directly equated to the living population or the death population of a local species (*ibid.* 211). This method is also affected by the accuracy of estimating age and sex based on available assemblages (*ibid.* 213). The most accurate method for identifying the season of use on a site is stable isotope analysis. This technique can be complex and expensive but is the best way to identify seasonal use of archaeological sites.

Stable oxygen isotopes, in particular, are one of the best for shell analysis, because the ratio of ^{18}O and ^{16}O within a shell directly reflects the water temperature at the time of incremental growth (Monks 1981, 215; Waselkov 1987, 163; Mannino *et al.* 2003, 668). Such an analysis was successfully performed on *Monodonta lineata* shells at Culverwell, Isle of Portland, England (*ibid.* 667). As in other shell species, growth pauses are known to occur in *M. lineata* if it is too hot or too cold. A growth pause during the winter can more easily be taken into account when analysing the results if there were no heat extremes (*ibid.* 672). Another factor to be considered is that changes in water salinity can change isotopic levels. Samples near outflows of rivers or streams are therefore problematic (*ibid.* 674). To avoid kinetic effects on the results, rapidly growing juvenile shells (less than 1 year) should be avoided if possible. The samples should also not be too much over one year in age to avoid the growth increments becoming too small. This factor is more difficult to control in archaeological assemblages due to the preferential gathering of large, older shells for food (*ibid.* 270). For a broad season of death, a minimum of three contiguous samples should be taken close to non-damaged edges (*ibid.* 669). Samples from one or more full growth increments, which form yearly, can also be used to better understand the seasonal changes and growth pauses experienced by the specimen (*ibid.* 270). Attempts to use this method in Ireland have had mixed results due to oxygen ratios also being affected by changes in salinity which is a common occurrence in tidal estuarine environments. Price and Pearce (1997) used cockles for this analysis with some success. Murray (2000) attempted a $\delta^{18}\text{O}$ analysis of limpet shells from the west coast of Ireland, which

was inconclusive due to environmental ‘noise’ being seen in the data along with temperature fluctuations (Murray 2000, 358–62).

Another scientific method that may be more applicable to Ireland is the use of trace element analysis such as strontium and magnesium (Fuge *et al.* 1993; Murray 2000). Price and Pearce (1997) used this technique on cockles from the west and east coasts of Ireland. He looked at traces of magnesium, strontium, manganese, and barium. Strontium concentrations showed a trend related to growth rate and seemed to be a reliable seasonal indicator. Barium was more influenced by bioavailability than seasons; manganese was influenced by temperature, which could indicate seasonality, but was also affected by salinity, similar to the $\delta^{18}\text{O}$ analysis (*ibid.*; Murray 2000, 349–50). For other trace element analysis examples see Trompetter and Coote (1993), Dodd (1965), and Fuge *et al.* (1993).

All of the above indicators should be used in conjunction with as many other indicators as possible (Monks 1981, 229; Mannino *et al.* 2003, 678). Different indicators from the same species may need to be used, because the season of one body element cannot be assumed to be the same as another body element of the same specimen (Monks 1981, 201). Comparative collections from different phases of growth are recommended when studying growth structures, population compositions, or age at death estimates. This allows for better chronological control when interpreting the sample (*ibid.* 229; Mannino *et al.* 2003, 668). In order to help balance any bias towards a particular species in the assemblage, a Minimum Number of Individuals (MNI) should be calculated (Monks 1981, 224). It must also be understood that the presence of a single indicator for one season carries as much interpretive weight as the presence of hundreds of indicators for another season (*ibid.* 182).

3.7 Significance

Around 10,000 years ago, the first humans arrived in Ireland to settle along the shoreline (O’Sullivan and Breen 2007, 1; McErlean 2011, 72). This means that some of the earliest evidence of human occupation on the island can be found within coastal shell middens. There are between 200 and 500 known Irish shell middens (Woodman and Milner 2013, 37; Milner and Woodman 2007, 101; Murray *et al.* 2011, 8). These middens can be found all along the c. 7,500 km of Irish coastline which is on a high aquatic productivity area of a wide coastal shelf (Perlman 1980, 270). This

environment is one of the most productive zones in the world surpassed only by swamps and tropical forests (*ibid.*, 274; Burenhult 1984, 44). If an Optimum Foraging Theory is to be used, the shellfish and hook-and-line fish within these zones actually have the highest return-rate of any prey except for deer-sized organisms (Perlman 1980, 277).

Due to the productive potential of Ireland's coast, shell middens often include evidence of different food resources, both aquatic and terrestrial. Raw material usage; social complexity; human-environment interaction; seasonality; site formation processes; economics; and the changing relationships between the coast and agriculture can also be studied within these deposits (O'Sullivan and Breen 2007, 21; Álvarez *et al.* 2011, 1–5; Milner and Woodman 2007, 109). Ambrose (1967) identified five research topics that can be analysed through middens: (1) faunal remains and food supply; (2) variation in species for ecological conditions; (3) mapping ancient shorelines; (4) cultural reconstruction through artefacts; (5) depositional and post-depositional processes (Stein 1992, 7). The widespread geographical and chronological distribution of the sites make them perfect candidates for analysing all the above topics along with landscape archaeology. The latter can include additions of palynology, palaeotopography, and oxygen isotope ratio studies (Perlman 1980, 298).

The immense potential for research within these sites means that careful, ongoing research is vital for understanding Ireland's history (Woodman and Milner 2013, 40). Unfortunately, these sites are an underestimated and poorly understood resource. Although the County Archaeological Inventories and the Record of Monuments and Places (RMP) include shell middens, they are presented with little overall sense of their importance (Edwards and O'Sullivan 2006, 4–5). This is due to the popular ideas of the sites being linked to either 'Mesolithic strand-loopers' or a later reduction in living standards. These sites should not be dismissed, however, since archaeology has proven repeatedly how important these sites are. Their trivialization also affects the amount of concern given to their destruction (Milner and Woodman 2007, 101). Due to their inherent vulnerability (Woodman 2001, 32), the excavation and analysis of these sites is of heightened importance with their increasing loss (Woodman and Milner 2013, 40 and McCarty 1988, 137).

Chapter 4: Shell Middens and Marine Resource Use in Early Prehistory

Introduction

This chapter describes Irish shell middens dating from the Mesolithic, Neolithic, and Chalcolithic. The Mesolithic is here defined as 8000–4000 BC. The Neolithic is defined as 4000–2500 BC and the Chalcolithic as 2500–2100 BC. A brief overview of the archaeological history of these periods is first introduced along with a review of recording of relevant shell middens. The distribution of the sites is then discussed with reference to potential biases within the archaeological record. This is followed by a discussion of the chronology of these deposits. Case studies are provided which typify the early prehistoric data. Broad patterns are then presented concerning associated monuments and features along with species identification of molluscs, animals, and plant remains. The chapter concludes with a brief discussion of significant findings.

The three periods of the Mesolithic, Neolithic, and Chalcolithic are discussed together due to three factors: 1) the low number of well documented Mesolithic sites that lack evidence of Neolithic continuation or re-use; 2) the similarities evident between the Mesolithic and Neolithic shell middens overall; and 3) the Late Neolithic and Chalcolithic show evidence of a similar decline in shell midden creation prior to a significant increase in same during the Bronze Age.

4.1 A History of Research

Much of the shell midden research in Ireland has been focused on Mesolithic sites (Chapter 2). The sites of the ‘Stone Age,’ before Mesolithic became a term used on the island, first caught the attention of antiquarian researchers such as George Henry Kinahan, Dean William Buckland, William Harte, and William Knowles. Many of these men participated in the debate over whether or not an Irish Mesolithic period existed separate from a proto-Neolithic. The Mesolithic was firmly accepted as, at least, a chronologically distinct period in Ireland by the time of the Harvard Expeditions in the 1930s (Woodman 1978, 7–11; 2009, xxxvi).

The recognition of distinct periods within the ‘Stone Age’ brought its own research questions. Numerous sites were identified in the north of the island dating to the Mesolithic and for many years it was thought that there were no Mesolithic sites in the south. This was proven incorrect in the 1980s with Woodman’s discoveries of the

Blackwater Valley microlith scatters in 1982 and Ferriter's Cove, Co. Kerry (KY030) in 1983 (Woodman 1986, 10; Power 1989, 46). This was followed by a resurgence of interest in shell midden sites as they were still often believed to be primarily Mesolithic in date (Chapter 2). As a result of this continual focus on Mesolithic shell bearing sites, deposits with Mesolithic evidence are among the most documented. The search for more deposits dating to the Mesolithic also led to detailed excavations of shell middens which were found to be later in date. It is now better understood that shell middens are not exclusive to this period, though the depth of information collected from early sites, specifically those dating to the Mesolithic/Neolithic transition, continue to garner investigative attention.

4.1.1 A Brief Overview of Early Prehistoric Chronology

In Ireland, the Mesolithic marks the first definitive human occupation in Ireland with the earliest securely dated site at Mount Sandel, Co. Derry. The earliest date produced at this site was 8955 ± 185 BP; 8550–7598 BC (UB-2357) from occupation level charcoal, though most of the evidence suggests that the height of early activity occurred around 7900 BC (Woodman 1985; Chapple 2018). The Mesolithic itself is typically split between the Early Mesolithic (c. 8000–6500 BC) and the Late Mesolithic (c. 6500–4000 BC) based primarily on a shift in lithic technologies along with a change in settlement patterns (Woodman 2009). Most of the Mesolithic shell middens date within the Late Mesolithic, most likely due to the shift seen across the island from fresh-water site loci to coastal areas.

Evidence is emerging of a potential Palaeolithic occupation of Ireland prior to the settlement of Mount Sandel, though the discussion is ongoing. The discovery of butchery marks on a bear patella from caves in Co. Clare dated to $10,850 \pm 50$ BP; 10,935–10,778 BC (OxA-29358) provides compelling evidence of earlier colonisation (Dowd and Carden 2016). No shell middens have been dated to this period thus far.

The Mesolithic period ends with the introduction of farming, ceramics, and new lithic technology in the Neolithic. This 'New Stone Age' is often split into Early (4000–3600 BC), Middle (3600–3100 BC), and Late (3100–2500 BC) categories based upon both archaeological evidence such as the shift from rectangular houses to pit and post complexes between the Early and Middle Neolithic and environmental changes such as an increase in bog cover (Whitehouse *et al.* 2014).

The beginning of the Chalcolithic is noted through much of Western Europe by the appearance of Beaker pottery and related material culture and with early metalwork. There is also an increase in the re-use of Early Neolithic megalithic monuments and the creation of a new type of megalith: the wedge tomb (Carlin and Cooney 2017). This period ends with the introduction of the Bronze Age to Ireland with the arrival of new funerary practices, housing structures, pottery forms, and the use of tin-bronze.

4.1.2 A History of Survey and Excavation

Eight early prehistoric shell midden sites were discovered by antiquarians between 1866 and 1904, all of which were researched further in later years (Table 4.1). An even earlier discovery was made by a local farmer in 1839 as he was digging on his land. This site was later commented on in greater detail in 1984. Similarly, one shell midden was uncovered due to ploughing in the 1940s and informants reported new shell middens in the 1960s and in 1993. Natural erosion revealed two of the early prehistoric shell middens and six were recorded due to planned surveys. One shell midden was first recorded when sampled and the remaining ten were recorded with excavation (three commercial and seven research excavations).

Catalogue ID	Method of Discovery	Further Research
AN004	Antiquarian 1891	Excavation 1934 1966
AN006	Excavation 1957	—
AN008	Erosion 1932	Erosion 1935
AN010	Excavation 1931	Excavation 1935–9 Reanalysis 2015
CE002	Erosion 2009	Excavation 2009 2011
CE003	Survey 2011	Excavation 2012
DL027	Antiquarian 1866	Survey 1990s Sampling 2000 Excavation 2001–3
DL028	Antiquarian 1866	Excavation 2001 Sampling 2007
DL031	Survey 1999	Excavation 2001 Sampling 2007
DL032	Excavation 2001	Sampling 2007
DL034	Antiquarian 1866	Survey 2001
DL036	Antiquarian 1866	Survey 1999 2000 2001
DL037	Sampling 2001	—

Catalogue ID	Method of Discovery	Further Research
DL050	Antiquarian 1887–9	Informant 1931 Survey 1942 1981
DU001	Farmer Digging 1839	—
DU006	Ploughing 1940s	Excavation 1949 1964 1969 Sampling 1997
DU009	Excavation 1956–9	Sampling 1997 Reanalysis 2005
DW001	Excavation 1936	Survey 1996 Excavation 1997 2001
DW002	Antiquarian 1904	Survey 1935 Excavation 1958 1961 1963
DW003	Commercial 2008	—
DW006	Commercial 2005–6	—
DW007	Antiquarian 1889	Antiquarian 1893 1901 1936 1938 Excavation 1935 1951–2
DW008	Informant 1960s	Sampling 1960s
DW036	Commercial 2003–4	—
GA004	Survey 1922	Survey 2009 Sampling 2009
KY030	Excavation 1983–7, 1992–3 1995	Survey 2019
LH005	Excavation 1948	—
MO031	Informant 1993	—
SO018	Survey 2009	—
SO041	Survey 1979	Excavation 1980–1
SO080	Survey 1985	Survey 1994 Sampling 2000

Table 4.1: Method of discovery and further research of early prehistoric shell midden sites. For more information on each site see Table 4.2.

4.2 The Archaeology of Early Prehistoric Shell Middens

A total of 52 individual shell midden features from 31 shell midden sites date to the early prehistoric periods (Table 4.2). A single shell midden from Luffertan, Co. Sligo (SO099) contained an erroneously late date of 9440 ± 100 BP; 9190–8461 BC (Lu-1809) from charcoal, which may be of natural origin and is therefore not considered here. Within the next two sections the distribution and chronology of these sites is addressed. The coordinates used for distribution are based upon the National

Monuments Services of Ireland and Northern Ireland where available. The chronology is based upon radiocarbon dates and artefactual inclusions cited in available records.

Site Name, Townland	County	SMR	Catalogue ID	Date (BC)	LOC
Glenarm, Cloney	Antrim	ANT029:048	AN004A-B	Late Meso Early-Mid Neo	A/B
Ballygalley	Antrim	ANT035:017	AN006	Neo	C
Greenisland, West Division	Antrim	ANT052:065	AN008	Early Meso	B
Portbradden Cave, Templastragh	Antrim	ANT003:034	AN010B	Early Neo	C
Site 1, Fanore More	Clare	CL001-019	CE002	44 th -37 th c.	A
Site 2, Fanore More	Clare	CL001-021	CE003	50 th -46 th c.	A
Baylet	Donegal	DG038-052	DL027A-B	56 th -31 st c. Neo	B
An Machaire Beag	Donegal	DG038-053	DL028	37 th -31 st c.*	C
Ballymoney	Donegal	DG046-035	DL031	49 th -37 th c.	B
Castlequarter	Donegal	DG046-036001	DL032	40 th -36 th c.	C
Castlequarter	Donegal	DG046-037	DL034	Late Meso	C
Grange	Donegal	DG046-039	DL036	Meso-Neo	C
Drumboy	Donegal	DG046-040	DL037	38 th -34 th c.	C
Finner	Donegal	DG106-005	DL050	Chalc	C
Rush	Dublin	DU008-013003	DU001	Early Meso	B
Sutton, Burrow	Dublin	DU015-024	DU006A-B	63 rd -39 th c. Late Meso	B
Dalkey Island	Dublin	DU023-029002	DU009B-D	60 th -37 th c.* Chalcolithic 60 th -34 th c.	A/B
Rough Island, Ringcreevy	Down	DOW011:014	DW001	Meso-Neo	B
Ringneill	Down	DOW011:017	DW002	45 th -40 th c.*	A
Castle Espie	Down	DOW011:055	DW003	25 th -20 th c.	C
Portaferry, Ballyphilip	Down	DOW032:003	DW006	Neo	B
Dundrum, Murlough Lower	Down	DOW044:033	DW007	Neo-Chalc	B
Ballinran	Down	DOW054:024	DW008	Late Meso	C
Kilnatierny	Down	-	DW036	47 th -41 st c.*	B
Tullybeg	Galway	GA010-040	GA004	47 th -40 th c.	C
Ferriter's Cove, An Baile Uachtarach Theas	Kerry	KE042-035	KY030A-P	52 nd -34 th c.	A/B
Rockmarshall	Louth	LH008-026003	LH005	48 th -41 st c.	A
Inis Gé Theas	Mayo	MA023-018002	MO031	Neo	B
Conor's Island	Sligo	SL005-194	SO018	44 th -42 nd c.*	B
Settlement 15, Culleenamore	Sligo	SL013-089002	SO041B-C	25 th -21 st c. 38 th -32 nd c.	B
Tanrego West	Sligo	SLO019-057001	SO080	33 rd -28 th c.	C

Table 4.2: List of all sites discussed in chapter with relevant deposits indicated under Catalogue ID. Date estimates are based on radiocarbon dates where available and are otherwise based upon artefact inclusions discussed in Section 4.3.2. Dates with * indicate that problematic radiocarbon samples were left out of the estimation. Further information concerning these dates is given in catalogue entries. LOC indicates Level of Confidence

4.2.1 Distribution

The site with the largest number of early prehistoric shell midden features is Ferriter's Cove, Co. Kerry (KY030) with sixteen of its twenty-two deposits dating to this period through radiocarbon analysis, artefacts, and stratigraphic relationships. The remaining six contained no dating evidence, but most likely related to the Mesolithic/ Neolithic transition along with the rest of the site. This is the southernmost early prehistoric shell midden known in Ireland near the southern extent of the west coast. In the lowland west, only three sites are found: two at Fanore More, Co. Clare (CO002 and CE003) and Tullybeg, Co. Galway (GA004). Four sites are found within the highland west region and four are identified on the east coast. The remaining nineteen early prehistoric sites are found in the north (Figure 4.2).

There are clusters of early prehistoric shell middens found bordering the north coast of Strangford Lough and along the eastern coast of Lough Swilly. Both clusters are found within the northern region. While this northern trend may be a true reflection of early prehistoric patterns of mollusc deposition, a more likely explanation is that many of the earliest sites in the isostatic submersion zone of the south and west have been lost, skewing the available data (Chapter 3). There is also a much longer tradition of seeking out prehistoric shell mounds in Ulster by local antiquarians, a practice not often expanded south. Woodman (1978) discussed this bias in his early work on the Mesolithic in Ireland. He noted that Mesolithic studies have been shaped by northern antiquarians as well as modern collectors (Figure 4.1).

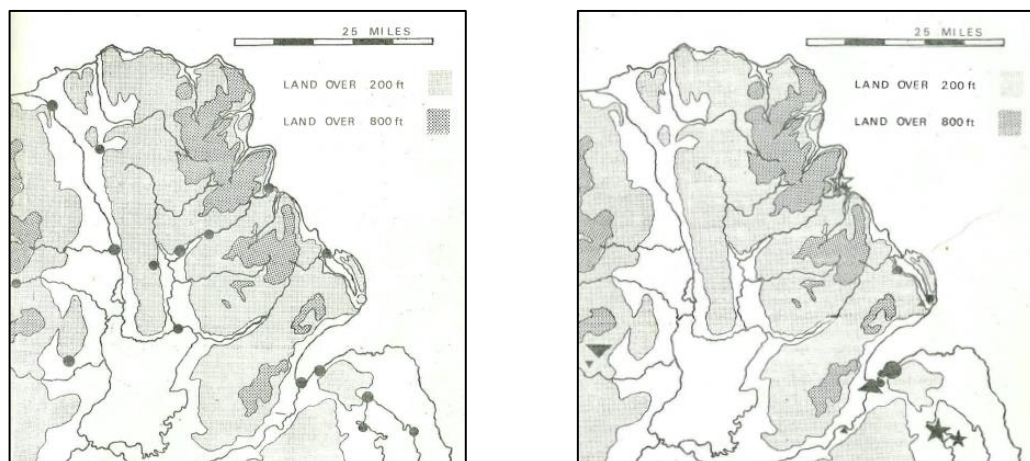


Figure 4.1: *Left*: Distribution map of the homes of collectors. Larger circles indicate multiple collectors in the same town. *Right*: Distribution map of the homes (larger symbols) and sites discovered (smaller symbols) (Woodman 1978, 3–4).

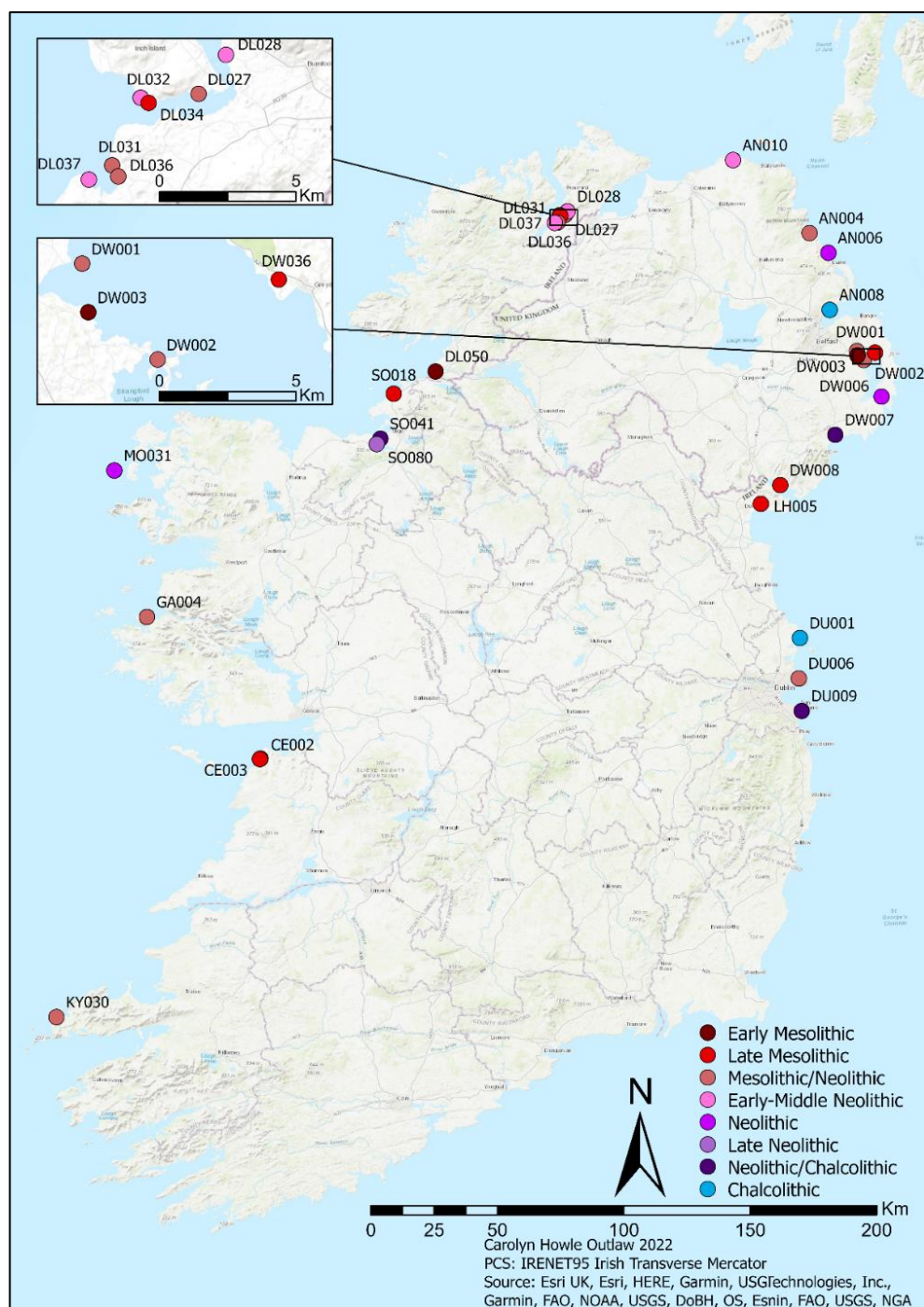


Figure 4.2: Distribution map of early prehistoric shell midden sites with rough estimates of dates. The inset maps show the clusters of sites at Lough Swilly, Co. Donegal and Strangford Lough, Co. Down.

4.2.2 Chronology

Radiocarbon analysis was applied to 28 of the 52 early prehistoric shell midden features (19 of the 31 shell midden sites). Many of the early prehistoric sites were

dated using multiple radiocarbon dates, averaging almost 3 dates per feature, though nine total samples from five sites were problematic (Figure 4.3).

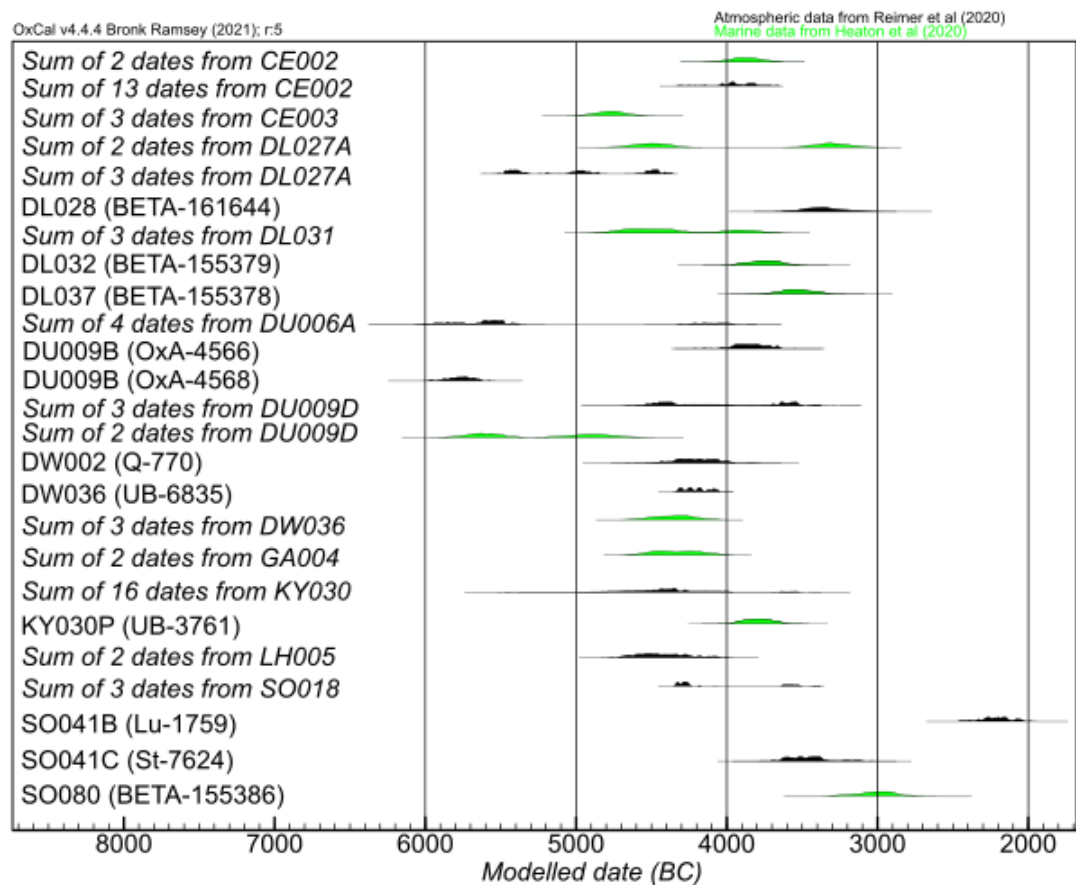


Figure 4.3: Radiocarbon dates of Mesolithic to Chalcolithic sites in alphabetical order by catalogue ID. Sum probabilities given where possible for sites with multiple dates. Marine calibrated dates shown in green.

The earliest date within the early prehistoric chronology is from a pig ulna found within the midden at Sutton, Co. Dublin (DU006A). This sample was dated to 7140 ± 100 BP; 6227–5803 BC (OxA-4449). Sutton contains evidence of other extremely early animal bones including that of cattle (discussed further in section 4.5.3). A bone from Kilnatierny, Co. Down (DW036) produced the youngest Mesolithic date of 5365 ± 36 BP; 4330–4054 BC (UB-6835), though many dates border between the traditional Mesolithic/Neolithic boundary. Most Neolithic samples fall before a hearth sample from Conor's Island, Co. Sligo (SO018) which dated to 4765 ± 38 BP; 3639–3381 BC (UBA-21143). One radiocarbon sample, however, did produce a Late Neolithic date. This came from an oyster sample from Tanregro West, Co. Sligo (SO080) which dated to 4710 ± 60 BP; 3276–2776 BC (BETA-155386). Only

one radiocarbon sample which could be recalibrated produced a Chalcolithic date: charcoal from Settlement 15, Co. Sligo (SO041B) dating to 3780±60 BP; 2454–2031 BC (Lu-1759). The site of Castle Espie, Co. Donegal (DW003) also produced a Chalcolithic date, though the raw date is unknown.

Artefactual inclusions were used to date 16 shell midden features on 15 sites. Diagnostic artefacts used for this purpose consist of Mesolithic lithics including microliths and butt-trimmed flakes, Neolithic pottery including Western Neolithic Ware, Neolithic lithics including leaf-shaped arrowheads, Chalcolithic Beaker Ware, and Chalcolithic lithics including barbed and tanged arrowheads. Stratigraphy was then used to date the remaining eight shell midden features on a total of two sites. Shell-bearing pits (DU006B) were found beneath the Mesolithic dated shell midden (DU006A) at Sutton, Co. Dublin. Seven of the shell midden features identified at Ferriter's Cove, Co. Kerry (KY030) were dated by association with other dated features from the Late Mesolithic through the Early Neolithic.

4.3 Key Case Studies

The following case studies were chosen due to their importance for interpreting early prehistoric shell midden sites. The first site, Fanore More, Co. Clare (CE003), is one of the best documented sites containing only Mesolithic evidence. The second site, Ferriter's Cove, Co. Kerry (KY030), was one of the first sites with Mesolithic evidence found in the south of Ireland. It also contains some of the earliest indications of contact with outside Neolithic farmers. The final site, Dalkey Island, Co. Dublin (DU009), also contains evidence from the Mesolithic and Neolithic, though it is unique in that it also contains a deposit which indicates Chalcolithic re-use of the site. The site also contains unique human remains deposition which aligns more with practices seen in late prehistory (Chapter 5).

4.3.1 Mesolithic Resource Use: Site 2, Fanore More, Co. Clare (CE003)

A distance of c.280m separates the Mesolithic deposit of Site 2, Fanore More (CE003) with the Mesolithic/Neolithic Site 1 along the same shoreline (CE002). This proximity may indicate that these two now disparate sites may have once been connected. The dating of Site 2, however, does seem to separate it from its neighbour by several centuries. The oldest date obtained from the Mesolithic/Neolithic site (CE002) was

5449±53 BP; 4025–3641 BC and the youngest date from the Mesolithic site (CE003) was 6314±37 BP; 4976–4586 BC (UBA-23428), both from limpet samples (Lynch 2017).

This shell midden is of moderate size compared to other Mesolithic shell midden features with a volume of 100m³. The site contained a small cache of chert flakes including clear diagnostic forms of the Late Mesolithic. Lithics of sandstone, shale, and flint were also uncovered including broad blades and ground stone axes. Environmental evidence suggests an abundance of pine forests nearby, though some of the charcoal analysed were also identified as birch and willow or poplar. Fruits and hazelnuts were also identified on the site. Both freshwater and marine fish were also being exploited at the site, indicating a nearby freshwater source. Shellfish on the site were primarily inter-tidal species which prefer hard substrates such as winkle and limpet along with some dog whelks, top shells, and mussels. The presence of oyster, scallop, and carpet shells, however, indicate some shallow to deep water harvesting from softer substrates as well (Lynch 2017).

Three shells are of particular interest to understanding Fanore More Site 2: three perforated cowrie shells (Figure 4.4). These shells had double perforation and Lynch has suggested they would have been worn as either strung beads or sewn onto garments. Lynch compares these shells to similar findings from the Mesolithic of Britain and the Continent (Lynch 2017, 26). If these shells were part of a shared idea between cultures, it indicates that interactions between the Irish and Europe were occurring far earlier than seen through the exchange of domesticates as seen at Ferriter's Cove, Co. Kerry (KY030) discussed below.



Figure 4.4: Perforated cowrie shells from Fanore More, Co. Clare Site 2 (CE003) (Lynch 2017, 26).

4.3.2 The Mesolithic/Neolithic Transition: Ferriter's Cove, Co. Kerry (KY030)

Ferriter's Cove, Co. Kerry (KY030) is one of the most important sites in Ireland for understanding the Mesolithic/Neolithic transition due to the inclusion of some of the earliest evidence of domesticated cattle on the island. This site finalised the paradigm shift that accepted a Mesolithic within Munster (Woodman *et al.* 1999, 153). The domesticated cattle bones indicated that Mesolithic hunter/gatherers of Ireland were not isolated or on the fringes of cultural changes but were in fact central to the spread of new ideas from overseas.

The site itself showed evidence of fishing, shellfish harvesting, meat processing, lithic knapping, and plant collection (Woodman *et al.* 1999, 125). Post holes around evidence of fires were interpreted as either wind breaks or drying racks. Such drying racks may have been used for drying or smoking the fish that was caught. The abundance of shells on the site may be left from the processing of shellfish for use of their meat as bait to catch these fish. The shellfish, however, may also have been eaten.

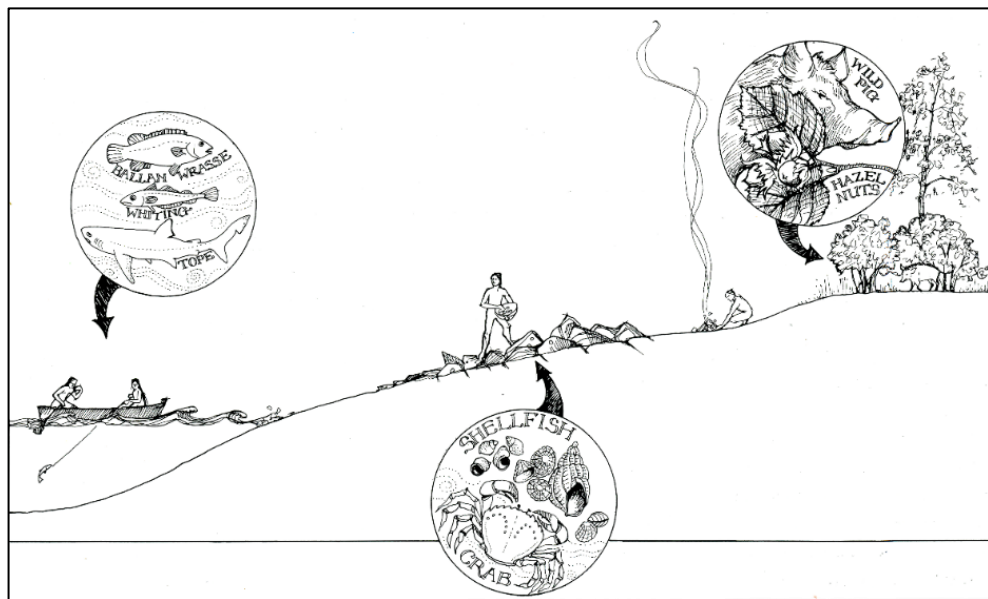


Figure 4.5: Reconstruction of resources available from the coast as evidenced by finds from Ferriter's Cove, Co. Kerry (KY030) (Woodman *et al.* 1999, 137).

The shellfish identified here were primarily inter-tidal species from hard substrates such as winkle (*Littorina littorea*), dog whelk (*Nucella lapillus*), and limpet (*Patella vulgata*). Cockle (*Cerastoderma edule*) and cowrie (*Travia monachia*) shells were the only non-intertidal species present, though the former can be found at or just below the low tide mark on or beneath rocks and may have been exposed during harvesting

of the primary species. No freshwater fish was identified at the site, though a few migratory fish such as salmon were identified. The evidence, however, points to a summer/autumn occupation, which may have been too early for the salmon runs. Other dietary evidence on the site included hare, bird, crab, and hazelnut shells (Figure 4.5).

Numerous lithics were identified at the site including polished stone axes which were made of greenstones, siltstones, rhyolites, volcanic tuffs, and some flint. A cache of the stone axes was identified in the Southern Area. Debitage and broken tools were used by Woodman to better understand the association with the different areas of activities on the site.

One thing that sets Ferriter's Cove apart from many other shell midden sites is the nature of the shell deposition. At least 22 individual shell midden features have been recorded at the site with the largest only measuring 1.1m². Woodman himself suggested that Ferriter's Cove was not a shell midden site due to the numerous activities evident at the site, though he does indicate that the size of the deposits is not the issue (Woodman and Milner 2013, 37). With the definition used in this thesis as presented in Chapter 3, neither the size nor the other activities taking place remove this site from investigation with other coastal shell midden sites. The horizontal deposition of numerous deposits primarily consisting of shells over a wide area is, in fact, seen as a similar phenomenon to larger features which show numerous vertical depositional occurrences.

4.3.3 Neolithic Ritual and Chalcolithic Re-use: Dalkey Island, Co. Dublin (DU009)

The site at Dalkey Island is a complex one with five distinct activity areas ranging in date from the Mesolithic to the Early Medieval. Areas labelled by the excavator as Sites II and V contained shell midden evidence. Deposition at both sites II and V would have begun in the Late Mesolithic. The activity in Site V stopped in the Early Neolithic while activity continued at Site II. Site V was again used during the Chalcolithic with the deposition of the 'Beaker shells' (Leon 2005, 18).

Prehistoric activity at Site II included a shallow trench, three pits, postholes, and a shell midden (DU010B). The midden produced radiocarbon samples dating to the Mesolithic, Neolithic, and Bronze Age. The artefacts identified within the midden primarily supported the Mesolithic and Neolithic activity. These included 'Larnian'

flints, polished stone axes, and Neolithic A pottery sherds (Liversage *et al.* 1968, 102–4). A perforated scallop shell was also noted which may have been used as a bead but may be naturally bored (Figure 4.6). A burial, labelled Burial II, was also identified within the shell midden. This was radiocarbon dated to 4340 ± 75 BP; 3334–2707 BC (BM-78). This included an almost complete skeleton of an adult male. The deposition of these remains occurred after the skeleton was dry, with no flesh on the bones. The skull was filled with winkle shells prior to the burial within the primarily limpet midden (Figure 4.6) (*ibid.* 103–4).

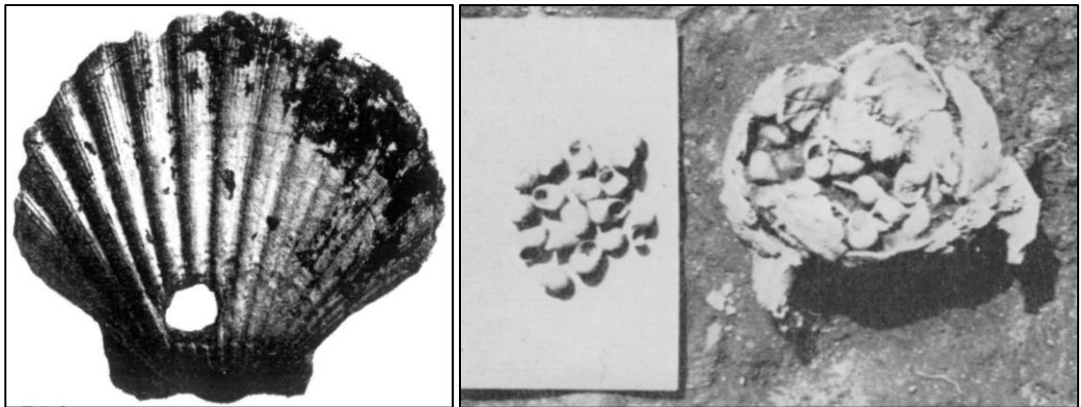


Figure 4.6: Left: Perforated scallop shell identified within the midden at Site II (DU009B) (Liversage *et al.* 1968, Plate XI). Right: Cranium of Burial II *in situ* containing winkle shells with a few shells removed (Leon 2005, 8).

Two shell middens were identified on Site V. The largest of the two (DU009D) contained ‘Larnian’ flints and again produced radiocarbon dates spanning the Mesolithic and Neolithic. Burial XVIII was dug into the midden and was refilled with midden material, though the dating of this burial is unclear and may be related to another grave, Burial XVII, which was not dug into the midden, but just above it. If this is the case, then both burials were most likely not placed there due to the presence of the shell midden itself. The smaller midden (DU009C) at Site V contained Beaker coarse ware pottery sherds along with shells, forming an oval patch of fragmented midden material (Liversage *et al.* 1968, 59–63). There does not appear to be activity at this site between the Early Neolithic and the Chalcolithic deposit.

The midden in Site II (DU009B) was primarily made up of limpets with winkles also present. These are both intertidal species that can often be found together on rock outcrops along the shore. Bones within the midden included a mixture of wild and domestic species including cattle, pig, sheep/goat, dog, fish, bird, seal, and bear. The

basal midden in Site V (DU009D) was also primarily made up of limpets (*Patella vulgata*), but a great deal more shell species were also recorded including both intertidal and shallow water species from both hard and soft substrates. The same bone remains were reported within this deposit as was recorded at Site II along with cetacean.

The combination of dog bones, a bead, and human remains, particularly with emphasis placed on the skull, is a recurring theme in shell midden related burials through much of late prehistory (Chapter 5). The appearance of all three of these inclusions within the midden of Site II (DU009B) may indicate the beginning of a symbolic way of thinking which spreads out from this area, or it may be a separate phenomenon with similar material remains unique to Dalkey Island.

4.4 Data

The following sections aim to present the available data collected concerning shell middens dating from the Mesolithic to the Chalcolithic. This includes potential associations, dimensional measurements, inclusions of fauna and flora, artefactual inclusions, and any human remains from within the shell middens themselves. The fauna and flora are separated into shells, bones, and plant remains. The data is briefly discussed here but will be further expanded upon in section 4.6.

4.4.1 Associations

One of the best ways to analyse the function of shell middens is to examine their relationships with structures, burials, and other monuments. There has only been a single substantial structure from the Late Mesolithic identified to date in Ireland. This was discovered along the Toome Bypass and does not inform interpretations of coastal activities (Woodman 2009, xlv). The only known Mesolithic burials are the cremations found along the River Shannon in Hermitage, Co. Limerick (Collins and Coyne 2003; Woodman 2009, xl). These remains are approximately 70km to the east of the nearest shell midden sites located on Scattery Island, Co. Clare (CE020, CE025). These sites have evidence spanning the Late Medieval to the Post Medieval along with a few undated deposits.

Only one firmly dated fish trap from the Mesolithic is known in Ireland. This wattle structure was discovered in the Liffey Estuary in Dublin city. The site lies

approximately 10m southwest of the shell midden site of Dalkey Island, Co. Dublin (DU009). Other potential Mesolithic fish traps have been identified at Newferry, Co. Antrim and Toomebridge, Co. Derry (McQuade and O'Donnell 2007, 581). Both of these sites are approximately 50km from the nearest shell midden.

There is some evidence of smaller structures through stakeholes and postholes at a few of the Mesolithic and transitional period sites. These, however, are usually quite insubstantial and may have constituted no more than wind breaks or temporary shelters. Such stakehole structures were identified at Ferriter's Cove, Co. Kerry (KY030) and were interpreted as either wind breaks or drying racks.

The Neolithic saw the emergence of house structures such as those found at Lough Gur, Co. Limerick and Corbally, Co. Kildare (Grogan 2002). The closest known Neolithic house structure to a Neolithic shell midden is 1.3km (NISMR ANT035:054 and AN006) in Ballygalley, Co. Antrim. One Mesolithic midden in Rush, Co. Dublin (DU001) is only 4.36km from a Neolithic house site (SMR DU008-110---), but it is doubtful that these are related given the dating evidence of the midden. Two Neolithic houses (SMR LH007-162 and LH007-172) also lie within less than 10km of the Mesolithic shell midden at Rockmarshall, Co. Louth (LH005). Again, this shell midden is most likely not contemporary with these structures, though there are undated shell middens at Rockmarshall as well. There is one further shell midden within 10km of a potentially contemporary structure. These sites are separated by approximately 8.1km at Rough Island, Co. Down (NISMR DOW005:082 and DW001).

The Neolithic also saw the emergence of megalithic monuments associated with the dead. Examples of such structures have been found within 1km of Neolithic shell deposits and one Mesolithic shell deposit. The Neolithic shell deposit in Tanreg West, Co. Sligo (SO080) lies 979m from an unidentified megalithic structure (SMR SL019-063----) and 839m from a court tomb (SMR SL019-135----). Two sites in Co. Antrim, Glenarm (AN004) and Portbradden Cave (AN010), are close to two different unidentified megalithic tombs, ANT029:099 and ANT090 respectively. The former is 598m away and the latter is 940m away. The Mesolithic shell deposit at Ballinran, Co. Down is found only 377m away from a court tomb (NISMR DOW054:012).

On shell midden sites themselves, burnt areas or hearths are some of the most common features identified. Nine sites contained such evidence and while only four of these also contained fire cracked rocks and another one contained burnt shells and bone; the fires were most likely used for food processing. Woodman suggested the

fires at Ferriter's Cove, Co. Kerry (KY030) were used for drying fish. Other uses include roasting meat and boiling shellfish to release meat for bait. The fires could have also been set simply to provide heat and light.

4.4.2 Dimensions

Thirty-nine (75%) shell midden features had at least one-dimensional measurement recorded (Table 4.3). The longest deposit measured 109.7m long; the widest measured 20m wide; and the thickest measured 1.5m thick. The shortest deposit measured 0.4m long; the smallest width was also 0.4m; and the thinnest deposit measured 0.01m. Both the largest area and volume was recorded at the site with the greatest length, Tullybeg, Co. Galway (GA004) with an area of 2007.5m² and a volume of 401.5m³. The smallest area and volume were also both recorded at the same site. One deposit at Ferriter's Cove, Co. Kerry (KY030D) had an area of 0.2m² and a volume of 0.02m³.

Sixteen shell midden deposits, 55% of the deposits with at least two recorded dimensions, meet the volume for large 'shell middens' proposed in Chapter 3 of 10m². Twelve deposits, or 60% of the deposits with three recorded dimensions, meet the volume boundary proposed of 2m³. Overall, 16 of 29 (55%) shell midden deposits with at least two recorded dimensions could be classified as large 'shell middens' with five of those that cannot be classified as such all recorded at the same site: Ferriter's Cove, Co. Kerry (KY030).

Catalogue ID	Length (m)	Width (m)	Thickness (m)	Area (m ²)	Volume (m ³)
AN004A	52	3	1.5	156	234
AN004B	52	3	0.5	156	78
CE002	7	2	0.1	14	1.4
CE003	20	20	0.3	400	120
DL027A	12	—	0.9	10.8	—
DL027B	0.7	0.4	0.4	0.3	0.1
DL028	33	—	0.6	19.8	—
DL031	80	10	0.4	800	320
DL032	25	5	0.2	125	25
DL034	17.5	—	—	—	—
DL036	100	—	—	—	—
DU001	—	—	0.2	—	—
DU006A	30	20	0.5	600	300
DU006B	1.6	1.6	0.4	2.6	1
DU009B	16	4.5	0.3	72	21.6
DU009C	4	1.5	0.1	6	0.6

Catalogue ID	Length (m)	Width (m)	Thickness (m)	Area (m ²)	Volume (m ³)
DU009D	6	4	0.2	24	4.8
DW001	8.3	8.1	0.2	67.2	13.4
DW002	—	—	0.6	—	—
DW003	10	10	—	100	—
DW006	1.8	—	0.2	0.4	—
DW036	4	0.8	0.2	3.2	0.6
GA004	109.7	18.3	0.2	2007.5	401.5
KY030A	0.6	—	—	—	—
KY030B	0.9	0.9	0.2	0.8	0.2
KY030C	—	—	0.1	—	—
KY030D	0.4	0.4	0.1	0.2	0.02
KY030E	2	0.6	—	1.2	—
KY030G	2	0.8	—	1.8	—
KY030H	0.5	—	—	—	—
KY030I	0.5	0.6	—	0.3	—
KY030L	—	—	0.01	—	—
KY030O	0.5	—	—	—	—
KY030P	—	—	0.2	—	—
LH005	18.3	10.1	0.9	1.8	1.6
SO018	12	—	0.3	3.6	—
SO041B	8.5	6	1	51	51
SO041C	8.5	6	1	51	51
SO080	10	—	0.5	5	—
TOTAL:	34	24	30	29	20
Average:	19.3	5.7	0.4	161.4	81.3

Table 4.3: Dimensional measurements available for shell midden features dating from the Mesolithic to the Chalcolithic. The total number of features with each measurement is given at the bottom followed by the average. All measurements have been rounded to the nearest tenth.

4.4.3 Fauna and Flora

Where the information is available shell, bone, and plant species of early prehistoric shell middens is presented below. Common English names are used here (see Chapter 2). Most species are in fact only identified to genus as and species groups such as fish and bird are presented together due to the infrequency that these are differentiated in the available texts. Where these species groups have been differentiated, the data is presented in relevant catalogue entries.

Shells

Winkle was the most common shell species identified in early prehistoric shell middens followed by limpet, mussel, and oyster (Table 4.4). Limpets, winkles, and

mussels can be harvested from rocky shorelines during low tide. Oysters are also found attached to hard substrates, though they are not tidal and may have required the use of technologies for dredging, sailing, or swimming and diving. However, some oysters can be harvested in the shallow waters of low tide. Other species found regularly include four species which can be found in similar conditions to the limpet, wrinkle, and mussel. Cockles and scallops are instead found in sandy environments. Cockles can be found buried in the sand along the shore at low tide. Scallops are typically found further afield, in the nearshore or even offshore areas.

Most of the species are consistent through both time and space, but the oyster is only found as a dominant species at northern sites (Figure 4.7). The oyster is known to be a primary species in more southern sites in later periods and is found within early prehistoric shell middens in Dublin (DU006A and DU009D). It is possible that the technology for fishing oysters in the nearshore or offshore was more prevalent in the north, or there was a cultural preference for this species.

Sixteen shell midden deposits also contained minor species, or species seen in five or fewer total deposits during this time. The most common of these include carpet shells (found within six deposits), freshwater shells (found within four deposits), razor shell (found within four deposits), and clam (found within four deposits). Razor shells along with ocean quahog (found in two deposits) and rayed artemis (found in one deposit) are also recorded as a dominant species. Razor shells are dominant within Greenisland, Co. Antrim (AN008); ocean quahog and rayed artemis were both dominant in Glenarm, Co. Antrim (AN004A). Sting wrinkle (1) cowrie (1) land snails (1) [check that ensis silqua is a razor shell and what is Tellina tenuis or Turbonilla crenata?]

ID	<i>Littorina littorea</i>	<i>Patella vulgata</i>	<i>Mytilus edulis</i>	<i>Ostrea edulis</i>	<i>Nucella lapillus</i>	<i>Cerastoderma edule</i>	<i>Pecten</i> sp.	<i>Littorina obtusata</i>	<i>Gibbula</i> sp.	<i>Buccinum undatum</i>	Other/ Unidentified
AN004A	D	—	—	—	—	—	—	—	—	—	D
AN004B	D	D	—	D	—	—	—	—	—	—	—
AN006	D*	D*	—	—	—	—	—	—	—	—	—
AN008	—	D	—	D	—	—	—	—	—	—	D
AN010B	X	X†	X	—	X	—	X	X	X	—	—
CE002	D†	D†	—	—	D†	—	—	X†	X†	—	X
CE003	D†	D†	X†	—	X†	—	X†	—	X†	—	X
DL027A	X†	—	X†	D	—	—	—	—	—	—	X
DL027B	—	—	—	D†	—	—	—	—	—	—	—
DL028	D	X	X	X	X	X	X	X	X	D	X
DL031	D†	—	—	D†	—	—	D†	—	—	—	D†
DL032	X†	—	—	D†	—	—	—	—	—	—	—
DL034	—	—	—	—	—	—	—	—	—	—	/
DL036	—	—	—	D	—	—	—	—	—	—	—
DL037	—	—	—	D†	—	—	—	—	—	—	—
DL050	—	—	—	—	—	—	—	—	—	—	/

ID	<i>Littorina littorea</i>	<i>Patella vulgata</i>	<i>Mytilus edulis</i>	<i>Ostrea edulis</i>	<i>Nucella lapillus</i>	<i>Cerastoderma edule</i>	<i>Pecten</i> sp.	<i>Littorina obtusata</i>	<i>Gibbula</i> sp.	<i>Buccinum undatum</i>	Other/Unidentified
DU001	D‡	X‡	X‡	—	—	—	—	—	—	—	—
DU006A	X†	X	X	X†	X	X†	X†	X	X†	X	X
DU006B	—	—	—	—	—	—	—	—	—	—	/
DU009B	X‡	D‡	—	—	—	—	X‡	—	—	—	—
DU009C	—	—	—	—	—	—	—	—	—	—	/
DU009D	X	D	X*	X^	X	X	X	X	X^	—	—
DW001	X	X	X	D	X	X	X†	X	—	X	X
DW002	D	X	X	X†	—	X	—	X†	—	X	X
DW003	—	X*	X*	D*	—	—	—	—	—	—	X
DW006	D*	D*	—	—	—	—	—	—	—	—	—
DW007	—	—	D*	—	—	—	—	—	—	—	—
DW008	—	—	—	D*	—	—	—	—	—	—	—
DW036	D	X*	X	D†	X	X	X†	X	X†	X	X
GA004	D	X*	—	—	X	—	—	—	—	—	—
KY030A	D	D	X	—	D	—	—	—	—	—	—
KY030B	D	X	X	—	X	—	—	—	—	—	—
KY030C	X	X	X	—	D	—	—	—	—	—	—
KY030D	D‡	—	D‡	—	D‡	—	—	—	—	—	—
KY030E	D	X	—	—	D	—	—	—	—	—	—
KY030F	D‡	D‡	—	—	—	—	—	—	—	—	—
KY030G	X	D	X	—	X	—	—	—	X	—	X
KY030H	D‡	X‡	—	—	—	—	—	—	—	—	—
KY030I	D	X	—	—	X	X‡	—	—	—	—	—
KY030J	X	X	X	—	D	—	—	X	—	—	X
KY030K	X	D	—	—	D	D	—	—	—	—	—
KY030L	D‡	—	—	—	—	—	—	—	—	—	—
KY030M	—	—	—	—	—	—	—	—	—	—	/
KY030N	—	D	—	—	—	X	—	—	—	—	—
KY030O	X	D	X	—	X	X	—	—	—	—	—
KY030P	D‡	X‡	—	—	—	X	—	—	—	—	—
LH005	X	X	X	X†	X	X	X†	—	X	X	X
MO031	—	—	—	—	—	—	—	—	—	—	/
SO018	D	X	X*	D	—	D	—	X	X	—	X
SO041B	X*	X*	X*	D*	—	X*	X*	—	—	—	—
SO041C	X*	X*	X*	D*	—	X*	X*	—	—	—	—
SO080	—	—	—	D‡	—	—	—	—	—	—	—
TOTAL:	37	34	23	21	21	15	12	10	10	6	23
Dominant:	22	14	2	16	7	2	1	0	0	1	3

Table 4.4: Shell species identified in Early Prehistoric shell midden deposits. X indicates the species is present. D indicates that a species was dominant. Under the column 'Other/Unidentified,' X indicates a known shell species other than those listed and / indicates unidentified species. * indicates the genus is known, but the species is not. † indicates that the species listed is present along with similar species (for instance, *Ostrea edulis* (common oyster) and *Anomia ephippium* (saddle oyster) are both present at DY006A). ‡ indicates that only vernacular names are used in available sources and scientific species are assumed. ^ indicates that a similar species is found instead of the more common species listed (for instance, *Anomia ephippium* (saddle oyster) was reported at DU009D, but *Ostrea edulis* (common oyster) was not).

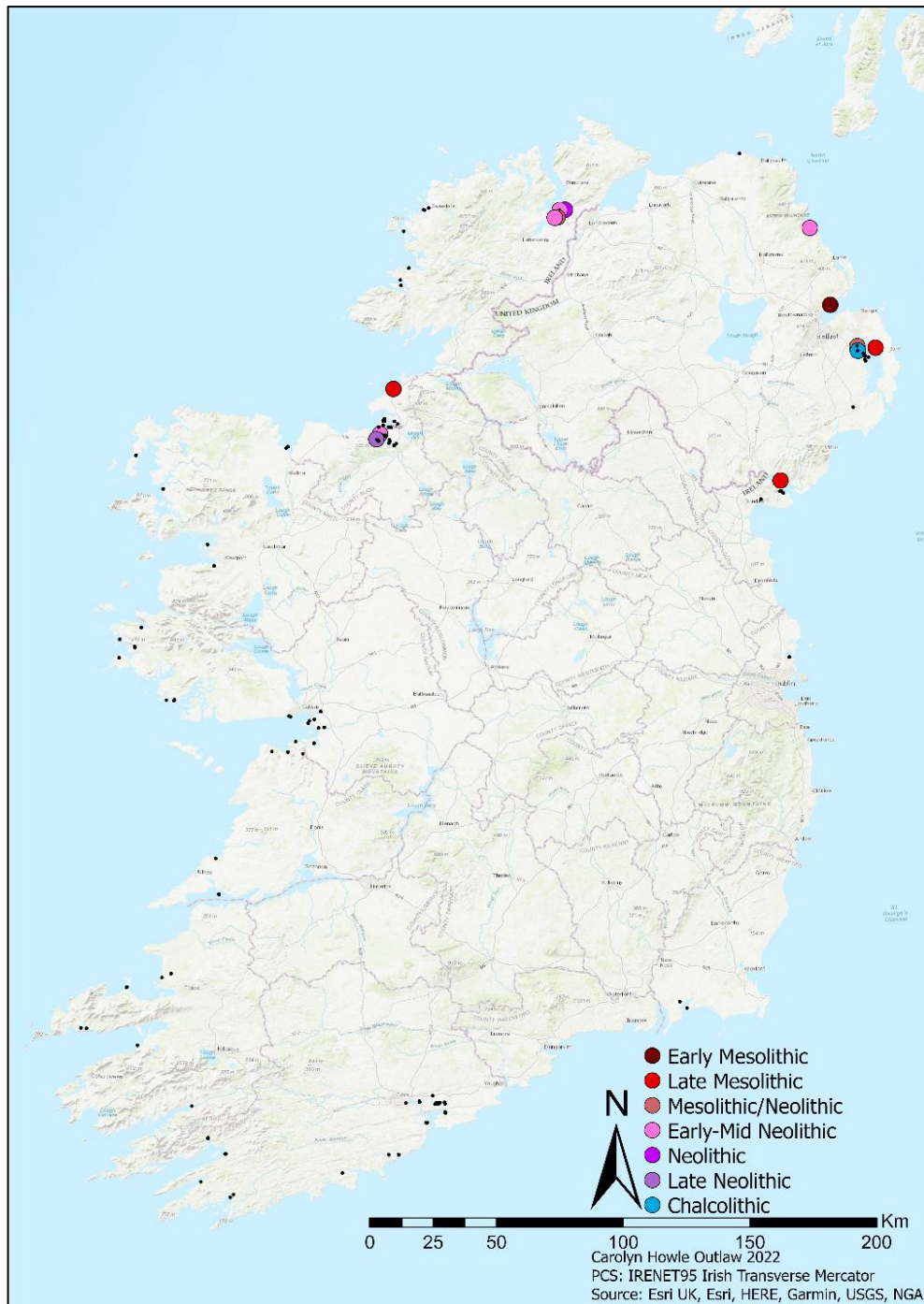


Figure 4.7: Distribution map showing all shell middens containing oyster as a dominant species. Early prehistoric shell middens are indicated by large circles while all other oyster middens are indicated by black dots.

Bones

Twenty-five (48%) of early prehistoric shell midden deposits contained animal bone (Table 4.5). Where reported, fish are the most common bones identified within these deposits. When the fish were recorded to species, they included examples of wrasse,

breem, cod, pollack, tope, mullet, salmon, haddock, herring, and other primarily marine species. Pig was also a frequent species identified. This is not surprising given that native wild pig was a sustainable food source prior to domestication (Woodman 1978, 135, 2009, xl; Edwards and Bradley 2009, 218).

Eleven of the shell midden deposits also contained less frequent species including horse, crab, hare, rabbit, cetacean, bear, and seal. The rabbit evidence from Rough Island, Co. Down (DW001) was most likely intrusive as rabbits were not yet introduced to Ireland. The horse at Dundrum, Co. Down (DW007) is among the earliest evidence of this species (see McCormick 2007, 86).

Catalogue ID	Fish	Pig	Cattle	Bird	Sheep/Goat	Deer	Dog	Other/Unidentified
AN004A	—	—	D	—	—	D	—	—
AN004B	—	D	D	—	D	—	—	—
AN008	—	—	—	—	—	—	—	D
AN010B	D	X	X	X	X	X	—	X
CE002	D	—	—	—	—	—	—	—
CE003	D	—	—	—	—	—	—	X
DL027A	X	X	—	X	—	X	X	—
DL027B	—	—	—	—	—	—	—	/
DL028	—	—	D	D	—	D	—	—
DU006A	X	X	X	X	—	X	X	X
DU009B	D	D	D	X	D	—	X	X
DU009D	D	D	X	D	X	—	D	D
DW001	—	D	D	—	—	—	—	D
DW002	—	D	D	—	D	—	—	—
DW007	—	X	X	—	X	X	X	X
DW036	D	D	—	—	—	—	—	X
KY030C	D	—	—	—	—	—	—	—
KY030E	D	—	—	—	—	—	—	—
KY030I	D	—	—	—	—	—	—	—
KY030K	—	—	—	—	—	—	—	/
KY030P	D	X	—	X	—	—	—	—
LH005	D	—	—	—	—	—	—	X
MO031	—	—	—	—	—	—	—	/
SO041B	—	D	—	X	—	—	—	X
SO041C	—	X	D	—	—	—	—	—
TOTAL:	13	13	11	8	6	6	5	14
Dominant:	11	7	7	2	3	2	1	3

Table 4.5: Bone species identified in Early Prehistoric shell midden deposits. Fish and bird are not differentiated to species. X indicates the species is present and D indicates that a species was dominant within the deposit. Under the column 'Other/Unidentified,' X indicates a known bone species other than those listed and / indicates an unidentified species. All species which are present within five or more deposits are listed.

There are a few Mesolithic sites that contain non-native species which may be problematic. As previously noted, the oldest domestic cattle bones in Ireland were found at Ferriter's Cove, Co. Kerry (KY030), though they were not identified directly within a shell midden feature. Woodman also dated another cattle bone from Sutton, Co. Dublin (DU006A) which originally returned a date of 6660 ± 80 BP; 5716–5477 BC (OxA-3691). This date was so old that they chose to run the sample again, returning a similar date of 6560 ± 75 BP; 5628–5373 BC (OxA-3960). This is an early date for any Western European domesticated cattle (*Bos taurus*) which may indicate that the bone was from a non-domesticated (*Bos primigenius*) from the continent (Woodman *et al.* 1997, 144). Another early deposit which reported cattle remains was the early occupation evidence excavated in Glenarm, Co. Antrim (AN004). While this has not been radiocarbon dated, the excavation was one of the earliest scientific excavations on the island and the deposit contained many Late Mesolithic tools (Movius *et al.* 1937). This could indicate that there are three early cattle remain sites related to shell midden deposits in Ireland.

The deer are another potentially problematic occurrence in Mesolithic deposits. For quite some time, the red deer was considered to be a typical mammal during the Mesolithic period (Woodman 1978, 135), but evidence has since shown that the red deer, while originally native to Ireland, was not present when humans first migrated to the island. They may have been reintroduced during the Neolithic or as late as the Bronze Age (Edwards and Bradley 2009, 218; Woodman, P. 2009, xxxix). Two Mesolithic sites with reported deer remains also produced reported cattle remains: Glenarm, Co. Antrim (AN004) and Sutton, Co. Dublin (DU006). The deer bones were not radiometrically dated and may have been intrusive, but another excavation may also be possible. The suggestion that the cattle remains in Sutton were from a wild animal may support the presence of another wild animal from the continent, such as the deer, being brought over as well. The third site with evidence of red deer remains is Baylet, Co. Donegal (DL027). This is another well-dated site, but the red deer was reported by Harte in 1866 and may have not been directly related to the midden as suggested (Harte 1866, 156–7).

Plant Remains

Thirty (58%) early prehistoric shell midden deposits contained charcoal. Six of these also contained hazelnut shells. The evidence of fruits present at Fanore More, Co. Clare (CE003) were the only other plant evidence present. Hazelnuts are known as a common resource during the Irish Mesolithic and their inclusion within the shell deposits of this period fits well within what is already known of the use of this resource. The presence of charcoal is also not surprising given the evidence of pyrolithic technologies being used at the shell midden sites and the need for fires for warmth and light regardless of the cooking strategies employed.

4.4.4 Artefacts

The most common artefacts found in early prehistoric shell midden deposits were lithics (Table 4.6). These included microliths, butt-trimmed flakes and other broad-blade technologies, Neolithic implements including leaf-shaped arrowheads, and barbed and tanged arrowheads associated with the Chalcolithic. Nondiagnostic lithics were also reported including scrapers. Debitage and cores were also identified within some of the deposits, potentially indicating lithic working taking place on site. Stone axes, ranging from early hand axes to ground stone axes and the polished stone axes typical of the Neolithic, were also identified along with a few axe roughouts. These roughouts also may indicate stonework taking place on site. Other stone artefacts identified included hammerstones, rubbing and polishing stones, and elongated pebbles. Fire cracked rocks were also quite common, being found within 15 deposits, indicating the use of pyrolithic technology on these sites. Nine deposits contained ceramics. These included Neolithic sherds such as Western Neolithic ware as well as Beaker ware sherds. Ballymoney, Co. Donegal (DL031) contained urn-like sherds which appeared more Bronze Age, though the primary sherds at this site were Neolithic. Bronze artefacts were also recorded at the Neolithic/Chalcolithic site of Dundrum, Co. Down (DW007) which may relate to use of this site during the Bronze Age. Other artefact identified include bone objects and shell beads.

ID	Lithics	Stone Axes	Stone(other)	Ceramics	Bone	Shell	Metal*
AN004A	flakes; core	—	—	—	objects	—	—
AN004B	flakes; cores	—	—	—	—	—	—
AN008	flakes	—	—	—	—	—	—

ID	Lithics	Stone Axes	Stone(other)	Ceramics	Bone	Shell	Metal*
AN010B	flakes	hand axes	—	—	—	—	—
CE002	flakes; cores	ground; roughouts	rubbing; fcrs	—	—	—	—
CE003	flakes	ground; roughouts	rubbing; hammer; fcrs	—	—	beads	—
DL027A	flakes	ground	fcrs	Western	—	—	—
DL027B	flake	—	—	sherds	—	—	—
DL028	flake	—	—	—	—	—	—
DL031	flake	—	fcrs	urn sherd*; sherds	—	—	—
DL034	flakes; cores	—	—	—	—	—	—
DL036	debitage	—	—	—	—	—	—
DL050	flakes	polished	hammer	sherds	—	—	—
DU001	flake	—	—	—	—	—	—
DU006A	flakes; cores; debitage	polished	elongated; fcrs	—	—	—	—
DU009B	flakes; core	polished	elongated; hammer	sherds	—	bead	—
DU009C	flakes; cores; debitage	—	—	Beaker	—	—	—
DU009D	flakes; cores	ground; polished	elongated; hammer; polishing; fcrs	—	—	—	—
DW001	flakes	—	—	Western	—	—	—
DW002	flakes	—	—	—	—	—	—
DW006	flake	—	—	—	—	—	—
DW007	flakes; cores	polished	hammer	sherds	object	—	bronze pins; bronze ornaments
DW036	flakes; debitage	—	—	—	—	—	—
KY030B	—	—	fcrs	—	—	—	—
KY030C	flakes	—	fcrs	—	—	—	—
KY030E	flakes; cores	—	fcrs	—	—	—	—
KY030G	—	—	fcrs	—	—	—	—
KY030H	—	—	fcrs	—	—	—	—
KY030I	flakes; debitage	—	fcrs	—	—	—	—
KY030K	—	—	fcrs	—	—	—	—
KY030L	flakes	—	—	—	—	—	—
KY030O	flakes; cores; debitage	—	elongated	—	—	—	—
KY030P	flakes	—	elongated; hammer	—	—	—	—
LH005	flakes	—	elongated; fcrs	—	—	—	—
MO031	flakes	—	fcrs	sherds	—	—	—
SO041B	cores; debitage	—	—	—	—	—	—
SO041C	cores; debitage	—	—	—	—	—	—
TOTAL:	33	9	20	9	2	2	1
Summary:	30 flakes; 13 cores; 8 debitage	1 hand axes; 4 ground; 5 polished; 2 roughouts	6 elongated; 2 rubbing; 6 hammer; 1 polishing; 15 fcrs	2 Western; 1 urn sherd; 1 Beaker; 6 sherds	2 objects	2 beads	1 bronze pins; 1 bronze ornaments

Table 4.6: Artefact types found within early prehistoric shell midden deposits.
* indicates artefacts typical of later periods.

4.4.5 Human Remains

Human remains were found within three shell deposits: Dalkey Island, Co. Dublin (DU009B), Dundrum, Co. Down (DW007), and Ferriter's Cove, Co. Kerry (KY030C). The jawbone found within the deposit at Dundrum has the least amount of dating evidence for the bone itself and no other information is known concerning the bone. The burial at Dalkey Island was discussed in detail previously and consisted of an almost complete skeleton of an adult man. Likewise, the human remains at Ferriter's Cove consisted of adult human bones, though the skeleton was not as complete perhaps due to more disturbance than seen at Dalkey Island or perhaps due to different post-mortem treatment of the remains. The remains at Ferriter's Cove did include teeth, perhaps suggesting that at least part of the skull was present, the part of the body symbolically differentiated at Dalkey Island through the inclusion of winkle shells within it. Both the Dalkey Island and Ferriter's Cove remains were radiocarbon dated. The former dated to the Neolithic and the latter to the Mesolithic/Neolithic.

4.5 Broad Patterns and Discussion

It has long been assumed that shell middens were a site type of the Mesolithic and were less common during other periods (see Milner and Woodman 2007). The chronological patterns of known sites, however, indicates that even though shell middens did occur during the Mesolithic, specifically the Late Mesolithic, the depositional activity remained constant until the Late Neolithic. Around 3500 BC, almost 1500 years after the transition to the Neolithic is traditionally marked, is the first decline in shell midden deposition noted in the data. This may coincide with cultural shifts brought in around the Late Neolithic/Chalcolithic that we have yet to fully realize.

The general lack of Early Mesolithic shell deposit activity fits well with what is known about the earliest settlement patterns and resource use in Ireland. The Early Mesolithic peoples tended to settle closer to fresh water sources further inland from the sea. Their use of the coast was limited, and shellfish seem to have been a rare if non-existent part of their diet. This changed across the island in the Late Mesolithic when settlements moved closer to the coastline and coastal resource use increased. The high volume of shellfish along with a reliance upon marine fish species emphasize the

shift to coastal resource use. This may be more related to a lack of evidence for the Early Mesolithic rather than a true shift and further research is required.

The shift to coastal diets on the continent and in Britain at this time may have influenced the move in Ireland without extra internal pressures. Flannery (1969; 1986) suggested there may have been population pressures which required a broader exploitation of resources in the landscape. There is evidence for early contact with those outside of the island in the form of early cattle remains, both domestic and perhaps wild. After this contact, Ireland eventually adopts farming practices as well. This change in resource exploitation after influence from abroad may best support a theory of acculturation; if a culture can change its diet due to acculturation during the Mesolithic/ Neolithic transition, why can this influence not also have caused a shift during the Early Mesolithic/ Late Mesolithic transition. Given that there is evidence for contact with farmers from abroad at some of the middens prior to the adoption of farming on the island, the former theory may be the most supported as we do have evidence of the Irish inhabitants changing their resource exploitation strategies after contact with other groups.

Throughout this period, the middens contain similar shell species (though there is a northern bias for the primary use of oyster) as well as similar faunal, flora, and artefactual remains. There are intra-site differences, but not on a scale that would suggest vast cultural shifts. Ferriter's Cove, Co. Kerry (KY030) is made up of many smaller shell deposits whereas Glenarm, Co. Antrim (AN004) is made up of two large middens. They still both contained early cattle remains, numerous shell species, and artefactual evidence spanning the Mesolithic/ Neolithic transition. These similarities are also not spatially affected as the former site is the most southern deposit of the time and the latter is one of the most northern.

One of the interesting differences between the Neolithic and Mesolithic sites is the proximity to potentially permanent dwellings for agricultural purposes. Studies have shown that site-tethered foragers will travel a maximum distance of 10km per day with most cultures foraging approximately 5km a day (Marín Arroyo 2009, 32; Kelly 2013, 96–7, 220, 284). With more research into shell deposits and their dates, this pattern may be further explored. If this trend is proven through further research, it may be analysed in comparison with the Mesolithic tradition of base camps and coastal foraging, though we have even less evidence of these earlier campsites.

With only a few shell middens close to megaliths, no direct correlation between these sites can be drawn. It is important to note, however, that shell midden sites were not isolated from the cultural environment of the period and were not as marginal as some have suggested (Chapter 2), even during the Neolithic period of new technologies and dietary additions.

There were a few inclusions within early prehistoric shell midden that were notably unusual. This includes the perforated shells from Fanore More, Co. Clare (CE003) and Dalkey Island, Co. Dublin (DU009B) and the inhumation at Dalkey Island (DU010D). Perforated shells are often associated with burial traditions and may be related to the same tradition which saw the burial at Dalkey Island, as discussed above. If further detailed analysis of shell deposits on the island uncovers artificially pierced shells from the Mesolithic, Neolithic, or Chalcolithic, their cultural significance may be determined. The three pierced shells from Fanore More have been interpreted as further evidence of contact with Britain and the continent.

The most substantial shell midden sites show evidence of use through the Mesolithic/Neolithic transition. The practice of shell foraging was not uniquely pre-agricultural and remained part of the Irish way of life at least until approximately 3500 BC. Shell midden deposition began anew, but with some varying cultural factors affecting the use of the sites during the Bronze Age (Chapter 5).

Chapter 5: Shell Middens in Later Prehistoric Ireland

Introduction

This chapter describes Irish shell middens dating from the Bronze Age and Iron Age, during the later prehistoric period in Ireland. The Bronze Age is defined here as 2100–500 BC and the Iron Age is defined as 500 BC–400 AD. Due to the relatively low number of shell middens from those periods, as discussed below, the traditional splitting of the periods in Early, Middle, and Late is not applied as no discernible patterns would be evidence at that scale. The chapter starts with an overview of the archaeological research history of the time period in general which includes descriptions of why the aforementioned date ranges were chosen. This overview is followed by a history of recording and study of later prehistoric shell middens primarily through surveys and excavations. The distribution and chronology of the later prehistoric shell middens is then addressed. This is followed by key case studies of significant sites. The data gathered in the collation of information for these sites is then presented. Finally, conclusions are suggested based upon the data presented including distribution, chronology, and ecofact and artefact associations. This is achieved with the understanding that the use of secondary sources, as discussed in the history of study, may have biased the data available.

5.1 A History of Research

The Bronze Age and Iron Age were first established in Ireland as part of the ‘Three Age System’ with Worsaae’s address to the Royal Irish Academy in 1846. This address was published in 1847 and was followed by his English translation of *The Primeval Antiquities of Denmark* in 1849. The latter discussed some Irish finds with respect to this chronological system (Worsaae 1846, 1847, 1849; Waddell 1998, 1). The inclusion of Ireland within the discussion of European artefact chronologies was encouraged by the antiquarians who focused on the island.

As stated in Chapter 2, the study of shell middens in Ireland began with antiquarians in the nineteenth century. These antiquarians were primarily based in the north of the island where raised beaches, coastal caves, and large expanses of dunes attracted artefact seekers such as Knowles, Windle, and Hassé. Knowles also worked along the

sandhills of the western coastline and Brunicardi reported a few sites in the south during her master's thesis at University College Cork.

Metal objects, which define the later prehistoric period, were often specifically sought after by antiquarians and collectors alike. This has led to the discovery of many shell middens dating to the Bronze Age and Iron Age. As further research goes into these sites, a better understanding of the role of coastal resources within these periods is helping to fill the gaps existing in our knowledge of the Iron Age in particular.

5.1.1 A Brief Overview of Later Prehistoric Chronology

Calendrical dates were first applied to Britain and Ireland's Bronze Age by Montelius in 1908, beginning his discussion with the Copper Age at around 2500–1000 BC and ending the Bronze Age at approximately 800 BC (Montelius 1908, 162). Not long after this publication, Coffey then shifted the Copper Age to 2000–1800 BC and ended the Bronze Age in 250 BC (Coffey 1913, 4–5). In 1937, Mahr gave an address to the Prehistoric Society concerning the chronology of Irish prehistory. Here, he defined the Bronze Age through the use of megaliths as 2100–900 BC or 400 BC (Mahr 1937, 395–6). Mahr does clarify his estimation of the end of the Bronze Age/beginning of the Iron Age later in his address as c.600 BC, a date still largely accepted in modern research (*ibid.* 412). These periods were all based upon cross dating and typologies of metals and ceramics until radiocarbon dating became a more widespread practice. These typologies often disagreed due to differences in depositional patterns (Fokkens and Harding 2013). One of the most recent discussions of the typo-chronological phases of the Bronze Age defines the period in Britain and Ireland as occurring in 2150–800/600 BC (Roberts 2013).

For many years, the end of the Irish Bronze Age and beginning of the Iron Age consisted of a hiatus in the archaeological record. More recent discoveries move to partially address this gap between 700–400/300 BC (Becker 2009, 358). This research bridging the periods is why, as mentioned in the chapter's preamble, the Bronze Age is described as ending in c. 500 BC for the purpose of this study.

The Irish Iron Age can be a difficult period to see in the archaeological record because it is generally aceramic, had less monumental structures overall, and the defining metalwork is often too corroded to be identified to a specific period. The first detailed accounts of the Iron Age was published by Armstrong in 1924 (Waddell 1998,

3) when he defined the period as beginning around 650 BC through to the ‘Early Christian Period,’ though the latter is not defined (Armstrong 1924, 1–3). The end of the Iron Age is still typically marked by the coming of Christianity and literacy into Ireland (Waddell 1998, 288). The date of 400 AD is historically applied to this shift (*ibid.* 4). Thanks to the increased excavations and dating programs brought on by commercial archaeology particularly in the late 1990s–mid 2000s, the picture of the Iron Age is less enigmatic than before, as described in Raftery’s seminal work, *Pagan Celtic Ireland* (1994).

The Iron Age has been split, like the Bronze Age, into three categories by many modern researchers: the Early Iron Age, the Developed Iron Age, and the Late Iron Age. The Early Iron Age is a somewhat transitional period between Bronze Age activity and the emergence of iron working technologies in Ireland; this is often defined as c. 700–400 BC (Becker *et al.* 2008). The Developed Iron Age is used to define the period more clearly for the purposes of this study to c. 500 BC. This stage of the period is often defined as c. 400 BC–1 AD when there is an obvious increase in Iron Age settlement sites and iron technology, including the characteristic La Tène material culture (Raftery 1994, 163; Armit and Ginn 2007, 136; Becker *et al.* 2008; Becker 2009, 170). Finally, the Late Iron Age includes the first appearance of Roman material culture in Ireland and brings the period as a whole to a close c. 400 AD with reduced archaeological evidence of activity (Becker *et al.* 2008; Cahill Wilson 2014).

5.1.2 A History of Survey and Excavation

Five later prehistoric shell midden sites were discovered by antiquarians between 1871 and 1913, all of which were researched further in later years (Table 5.1). In 1837, one shell midden was recorded by the Ordinance Survey of Ireland in Culleenduff, Co. Sligo (SO058). One shell midden was similarly recorded in the Topographical Files of County Galway in 1951 at Seaweed Point (GA050). Informants reported a site in Doonloughan, Co. Galway (GA027) in 1963 and a site in Ballymulholland, Co. Derry (DY002) in 1984. Seven shell midden sites were identified through archaeological survey, one was first reported during a dating programme, and five were uncovered through archaeological excavations. Only one of these excavations, at Doolin Pier, Co. Clare (CE011), took place for commercial reasons. Four later prehistoric shell midden sites were not investigated further after discovery. The most recent research took place

in 2019–20 when the author undertook surveys of three known sites including Poul Gorm, Co. Cork (CO030), Doonloughan, Co. Galway (GA027), and Coney Island, CO. Sligo (SO027).

Catalogue ID	Method of Discovery	Further Research
AN002	Excavation 1933-4	Re-analysis 2015
AN012	Antiquarian 1871	Excavation 1885-91 1927
AN013	Excavation 1936	Re-analysis 2015
AN014	Excavation 1934	Re-analysis 2015
CE011	Commercial 2012-4	—
CO030	Antiquarian 1913	Excavation 1985 Survey 2019
DL019	Survey 1941	Survey 1980s
DY002	Informant 1984	Survey 1984 Excavation 1984
DY006	Antiquarian 1888	Antiquarian 1889 1901 Excavation 1948
GA005	Survey 2003	Excavation 2006
GA022	Antiquarian 1901	Informant 1986 Survey 1992
GA027	Informant 1963	Survey 1986 1988, 2005, 2020 Excavation 1992
GA032	Antiquarian 1901	Survey 1984 Dating 1992
GA050	Topo File 1951	Survey 1973 1983 Dating 1973
GA069	Excavation 1992-5	—
KY023	Survey 1986	Dating 2002
KY050	Survey 1996	—
SO025	Dating 2001	Construction 2003
SO027	Survey 2015	Survey 2020
SO028	Survey 2009	—
SO041	Survey 1979	Excavation 1980-1
SO058	Map 1837	Dating 2007

Table 5.1: Method of discovery and further research of later prehistoric shell midden sites. For more information for each site see Table 5.2.

5.2 The Archaeology of Later Prehistoric Shell Middens

A total of 43 individual shell midden features from 23 shell midden sites date to later prehistory in Ireland (Table 5.2). Only one site with a potential later prehistoric date is not considered here due to the amount of uncertainty surrounding the dating. The shell midden site of Tievebane, Co. Donegal (DL026) produced a Bronze Age radiocarbon

date from an oyster shell, though Mesolithic and Neolithic flints from a nearby field were described as remnants of the midden.

Within the next two sections, the distribution and chronology of later prehistoric shell midden sites will be addressed. The coordinates used for site distribution is based up the National Monuments Services of Ireland and Northern Ireland where available. The chronology is based upon radiocarbon dates and artefactual inclusions cited in the available records.

Site Name, Townland	County	SMR	Catalogue ID	Date	Date LOC
Potter's Cave, Ballintoy Demesne	Antrim	ANT004:014	AN002D-I	8th c. BC–5th c. AD	B/C
White Park	Antrim	MRA001:035	AN012A	Bronze Age	C
Boat Cave, Ballintoy Demesne	Antrim	ANT004:008	AN013B	1st–4th c. AD	B
Chimney Cave, Ballintoy Demesne	Antrim	MRA002:005	AN014A-E	Bronze Age	C
Doolin Pier, Ballaghaline	Clare	CL008A006	CE011D-E	8th c. BC–5th c. AD	B/C
Poul Gorm, Monteensudder	Cork	CO104-002	CO030	12th c. BC–1st c.AD	B
Ard na gCeapairi	Donegal	DG032-005	DL019	BA–IA	C
Ballymulholland	Derry	LDY001:003	DY002	4th–2nd c. BC	B
Portstewart, Crossreagh East	Derry	LDY003:001	DY006	Neo–IA	C
Culfin	Galway	GA010-048	GA005B	2nd c. BC–1st c. AD	C
MN1, Mannin Beg	Galway	GA035-058	GA022C	5th–3rd c. BC	C
DL1, Doonloughan	Galway	GA048-008001	GA027A	21st–18th c. BC	B
MN2, Mannin More	Galway	GA049-024003	GA032B	11th–1st c. BC	C
Seaweed Point, Knocknacarragh	Galway	GA093-012	GA050	10th–5th c. BC	C
Dún Aonghasa, Cill Mhuirbhígh	Galway	GA110-039029 GA110-039031	GA069A-J	16th–5th c. BC	A/B
Fermoyle Island, Formaoil	Kerry	KE035-009	KY023	Iron Age	C
Beginish Island, Beginish	Kerry	KE079-028	KY050	4th c. BC–2nd c.AD	B
Ballincar	Sligo	SL008-197	SO025	13th–9th c. BC	C
Coney Island	Sligo	SL008-204	SO027	LBA	C
Oyster Island	Sligo	SL008-207	SO028	Iron Age	C
Settlement 15, Culleenamore	Sligo	SL013-89002	SO041A, D	Iron Age 29th–4th c. BC	B
Culleenduff	Sligo	SL014-140	SO058	16th–12th c. BC	C
Settlement 8, Luffertan	Sligo	SO014-156002	SO070	2nd c. BC–9th c. AD	C

Table 5.2: List of all sites discussed in chapter with relevant deposits shown under Catalogue ID. Date estimates are based on radiocarbon dates where available and are otherwise based upon artefact inclusions discussed in Section 5.2.2. Further information concerning these dates is given in catalogue entries. LOC indicates the Level of Confidence.

5.2.1 Distribution

The site with the largest number of later prehistoric shell midden features is Dún Aonghasa, Co. Galway (GA069) with ten of its 14 deposits dating to this period through radiocarbon analysis, artefacts, and stratigraphic relationships. The remaining four had no dating evidence. This is the most elevated shell midden site in Ireland at approximately 100m OD. Seven sites are found within the Northern region and another

seven are found within the Lowland West region as defined in Chapter 3. Six sites are found within the Highland West and only three are found within the South West (Figure 5.1).

There are no later prehistoric sites on the east coast of Ireland with all sites found to the west of Poul Gorm, Co. Cork (CO030) in the south and Chimney Cave, Co. Antrim (AN014) in the north. The absence of sites in the South East and East regions is consistent with the small number of shell middens in that part of Ireland. Only 33 sites in total have been reported from counties Dublin, Waterford, Wicklow, and Wexford combined. Of these, only 13 have any dating evidence, twelve of which are from the Early Medieval onward. The lack of deposits along these coastlines is addressed in Chapter 2 with reference to shore characteristics and less erosional exposure to their western counterparts. Due to these known biases, it is difficult to rule out any shell deposition occurring along these coastlines during the Bronze Age or Iron Age. The larger number of later prehistoric sites in eastern counties being uncovered due to commercial archaeology in recent years may suggest that the shell midden evidence has simply not been recorded yet rather than there being a lack of coastal resource deposition during this time period.

There are three notable concentrations of later prehistoric sites, in counties Galway, Sligo, and Antrim respectively. Three sites are found along the northwest coast of the Ballyconneely peninsula in Galway. The area is known for its shell middens from survey work in the Truska, Mannin, and Doonloughan dunes. Sligo, *Sligeach* ('shelly place'), is also known for its middens. Three later prehistoric sites are found on the north shore of Sligo Harbour and another three are found at Strandhill on the southern side of the Harbour. Co. Antrim has a cluster of four sites along White Park Bay and the Ballintoy shoreline. This area has been a focus of study for over 150 years with its dune systems and natural caves.

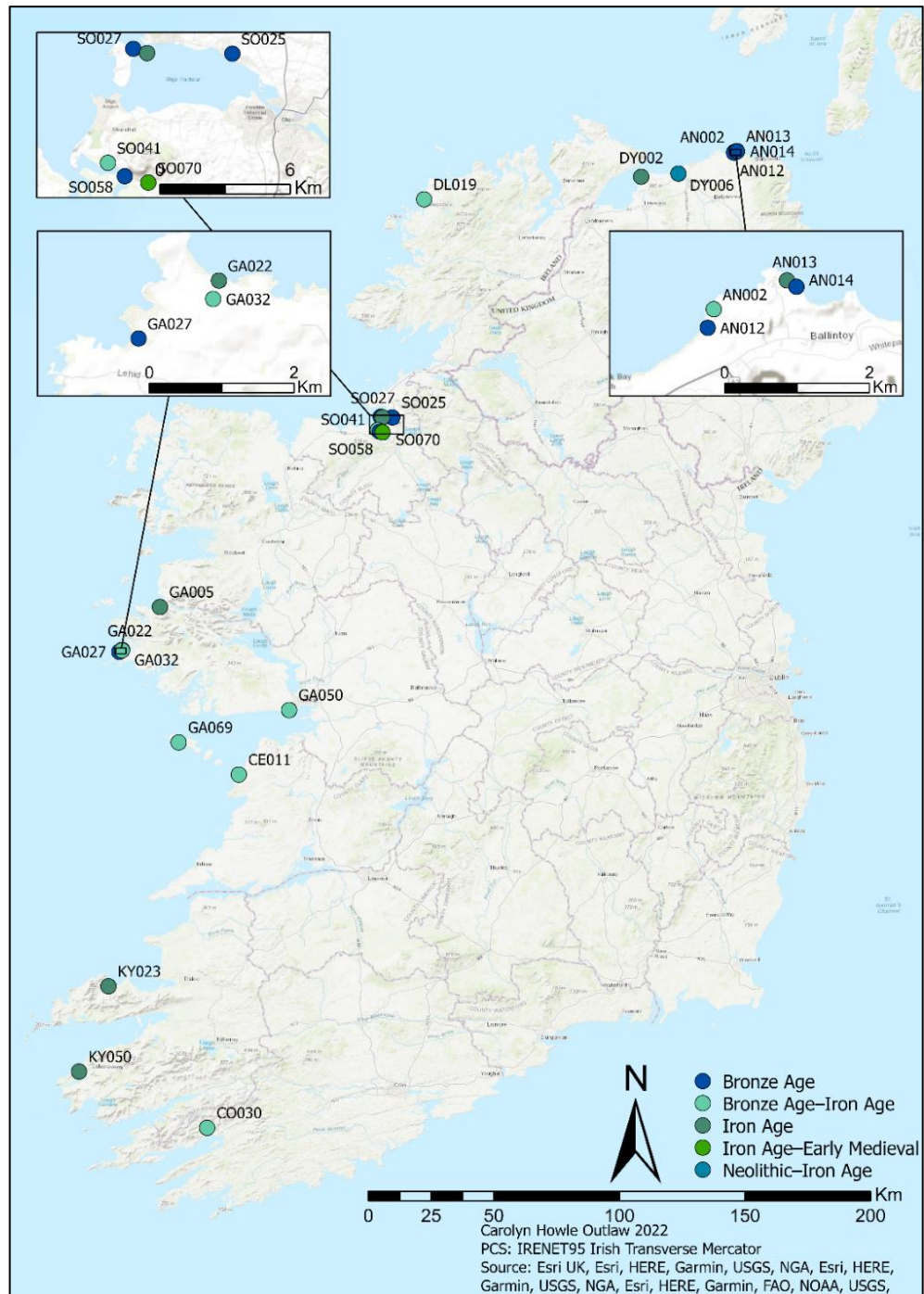


Figure 5.1: Distribution map of later prehistoric shell midden sites with rough estimates of dates. The inset maps show the clusters of sites at Ballyconneely, Co. Galway; Sligo Harbour, Co. Sligo; and White Harbour and Ballintoy, Co. Antrim.

5.2.2 Chronology

Radiocarbon analysis was applied to 24 of the 43 later prehistoric shell midden features (18 of the 23 shell midden sites) (Figure 5.2). The earliest date within the later prehistoric chronology is from a charcoal sample found within the shell midden at

Doonloughan (DL1), Co. Galway (GA027A). This sample was dated to 3587 ± 36 BP; 2035–1778 BC. A charcoal sample from a hearth near the bottom of Settlement 8, Co. Sligo (SO070) produced the youngest later prehistoric date of 2020 ± 55 BP; 170 BC–124 AD (Lu-1862). This site also produced an Early Medieval date of 1260 ± 50 BP; 663–881 AD (Lu-1756) from another hearth sample near the top of the midden. The site is included within this chapter as the material culture is more suggestive of later prehistoric use. Most later prehistoric radiocarbon dates fall within the 11th century BC, around the transitional Bronze Age/Iron Age boundary.

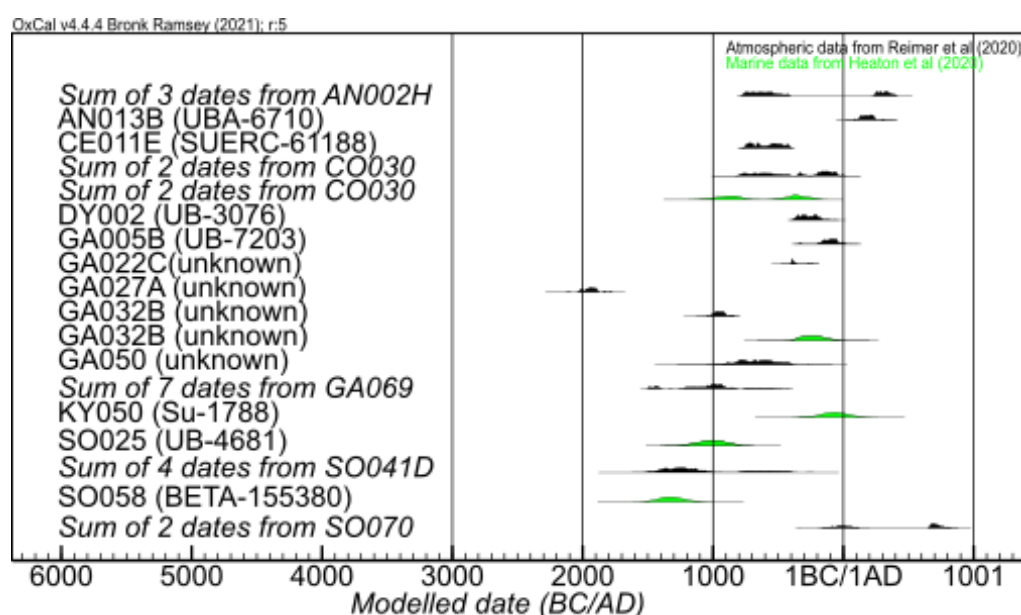


Figure 5.2: Radiocarbon dates of Bronze Age and Iron Age sites in alphabetical order by catalogue ID. Sum probabilities are given where possible for sites with multiple dates. Marine calibrated dates are shown in green.

Six shell midden features had artefactual evidence which supported the radiocarbon determinations. These included Potter's Cave, Co. Antrim (AN002H), Ballymulholland, CO. Derry (DY002), and four deposits at Dún Aonghasa, Co. Galway (GA069F–I). Artefactual inclusions were used to date 18 shell midden features on seven sites. Diagnostic artefacts used for this purpose consist of pottery, lithics, and bronze objects from the Bronze Age pottery and lithics and iron objects and a single glass bead from the Iron Age. Stratigraphy was used to date the remaining site of Coney Island, Co. Sligo (SO027). This site was dated based on its association with a Late Bronze Age *fulacht fia*.

The site of Portstewart, Co. Derry (DY006) has evidence from the Neolithic through to the Iron Age. This includes over 400 pottery sherds dated to the Neolithic, Chalcolithic, and Bronze Age. Many of the metal objects found at the site were of tin-bronze. The bottom layer of the site was found to primarily have Bronze Age artefacts, though Neolithic artefacts were also identified, while finds from the top layer were considered more consistent with the Iron Age.

5.3 Key Case Studies

The following case studies were chosen due to their importance for interpreting later prehistoric shell midden sites. All three examples had non-adult human remains including two articulated burials and one tooth. Dog bones are found within the first two examples. Beads, including those of shell, glass, bone, and stone, are found at all three sites discussed. The combination of human remains, dog bones, and beads is of potential significance for understanding later prehistoric shell midden sites.

5.3.1 Settlement 15, Culleenamore, Co. Sligo (SO041A, D): Bronze Age–Iron Age

Settlement 15 was one of the fifteen settlement sites described and recorded by Swedish archaeologist, Göran Burenhult, during his work in the region of the Carrowmore Passage Tomb Cemetery. These settlements were described during his 1979 survey as ‘platforms or other structures with high concentration of seashells’ (Burenhult 1980, 87). This particular settlement was excavated in 1980–1. The settlement had two midden areas, described as an inner and outer midden. The total midden area measured up to 3m thick, 100m long, and 30m wide and was made up almost exclusively of oyster shells (Burenhult 1984, 68). There were three distinct activity layers defined by hearths in the outer midden. The upper strata of the outer midden, defined by a hearth between stratum 3 and 4, dated to the Iron Age (SO041A) and was 25m long, 20m wide, and up to 1m thick. The Bronze Age layers of the inner midden (SO041D) was 36m long, 25m wide, and up to 1m thick.

The Bronze Age activity found in the inner midden contained no cultural material beyond shells and charcoal. The Iron Age activity identified in the outer midden contained finds of chert, an iron nail, and a whetstone within the top 15cm. Pottery sherds were found near the bottom of the layer. Animal bones and charcoal were also discovered throughout these strata. The animal bones were found to primarily be that

of cattle and pig. Bones of sheep/goat, deer, and dog were also identified. Deer remains included that of antler which are typically shed in the spring after the winter rutting season. It is not possible to say whether the antlers were gathered during this time or collected any time after the shedding occurred, but it does show that deer were in the surrounding area during the spring. All other animal remains were that of domesticates, perhaps indicating pastures were kept nearby. The abundance of oysters (*Ostrea* sp.) at the site indicates favourable environments nearby with plentiful oyster beds. The growth patterns on the oysters (*Ostrea* sp.) suggested primarily winter harvesting. Limpets (*Patella*), winkles (*Littorina* sp.), mussels (*Mytilus* sp.), cockles (*Cerastoderma* sp.), and scallops (*Pecten* sp.) were also found throughout the midden. The former three indicate rocky intertidal zones nearby while the latter two indicate sandy areas in the intertidal zone and nearshore to offshore.

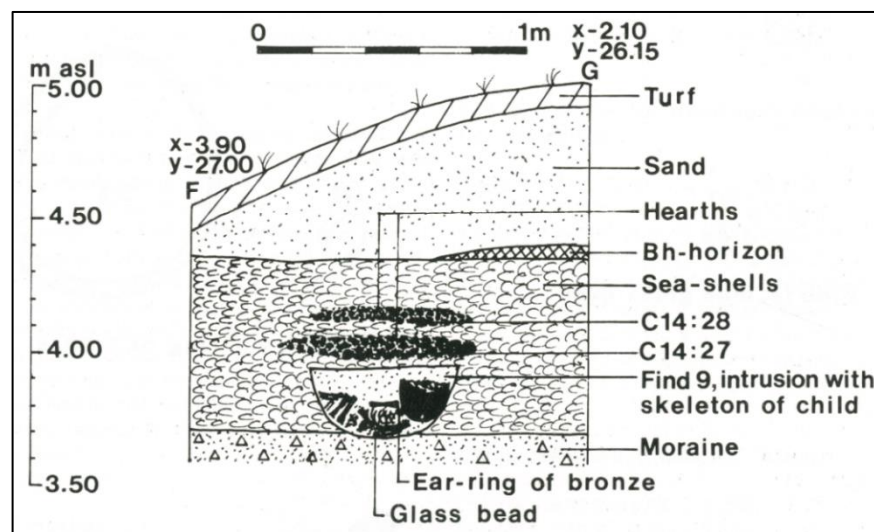


Figure 5.3: Section face with child burial at Culleenamore, Settlement 15, Co. Sligo (SO041A) (Burenhult 1984, 339).

The most striking find within the Iron Age activity of the outer midden was that of a child crouched inhumation within the midden itself (Figure 5.3). The grave was cut into the pre-existing shell matrix and was again covered by the shells. Burenhult dated the burial to the Iron Age with a glass bead found within the grave cut. There was also a single bronze earring next to the skeleton (Burenhult 1984, 331). The cut itself did not contain shells and must have been filled with sterile sediment prior to being covered with shells. Another explanation for the sterility around the remains may be that the deposition occurred within an organic container or bag, which allowed for

finer particles to fill the pit, but did not allow for the shells to interfere. The use of an organic container to hold cremated remains was noted at Derrycraw, Co. Down and Timakeel, Co. Armagh (Large 2004; Chapple *et al.* 2009, 114–5).

5.3.2 Dún Aonghasa, Cill Mhuirbhí, Co. Galway (GA069A–J): Bronze Age–Iron Age

Dún Aonghasa is a well-known cliff-edge fort which was intensively studied within the Discovery Programme’s Western Stone Forts project in 1992–5. This excavation led to the discovery of 14 separate shell midden features, ten of which were confirmed as dating to the Bronze Age or the Bronze Age/Iron Age transition. The other four deposits most likely also date to this time as they all relate to primary activity at the fort, though as these are not securely dated, they are not included in this chapter. As mentioned in Section 5.2.1, the fort lies at approximately 100m OD, which makes it one of the most elevated shell deposit sites in Ireland. The shellfish must have been gathered from elsewhere and brought up to the site for use.

The dated shell midden features within Dún Aonghasa were primarily made up of limpet (*Patella* sp.) and winkle (*Littorina littorea*) shells, though one feature (GA069C) contained cockle (*Cerastoderma edule*) as a dominant species, and another (GA069A) contained a high number of land shells. The limpets (*Patella* sp.) and winkles (*Littorina littorea*) indicate that most of the shellfish was collected from rocky intertidal zones while the cockles (*Cerastoderma edule*) indicate a sandy intertidal zone was also used, though less frequently. These deposits also contained bones of fish, cattle, sheep/goat, pig, horse, and bird. Some of the bird bones were identified as guillemot, a bird which is known to only be found on land during breeding season between May and August. These birds typically nest on cliff edges and would have been found in the area of the fort (BirdWatch Ireland 2022).

One of the shell midden features (GA069I) was found within a hollow beneath a potential hut wall. This deposit contained animal bones, pottery sherds, worked bone, an iron fragment, and beads of amber and shell. A neonate skeleton was uncovered at the northeast corner of the hollow (Figure 5.4). There was no grave cut, suggesting that the skeleton was placed among the shells and not dug into it. An animal bone from the deposit is radiocarbon dated to the Bronze Age and the human remains were radiocarbon dated to the Bronze Age/Iron Age transition. The slight discrepancy

between the dating is most likely due to horizontal stratigraphy causing the northeast corner of the hollow to be later than the area of radiocarbon dating elsewhere.

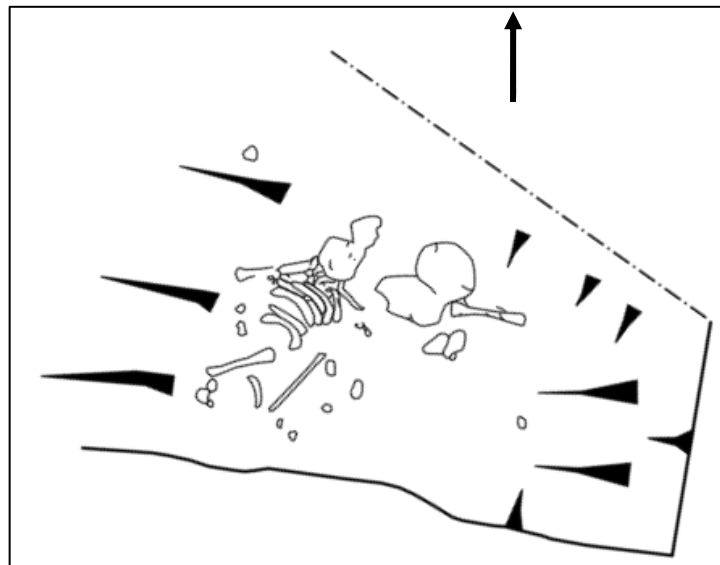


Figure 5.4: Burial at edge of bedrock hollow (after Cotter 1993, Fig. 8)

A shell bead was also found in one other shell midden feature within the fort (GA069F). Other finds throughout the dated shell midden features include flakes, ribbing stones, whetstones, grinding stones, pumice, metal working ceramics, pottery sherds, iron and bronze fragments, bronze ornaments, and iron knife, and worked bone including a comb, buttons, pins, and a handle. The fort was a location for both craftworking and domestic activities.

5.3.3 Settlement 8, Luffertan, Co. Sligo (SO070): Iron Age–Early Medieval

Similar to Settlement 15, Culleenamore, Co. Sligo (SO041) described above, Settlement 8 was one of the fifteen settlement sites recorded by Burenhult during his 1979 survey as ‘platforms or other structures with high concentration of seashells’ (Burenhult 1980, 87). This settlement was made up of a double stone circle on the top of a natural moraine hill. Two significant areas of shells were identified in ditches outside of the structure along with a large hearth while a primary shell midden was found within the central area of the site with another large hearth. This central midden produced the dating evidence along with many finds.

Finds included two iron knives, iron scissors, two iron arrowheads, three unknown iron objects, three pieces of iron slag, two glass beads, an unknown stone artefact,

seven retouched chert tools, flint and chert waste, and 16 shell beads. The shell beads included two oysters (*Ostrea* sp.) and 14 limpets (*Patella* sp.) (Figure 5.5). A human tooth was also identified along with animal bones and plant remains. The animal bones were identified as primarily cattle, pig, and sheep/goat. Deer, horse, and bird remains were also found. Plant remains included hazelnut shells, cereal grains, and weeds. The cereal grains were primarily barley and oat, though wheat, rye, and flax were also identified. Oyster (*Ostrea* sp.) were the dominant identified at this site indicating suitable conditions nearby.



Figure 5.5: Top: Perforated limpet shells. Bottom: Reconstruction of potential use of perforated limpet shells (Burenhult 1984, 108).

The evidence suggests that Settlement 8 was used for both craftworking and domestic activities. The high number of domestic animal evidence may suggest nearby pastures and the high level of cereal remains suggest arable agriculture. Domesticates

were not solely relied on, however, as the presence of deer, bird, hazelnuts, and shells suggest hunting and gathering were still taking place.

5.4 Overview of Available Data

The following sections aim to present the available data collected concerning shell middens dating from the Bronze Age to the Iron Age. This includes potential associations, dimensional measurements, inclusions of fauna and flora, artefactual inclusions, and any human remains from within the shell middens themselves. The fauna and flora are separated into shells, bones, and plant remains. The data is briefly discussed here, but interpretive conclusions are expanded upon in section 5.5.

5.4.1 Associations

Three later prehistoric shell midden sites were found within cave occupation evidence: Potter's Cave (AN002), Boat Cave (AN013), and Chimney Cave, Co. Antrim (AN014). Five of the sites were found as part of habitation sites with built structures including a cliff edge fort at Dún Aonghasa, Co. Galway (GA069); a stone enclosure at Settlement 8, Co. Sligo (SO070); stone huts at Doonloughan (GA027) and Mannin More, Co. Galway (GA032); and an unidentified stone structure at Doolin Pier, Co. Clare (CE011). One shell midden, at Coney Island, Co. Sligo (SO027), was found directly associated with a Late Bronze Age fulacht fia. Eight of the 23 later prehistoric shell midden sites contained hearths or burnt areas. Overall, the evidence suggests that most shell middens were accumulated on the site of occupation rather than at a distance to primary habitation. The fulacht fia evidence, along with sites without structural evidence, may suggest that special feasting or preparation sites were used on which shell middens were accumulated as well.

5.4.2 Dimensions

Twenty-five of the later prehistoric shell midden features have recorded dimensions. Ten of these contain length, width, and thickness measurements, allowing for estimated volumes. Two of the deposits contain both width and length, three deposits have both length and thickness, and thickness is the only available measurement for the remaining ten (Table 5.3).

The two largest shell midden features were recorded at Settlement 15, Co. Sligo with Bronze Age evidence (SO041D) recorded as 36m by 25m by 1m and Iron Age evidence (SO041A) recorded as 25m by 20m by 1m. One other site contained evidence of a larger area than that recorded for the latter, though the estimated volume was much smaller. This was the shell midden feature at Doonloughan (DL1), Co. Galway (GA027A) which measured 42m by 15m by 0.2m. The smallest shell midden feature by area was recorded at Culfin, Co. Galway (GA005B) with an area of 0.1m². The smallest volume was recorded at Doolin Pier, Co. Clare (CE011E) measuring 0.1m³.

Catalogue ID	Length (m)	Width (m)	Thickness (m)	Area (m ²)	Volume (m ³)
AN002E	—	—	0.2	—	—
AN002F	—	—	0.3	—	—
AN012A	—	—	0.3	—	—
AN013B	—	—	0.9	—	—
AN014A	—	—	0.1	—	—
AN014B	—	—	0.2	—	—
AN014C	—	—	0.2	—	—
AN014E	—	—	0.8	—	—
CE011D	5.3	5	—	26.5	—
CE011E	1.1	0.6	0.1	0.7	0.1
CO030	33.5	0.6	0.8	20.1	16.1
DY002	25	1	0.4	25	10
GA005B	0.9	—	0.1	0.1	—
GA027A	42	15	0.2	630	126
GA032B	—	—	0.3	—	—
GA050	60	—	0.7	42	—
GA069B	2.5	1.7	0.3	4.3	1.3
GA069E	—	—	0.02	—	—
GA069F	0.8	0.4	—	0.3	—
KY023	3.4	0.8	0.8	2.7	2.2
KY050	4.1	2	0.2	8.2	1.6
SO027	20	10	0.1	200	20
SO028	50	—	0.6	30	—
SO041A	25	20	1	500	500
SO041D	36	25	1	900	900
TOTAL:	15	12	23	15	10
Average:	20.6	6.8	0.4	159.3	157.7

Table 5.3: Dimensional measurements available for shell midden features dating from the Bronze Age to the Iron Age. The total number of features with each measurement is given at the bottom followed by the average. All measurements have been rounded to the nearest tenth.

Of the 15 shell midden features with area estimates, nine (60%) fall above the 10m² boundary required to be considered a large shell mound or midden as defined in Chapter 3. One further shell midden feature which did not exceed this boundary, did exceed the volume estimate of 2m³, making a total of ten deposits (67%) eligible for shell mound qualification.

5.4.3 Fauna and Flora

Where the information is available shell, bone, and plant species of later prehistoric shell middens are presented below. Common English names are used here (see Chapter 3). Most species are in fact only identified to genus and species groups such as fish and bird are presented together due to the infrequency that these are differentiated in the available texts. Where these groups have been differentiated, the data is presented in relevant catalogue entries.

Shells

Limpet was the most common shell species identified in later prehistoric shell midden features followed by winkle and oyster (Table 5.4). Limpets and winkles can both be harvested from rocky shorelines during low tide. Oysters are also found attached to hard substrates, though they are primarily subtidal and may have required the use of technologies for dredging, sailing, or swimming and diving. Some oysters, however, can be harvested in the shallow waters of low tide. Other species found regularly include cockle, scallop, and mussel. Mussels may be found in similar conditions to limpets and winkles. Cockles and scallops, however, are found in sandy environments. Cockles can be found buried in the sand along the shore at low tide. Scallops are typically found further afield, in the nearshore or even offshore areas.

Three shell midden features contained uncommon shell species as primary inclusions. At Ballymulholland, Co. Derry (DY002), the dominant species was ocean quahog. Whelk was a dominant species at Doonloughan (DL1), Co. Galway (GA027A). Land shells were identified frequently within one of the shell midden features at Dún Aonghasa, Co. Galway (GA069A). Other less common shell species identified include prickly limpet, clam, dog cockle, trough shell, and dog whelk. Prickly limpet and clam were both recorded at White Park, Co. Antrim (AN012A) along with the ocean quahog. Ocean quahog was also identified at Boat Cave, Co.

Antrim (AN013B). Clam, dog cockle, and trough shell were found at Ballymulholland, Co. Derry (DY002). Dog whelk was only recorded at Ard na gCeapairi, Co. Donegal (DL019). Burnt shells were identified at Poul Gorm, Co. Cork (CO030), Portstewart, Co. Derry (DY006), and Coney Island, Co. Sligo (SO027).

ID	<i>Patella vulgata</i>	<i>Littorina littorea</i>	<i>Ostrea edulis</i>	<i>Cerastoderma edule</i>	<i>Pecten sp.</i>	<i>Mytilus edulis</i>	Other/ Unidentified
AN002D	D‡	—	—	—	—	—	—
AN002E	D‡	D‡	—	—	—	—	—
AN002F	D‡	—	—	—	—	—	—
AN002G	D‡	—	—	—	—	—	—
AN002H	D‡	—	—	—	—	—	—
AN002I	D‡	—	—	—	—	—	—
AN012A	D*	D	X*	X‡	—	X*	X
AN013B	D‡	—	—	—	—	—	—
AN014A	D‡	D‡	—	—	—	—	—
AN014B	D‡	D‡	—	—	—	—	—
AN014C	D‡	X‡	—	—	—	—	—
AN014D	D‡	D‡	—	—	—	—	—
AN014E	—	—	—	—	—	—	/
CE011D	—	—	—	—	—	—	/
CE011E	D	—	—	—	—	—	—
CO030	X*	X*	D	X‡	—	X*	—
DL019	D‡	D‡	X‡	—	—	—	X
DY002	X	X	X	X	—	—	D
DY006	—	D	—	—	—	—	—
GA005B	D‡	—	—	D‡	—	—	—
GA022C	—	D‡	—	—	—	—	—
GA027A	X*	D	X‡	X‡	X‡	—	D
GA032B	D‡	—	—	—	—	—	—
GA050	X	X	D	—	X^	X	—
GA069A	D*	D	—	—	X	—	D
GA069B	D*	—	—	—	—	—	—
GA069C	—	D	—	D	—	—	—
GA069D	D*	X	—	—	—	—	—
GA069E	D*	D	—	—	—	—	—
GA069F	D*	—	—	—	—	—	—
GA069G	—	—	—	—	—	—	/
GA069H	D*	—	—	—	—	—	—
GA069I	—	D	—	—	—	—	—
GA069J	—	—	—	—	—	—	/
KY023	X‡	—	—	D‡	—	—	—
KY050	D‡	—	X‡	—	X‡	—	—
SO025	—	—	D‡	—	—	—	—
SO027	—	D‡	D*	—	—	—	—
SO028	—	—	D‡	—	—	—	—
SO041A	X*	X*	D*	X*	X*	X*	—
SO041D	X*	X*	D*	X*	X*	X*	—
SO058	—	—	D‡	—	—	—	—
SO070	X*	—	D*	—	—	—	—
TOTAL:	31	21	14	9	6	5	9
Dominant:	23	14	9	3	0	0	3

Table 5.4: Shell species identified in Late Prehistoric shell midden deposits. X indicates the species is present. D indicates that a species was dominant. Under the column 'Other/Unidentified,' X indicates a known shell species other than those listed and / indicates unidentified species. * indicates the genus is known, but the species is not. ‡ indicates that only vernacular names are used in available sources and scientific species are assumed. ^ indicates that a similar species is found instead of the more common species listed (for instance, *Aequipecten opercularis* (queen scallop) was reported at GA050, but *Pecten* sp. (such as great scallop) was not).

Bones

Thirty-four (79%) later prehistoric shell midden features contained animal bones (Table 5.5). The bones were unidentified within seven of these features. Cattle, pig, and sheep/goat were the most frequent species reported. Fish were also commonly found. Where recorded to species, they included examples of cod and gurnard ('gurnett' (Jackson 1936, 37)). Birds, where identified, were all reported to be seabirds including gannet, gull, and guillemot.

Less common species include cat, fox, and cetacean. Fox and cetacean were dominant species at Mannin Beg (MN1), Co. Galway (GA022C). Fox was also identified at White Park, Co. Antrim (AN012A) and Boat Cave, Co. Antrim (AN013B). Cetacean was also identified at Ballymulholland, Co. Derry (DY002) and Dún Aonghasa, Co. Galway (GA069C). White Park, Co. Antrim (AN012A) also contained cat remains. Ballymulholland, Co. Derry (DY002) contained dog coprolites, but no dog bones were reported. Two deposits reported butchery: White Park, Co. Antrim (AN012A) and Mannin Beg (MN1), Co. Galway (GA022C). Two deposits at Dún Aonghasa, Co. Galway (GA069C and D) contained burnt bone.

Catalogue ID	Cattle	Pig	Sheep/Goat	Fish	Deer	Horse	Bird	Other/Unidentified
AN002D	D	D	–	–	–	D	–	–
AN002E	–	D	–	–	D	–	–	–
AN002F	D	D	–	–	–	D	–	–
AN002G	D	D	–	–	–	D	–	–
AN002H	D	D	–	–	D	–	–	–
AN012A	X	X	X	X	X	X	X	X
AN013B	X	X	X	X	–	X	X	X
AN014A	D	–	D	D	–	–	–	–
AN014C	X	X	X	X	–	X	X	–
AN014D	–	–	–	–	D	–	–	–
CE011D	–	–	–	–	–	–	–	/
CE011E	–	–	D	–	–	–	–	–
CO030	D	–	–	–	–	–	–	–
DL019	X	X	X	–	X	X	X	–
DY002	D	X	X	–	X	–	X	X
DY006	X	X	X	X	X	–	X	X
GA005B	–	–	–	–	–	–	–	/
GA022C	–	–	–	–	–	–	–	D
GA027A	D	–	–	–	–	–	–	–
GA032B	D	–	D	–	–	–	–	–
GA069A	X	–	X	X	–	–	X	–
GA069B	–	–	–	X	–	–	–	/
GA069C	–	–	–	–	–	–	–	/
GA069D	–	–	–	–	–	–	–	/
GA069E	–	–	X	X	–	–	–	/
GA069F	–	–	–	D	–	–	–	–

Catalogue ID	Cattle	Pig	Sheep/Goat	Fish	Deer	Horse	Bird	Other/Unidentified
GA069G	–	–	–	–	–	–	–	/
GA069H	X	X	X	X	–	–	X	–
GA069I	–	–	–	–	–	–	–	/
GA069J	X	X	X	X	–	X	X	–
KY050	–	–	–	–	D	–	–	–
SO028	–	–	–	–	–	–	–	/
SO041A	D	D	X	–	X	–	–	X
SO070	D	D	D	–	X	X	X	–
TOTAL:	19	15	15	11	10	9	8	16
Dominant:	11	7	4	2	4	3	0	1

Table 5.5: Bone species identified in later prehistoric shell midden features. Fish and bird are not differentiated to species. X indicates the species is present and D indicates that a species was dominant within the deposit. Under the column 'Other/Unidentified,' X indicates a known bone species other than those listed and / indicates an unidentified species. All species reported within at least five deposits are listed.

Plant Remains

Twenty-nine (67%) later prehistoric shell midden features reported plant remains. Of these, 20 deposits (69%) contained only charcoal, six deposits (21%) contained charcoal along with other remains, and three deposits (10%) contained only non-charcoal remains. The only charcoal identified was that identified at Doolin Pier, Co. Clare (CE011E) which was found to be ash. Hazelnut was identified at three sites including Portstewart, Co. Derry (DY006) where the nutshell was found within a pottery sherd. Unburnt wood was reported at Dún Aonghasa, Co. Galway (GA069C). Wild taxa including 'weeds' were the only other non-cereal remains identified. Cereals were found within six deposits (Table 5.6).

Catalogue ID	Hazelnut	Cereals	Barley	Oat	Wheat	Rye	Flax	Wild Taxa	Wood	Charcoal
CE011D	–	X	–	–	–	–	–	X	–	X
CE011E	–	–	X	–	–	–	–	–	–	X
DY006	X	–	–	–	–	–	–	–	–	–
GA005B	X	–	–	–	–	–	–	–	–	–
GA027A	–	–	X	–	–	–	–	–	–	X
GA032B	–	–	X	X	X	–	–	–	–	X
GA069C	–	–	–	–	–	–	–	–	X	X
SO028	–	–	X	–	–	–	–	–	–	X
SO070	X	X	X	X	X	X	X	X	–	–

Table 5.6: Plant remains identified in later prehistoric shell midden features. Shell midden deposits only reporting charcoal are not included in the table.

5.4.4 Artefacts

Twenty-one later prehistoric shell midden features contained lithics including retouched tools, scrapers, knives, spear heads, arrowheads, and nondescript lithics (Table 5.7). Debitage and cores were also reported indicating lithic work occurring on site at White Park Bay, Co. Antrim (AN012A), Chimney Cave, Co. Antrim (AN014A, C–D), Doolin Pier, Co. Clare (CE011E), Coney Island, Co. Sligo (SO027), Settlement 15, Co. Sligo (SO041A), and Settlement 8, Co. Sligo (SO070). Three sites contained stone axes including a ‘rough’ axe at Chimney Cave, Co. Antrim (AN014D) and polished axes at Portstewart, Co. Derry (DY006) and Beginish Island, Co. Kerry (KY050).

Metalworking was evident not only through the identification of bronze and iron artefacts, but also of iron ore and slag as well as clay crucibles and moulds. These artefacts could indicate metalworking on site at sites such as Boat Cave, Co. Antrim (AN013B), Ard na gCeapairi, Co. Donegal (DL019), Ballymulholland, Co. Derry (DY002), Portstewart, Co. Derry (DY006), Dún Aonghasa, Co. Galway (GA069A, F–H, J), and Settlement 8, Co. Sligo (SO070).

Beads made from varied materials were identified within six deposits, three of which are part of Dún Aonghasa, Co. Galway (GA069F, H–I). These beads include a bone bead (GA069H), two shell beads (GA069F, I), and an amber bead (GA069I). The deposit with both a shell and amber bead also contained a neonate burial. Stone beads of jet and quartz were identified at Portstewart, Co. Derry (DY006) and a glass bead was found within the child burial at Settlement 15, Co. Sligo (SO041A).

ID	Lithics	Stone	Ceramics	Metal	Bone	Shell	Glass
AN002D	Meso flints*; BA flints	—	—	—	—	—	—
AN002E	Meso flints*; BA flints	—	—	—	pin	—	—
AN002F	Meso flints*; BA flints	—	—	—	—	—	—
AN002G	Meso flints*; BA flints	—	—	—	—	—	—
AN002H	Meso flints*; BA flints	—	—	—	handle; needle; pin; object	—	—
AN002I	Meso flints*; BA flints	—	—	—	—	—	—
AN012A	flakes; cores; arrowheads; spear heads; knives; scrapers	quern; hammer	sherds	—	needles; pins; object	—	—

ID	Lithics	Stone	Ceramics	Metal	Bone	Shell	Glass
AN013B	lithics	—	sherds	slag	comb; objects	—	—
AN014A	flakes; core	—	sherds	—	—	—	—
AN014C	flakes; cores	hammer; rubbing; anvils	—	—	—	—	—
AN014D	flakes; cores	rough axe	—	—	—	—	—
AN014E	—	—	sherds	—	—	—	—
CE011D	flakes	fcrs	—	—	—	—	—
CE011E	core	—	—	—	—	—	—
CO030	—	fcrs	—	—	—	—	—
DL019	scraper	hammer; discs; fcrs	food vessels; souterrain; clay fragments	slag; bog iron	—	—	—
DY002	—	—	—	slag	—	—	—
DY006	lithics	beads; bowl; pumice; hammers; anvils; polished axes	sherds; crucibles	slag bronze needle; bronze buckle; bronze object; bronze clasp; (bronze) ring; bronze pins; iron objects	—	—	—
GA027A	scrapers	fcrs	food vessels	—	—	—	—
GA050	—	fcrs	—	—	—	—	—
GA069A	—	grinding; rubbing	sherds; moulds; crucible	bronze pin; iron nails	comb; buttons	—	—
GA069B	—	—	sherds	—	—	—	—
GA069C	—	grinding	clay fragment; sherds	bronze fragment	—	—	—
GA069D	—	—	sherds	—	—	—	—
GA069F	flakes	pumice; fcrs	clay fragments; moulds; sherds	iron ore	points	bead	—
GA069G	—	rubbing; whetstone	mould; sherds	iron knife; iron fragments	pin	—	—
GA069H	flakes	pumice	crucibles; moulds; sherds	iron fragments	bead; pins	—	—
GA069I [†]	flake	pumice; rubbing	sherds	iron fragment	handle; pins	bead	—
GA069J	—	pumice; fragments	sherds; moulds	iron fragments; bronze ring	pin	—	—
KY023	—	fcrs	—	—	—	—	—
KY050	—	axe; pounder; fcrs	—	—	—	—	—
SO027	debitage	—	—	—	—	—	—
SO041A	retouched tools; debitage	whetstone	sherds	bronze earring; iron nail	—	—	bead

ID	Lithics	Stone	Ceramics	Metal	Bone	Shell	Glass
SO070	retouched tools; debitage	—	—	iron scissors; iron knife; iron object; iron arrowhead; iron fragments; slag	—	beads	beads
TOTAL:	21	19	17	13	10	3	2
Summary:	6 Meso flints*; 6 BA flints; 8 flakes; 2 lithics; 5 cores; 1 arrowheads; 1 spear heads; 1 knives; 2 scrapers; 3debitage; 2 retouched tools	1 quern; 4 hammers; 3 rubbing; 2 anvils; 3 axes; 8 fcrs; 1 discs; 1 beads; 1 bowl; 5 pumice; 2 grinding; 2 whetstones; 1 pounder; 1 fragments	15 sherds; 2 food vessels; 1 souterrain; 3 clay fragments; 3 crucibles; 5 moulds	4 slag; 2 iron ore; 1 bronze needle; 1 bronze buckle; 1 bronze object; 1 bronze clasp; 2 (bronze) rings; 2 bronze pins; 2 iron objects; 2 iron nails; 1 bronze fragment; 2 iron knives; 5 iron fragments; 1 bronze earring; 1 iron scissors; 1 iron arrowhead	7 pins; 2 handles; 2 needles; 3 objects; 2 combs; 1 buttons; 1 points; 1 bead	3 beads	2 beads

Table 5.7: Artefact types found within later prehistoric shell midden features. * indicates artefacts typical of earlier periods. † indicates a deposit containing a unique artefact type not otherwise listed.

5.4.5 Human Remains

Seven later prehistoric shell midden sites contained human remains. Only two articulated burials were found, both of which were non-adults. These were found at Settlement 15, Co. Sligo (SO041A) and Dún Aonghasa, Co. Galway (GA069I). The latter also contained loose human teeth. Settlement 8, Co. Sligo (SO070) likewise contained a loose human tooth. Two further sites contained aged remains including a neonate or infant skull at Boat Cave, Co. Antrim (AN013B) and various disarticulated adult bones at Doolin Pier, Co. Clare (CE011D). These bones included two mandible bones, four teeth, and an ulna. Three pieces of skull were found at Portstewart, Co. Derry (DY006) and unidentified disarticulated remains were reported at White Park, Co. Antrim (AN012A).

5.5 Discussion

Of the 240 dated shell midden features within 143 sites in Ireland, 43 deposits (18%) within 23 sites (16%) date to later prehistory. No distributional pattern is obvious with the sites from the Bronze Age and Iron Age being found relatively evenly throughout the South West, Lowland West, Highland West, and North. The absence of sites in the East and South East is most likely due to the nature of the shorelines themselves rather than an indication of a lack of molluscan use during the period (see Chapter 3).

Most of the deposits dated firmly within the Bronze Age were dated through artefactual evidence alone. The majority of deposits with any Iron Age evidence, transitional or otherwise, were dated through radiocarbon analysis. This change is most likely due to the higher visibility of Bronze Age material culture in the archaeological record. This suggests that more Iron Age evidence may become known with further dating of shell middens with less clear artefactual indicators.

Very few shell species outside of the primary eight are found in later prehistoric shell midden features. Only three deposits had rarer species, namely White Park, Co. Antrim (AN012A), Ballymulholland, Co. Derry (DY002), and Dún Aonghasa, Co. Galway (GA069A). The bias towards the common species may be more of recording bias than a true trend as species such as prickly limpets and dog cockles can be confused with their more common relatives quite easily during field survey and other species may simply not have been properly identified. The most striking pattern identified for the molluscan species noted is the absence of one particular species: dog whelks. The dog whelk was only reported within a single deposit and was not a dominant species. Dog whelks were common in early prehistory (Chapter 4), and they are also significant in the Early Medieval record. This makes their apparent lack of use during later prehistory notable. A selection bias may be evident as winkles and limpets, the two most common species, are found in the same environments as dog whelks. Perhaps, like J. H. Crothers in his review of the biology of *Nucella lapillus*, the later prehistoric Irish found the dog whelks to be ‘distasteful’ ‘even [for] one attuned to “sea food”’ (Crothers 1985, 301) (also see Knowles *et al.* 1899, 438).

The Bronze Age was the first time we see horse bones in multiple shell midden deposits as a dominant species. Foxes were seen in shell deposits for the first time during this period. Overall, there appears to have been a strong preference for domesticated animals in the faunal remains. This includes cattle, pig, sheep/goat, some

horse, as well as dog bones and coprolites. Not all of the animal remains are evidence for the consumption of meat, especially as only two sites reported evidence of butchery. Cattle may have been raised primarily for dairy products and sheep/goat for wool. It can be assumed that dogs were present at Ballymulholland, Co. Derry (DY002), at roughly the same time as humans — if not alongside the humans — due to the presence of coprolites within human created deposits.

The three deposits with dog bones also contained human remains, namely White Park, Co. Antrim (AN012A), Portstewart, Co. Derry (DY006), and Settlement 15, Co. Sligo (SO041A). The presence of living dogs on site suggested by the coprolites and dog remains within deposits also containing human remains may indicate the integration of dogs into the lives of humans at this time as working animals, companion animals, or for protection. Horses are also often associated with working animals, but the link is less clear as they are found in more deposits, in more frequency, and have no obvious correlations with other significant inclusions.

Wild animal bones from these shell midden deposits include that of deer, fish, bird, cetacean, and fox, though only deer, fish, and bird were found in significant numbers. Jackson (1936) was the only researcher to distinguish among the fish species identified. These included cod in Boat Cave, Co. Antrim (AN013B) and Chimney Cave, Co. Antrim (AN014A, C). Boat Cave was also said to contain ‘gurnett,’ which is assumed to be an alternative spelling of gurnard. Molluscs are part of the diet of both of these saltwater species, and they can both be found near the shore, especially when temperatures are cooler. Perhaps some of the shellfish were used to bait these fish for additional meat.

Metallurgical remains are recorded in seven shell midden features in the form of the iron and bronze fragments and finished artefacts, as well as iron ore and slag, and clay crucibles and moulds. The only metal found within deposits containing the clay moulds were that of iron (Table 5.7). One of the crucibles was also identified within a deposit with only iron fragments, while the other was found with both bronze and iron artefacts. This may be due to the fact that while both bronze and iron working were undertaken on or near shell midden sites, the bronze artefacts and ores/ingots were more likely to have been reused and carried away from the sites than were the iron artefacts and metallurgical waste.

There are certain significant inclusions that seem to often be associated with one another, namely dog bones, human bones, and beads. At White Park, Co. Antrim

(AN012A), disarticulated human bone was found within the same deposit as dog bone. At Portstewart, Co. Derry (DY006), human skull fragments were found within the same deposit as two stone beads and dog bones. At Dún Aonghasa, Co. Galway (GA069I), disarticulated human teeth and the burial of a neonate were found within the same deposit as a shell bead and an amber bead. At Settlement 15, Co. Sligo (SO041A), the burial of a child was found within the same deposit as a glass bead and dog bones. Sixteen shell beads were recorded at Settlement 8, Co. Sligo (SO070) along with a human tooth. No dog bones or beads were discovered at Doolin Pier, Co. Clare (CE011D), which contained adult human skull fragments and teeth, or at Boat Cave, Co. Antrim, which contained the skull fragments of a child. Only one bead was found outside of a deposit with human remains, a possible fish bone bead found in another deposit at Dún Aonghasa. No dog bones were found within deposits without human remains. It is unclear whether the grouped inclusion of human bone, dog bone, and beads was intentional. If it was, there may be some suggestion that each of these symbolised overlapping ideas to those who deposited them.

Glass beads were also found within Iron Age crouched inhumations of juveniles at Knowth, Co. Meath and dog bones were found associated with a crouched infant burial at Tara, Co. Meath (Roche 2002; Eogan 2012; O'Brien 2020, 39–40). Inhumations dated to this period are rare with only 36 other examples known in Ireland (*ibid.* 40). Late Iron Age inhumations are found clustered on the east coast (*ibid.* 34–7). Both of the inhumations found within shell midden features were along the west coast. One is radiocarbon dated to the Bronze Age/Iron Age transition and the other is dated to the Iron Age based on the glass bead found within the burial, though the latter was dug into a shell deposit primarily containing Bronze Age material culture. Though burials were rare during this period, almost half of those known outside of the shell deposits are non-adults (47%), an unusually large number in prehistoric contexts. It has been suggested that some burials during the Late Iron Age were used to claim or connect new ideologies with the past through internment within older monuments (*ibid.* 44–5). This may also be the case with the use of older shell deposits to contain the articulated remains of the children at sites.

The death of children and infants often has its own meanings beyond the idea of life and death more generally because they have often not fulfilled certain rituals and rites of passage associated with becoming a full part of the community. It is well documented that the liminal state of dead children and infants in particular, has resulted

in the burial of these young dead in liminal spaces in historic Ireland (see Chapter 8). There may be a similar phenomenon of burying children in areas which may reflect liminality such as ancient monuments no longer used but still honoured, boundaries between territories, or along the coast (Harding 2016). In the 11th–12th century, texts referenced an old practice of sacrificing first-born children or animals to a fertility god. Though the recording of this practice is over one thousand years later than the burials here discussed, the high number of child burials at the time may suggest some possible folk memory of a ritual long lost (see O’Brien 2020, 44).

The focus on skulls in shell-bearing deposits may be reflective of trends similarly seen in Britain as discussed by Brück (1995). Refuse deposits and human bones may both relate to ideas of fertility, as rubbish may be associated with fertiliser and the fertility of humankind has long been connected with the fertility of the natural world (Gingell 1992; Brück 1995, 262). Skulls in particular may have symbolised the idea of intelligence or the soul which may have been cognitively linked to fertility (*ibid.* 257); ‘depositing skull fragments... may relate to or be part of a reciprocal belief system involving the agricultural cycle, the fertility of the land, and the death and regeneration of the human population’ (Tracey 2012, 373).

In summary, the use patterns of shellfish in later prehistory are rather standard and the animals present on sites are primarily those which are expected for the period. The potential symbolic significance of the human remains within the deposits may be significant. These sites paint a picture of a people who value the fertility of the land, of livestock, and of their communities. They made use of primarily rocky shoreline shellfish, avoiding certain species such as dog whelks. They may have used some of these shellfish to fish for cod and gurnard. Dogs lived among the communities and may have held special significance to the people of the time. The ‘rubbish’ making up the middens, the human remains of non-adults and skulls deposited within them, along with dog bones and beads may have all played a symbolic role in honouring the fertility of the natural world and encouraging its continuation.

Chapter 6: Coastal Economies in Early Medieval Ireland

Introduction

This chapter focuses on shell midden sites dating to the Early Medieval period in Ireland. The beginning of this period is defined by the introduction of Christianity at the start of the fifth century with the period ending with the cultural changes associated with the Anglo-Norman invasion in the later twelfth century. Following the Early Medieval Archaeology Project, commonly known as EMAP, this thesis uses the years 400–1100 AD to bound the period (O’Sullivan *et al.* 2014, 4).

The chapter begins with a brief historical overview of the Early Medieval period in general followed by a history of survey and excavation of Early Medieval shell middens. The distribution and general chronology of these sites is then discussed. The case studies and raw data presented in the next two sections are referenced in section 6.6 with an overview of patterns in the data. The chapter concludes by examining the significance of shell middens in the economy and society of Early Medieval Ireland.

6.1 A History of Research

The Early Medieval period has been discussed in the literature under numerous names including ‘early Christian,’ ‘Dark Ages,’ ‘early historic,’ and even ‘later Iron Age’ (Edwards 2004, xiii). As the Iron Age is better understood, more clarity has been added to its separation from the Early Medieval period, with all of the cultural, architectural, and artefactual changes which marked this shift. Not only does this period include the first written sources in Ireland and the spreading of Christianity, but also shifts in settlement structures and patterns and in native craft production.

6.1.1 A Brief Overview of Early Medieval Chronology

This period is defined by enclosed settlements of raths and cashels, the founding of enclosed ecclesiastical compounds, and new forms of unenclosed habitation sites such as settlements with cemeteries, transhumance occupations, and an increased use of cave dwellings (O’Sullivan *et al.* 2008, 48). The first urban centres grew from trading ports set up by Vikings in the ninth and tenth centuries with large monastic sites acting as native centres of population throughout this period (Edwards 2004, 11). The coastal shell midden sites discussed are an integrated part of these new settlement forms.

Non-scientific dating of sites of this period is often more readily available due to the increase seen in non-organic artefactual remains. These include the first native pottery produced since the Bronze Age, primarily souterrain ware concentrated in northeast Ireland, and potentially smaller scale production elsewhere with similar coarse-ware vessels. Other native technologies at the time include that of glassmaking, stonework, iron forging, copper smelting, and cloth making. The latter is primarily left in the archaeological record as spindle-whorls (Edwards 2004, 68).

Imports of the period which survive in the archaeological record primarily included ceramics. These include slip wares from the Mediterranean, Roman amphora, E-ware vessels, and English-made pottery. Glass, amber, and jet objects were imported, but are often less diagnostic. Imported coins such as those used by the Vikings, however, play a large part in dating sites where found (O’Sullivan *et al.* 2008, 249).

Much of the craftworking in stone, copper and bronze, iron, and bone continued, with Early Medieval art influenced by insular Iron Age decoration. The earliest Medieval art in Ireland has a ‘latent La Tène element’ which merges with Germanic zoomorphic imagery to form Insular art for which Early Medieval Britain and Ireland are known (Harbison 1999, 14 and 69). The art forms and iconography of this period is well studied and has resulted in many reliably dated sites.

6.1.2 A History of Survey and Excavation

In 1881, the first shell midden to be recognised as dating to the Early Medieval in Ireland was identified by the antiquarian, Ussher (1886), in Bewley, Co. Waterford (WA011). Two middens were discovered prior to this site but were not recognised as Early Medieval until later research took place. A shell midden was mapped by the Ordnance Survey of Ireland in 1837 in Grange West, Co. Sligo (SO067). The antiquarian, Leonard (1868), reported on a shell midden in Gooreenatinny, Co. Galway (GA009). Only two other sites were discovered by antiquarians: An Charraig Fhinn, Co. Donegal (DL022) and Dooey, Co. Donegal (DL040).

The first Early Medieval shell midden to be discovered through excavation was Nundrum, Co. Down (DW004), excavated in 1922–4. A further ten sites were found due to either rescue or research excavations (Table 6.1). Surveys identified another nine of the sites. Noted erosion at Lambay Island, Co. Dublin (DU002) in 1994–5 led to rescue excavation in 1995. Only eight sites had no further research reported after

their initial discovery. Re-analysis was undertaken at six sites after their discovery. Other research that took place on already discovered sites included excavation, survey, sampling for dating, and one commercial excavation.

Catalogue ID	Method of Discovery	Further Research
AN002	Excavation 1933–4	Re-analysis 2015
AN003	Excavation 1934	Re-analysis 2015
AN005	Informant 1991	Excavation 1991
AN009	Excavation 1933–4	Re-analysis 2015
AN010	Excavation 1931	Excavation 1935–9 Re-analysis 2015
AN015	Excavation 1935	—
AN016	Excavation 1934	—
DL022	Antiquarian 1898	Excavation 1985 Survey 2019
DL040	Antiquarian 1901	Survey 1937 Excavation 1959
DL053	Excavation 1987–92	—
DU002	Erosion 1994–5	Excavation 1995
DU009	Excavation 1956–9	Dating 1997 Re-analysis 2005
DW004	Excavation 1922–4	—
DY001	Informant 1979	Survey 1979 Excavation 1979
GA005	Survey 2003	Excavation 2006
GA008	Informant 1954	Survey 1993 2002, 2014
GA009	Antiquarian 1868	Survey 1983 2014 Dating 1988
GA026	Informant 1969	Survey 1984
GA027	Informant 1963	Survey 1986 1988, 2005, 2020 Excavation 1992
GA074	Excavation 1948–9	Re-analysis 1999–2000
KY004	Survey 1986	—
KY048	Survey 1989	Survey 1996
KY051	Excavation 1955	—
KY053	Survey 1987	Excavation 1992–5
MO028	Survey 1945	Survey 1952
MO065	Survey 1945	Dating 2018
SO020	Survey 2009	—
SO041	Survey 1979	Excavation 1980–1
SO047	Survey 1985	Survey 2009 Dating 2009
SO067	Survey 1837	Survey 1979 Excavation 1980
SO078	Informant 1962	Commercial 1962
WA011	Antiquarian 1881	—

Table 6.1: Method of discovery and further research of Early Medieval shell midden sites. For more information concerning each site see Table 6.2.

6.2 Historical Sources

Latinate literacy using an early form of the Irish language was introduced to Ireland in the latest part of the Iron Age, as seen with the advent of Ogham, and grew through the Early Medieval with the spread of Christianity and its associated texts. While the earliest inscriptions were primarily personal and tribal names of commemorative nature, the medieval world saw the introduction of longer texts such as secular and canonical laws, hagiographies, myths and sagas, and contemporary annalistic ‘histories.’

Shellfish are only directly referenced in the histories that survive from Early Medieval Ireland. The first specific mention of this resource outside of these texts is made in the Irish Grammatical tracts of the thirteenth century and the Yellow Book of Lecan in the early fourteenth century (Murray 2000, 180). Gerald of Wales does mention goose barnacles in his twelfth century account, *Topographia Hiberniae* (Moriarty 1997, 74–7). Murray (2000, 162) suggests that the lack of earlier references is due to the low status of shellfish as food. Shellfish are, however, alluded to in reference to general seafood consumption, the collection of resources along the coast, and some by-products such as pearls and, possibly, purple dye.

The law texts, both secular and canonical, date back to as early as the 7th and 8th centuries (Murray 2000, 163). The legends and hagiographies are more difficult to date, but are generally understood to be of similar chronology (Bitel 1990; Murray 2000, 162). Contemporary histories have a more definitive date. The earliest history with relevance to this study is that of Bede from c.731 AD. This source, however, must be recognised as an attempt to describe Britain and Ireland in an imitation of Eden and may be more exaggerative than factual. It may also not be from any first hand observations (Kendall 1979; Wallace-Hadrill 1988; Murray 2000, 391). The next relevant source is the work attributed to Nennius of Wales from c. 831 AD who describes the Irish freshwater pearl, though his book may again need to be understood in the context of creating a Biblical narrative for Britain and Ireland (Lucey 2005, 1).

6.2.1 Secular Law

Early Medieval law texts have survived into modern day in various states of preservation. Unfortunately, the law text most relevant to the study of shell middens, entitled *Muirbreatha* or ‘sea-judgement,’ is mostly lost with only a few excerpts

surviving as quotes in other works (Murray 2000, 162). There is one passage in *Bretha Crólige* (Binchy 1938, 20–1), laws dealing with the maintenance of the sick, which denies ‘sea produce’ to those who are ill:

‘There are three condiments which the rule of nursing in Irish Law excludes: every salt fare (*cac sailte*) which is prepared with sea produce, the flesh of a whale (*carne mairmil*) and of a horse and honey. For the produce of the sea impels one to drink.’ This ‘salt fare’ and ‘sea produce’ would more than likely include saltwater fish, seaweed, and shellfish. These foodstuffs, therefore, must have been consumed regularly enough to be considered a potential hazard to those in poor health.

There are a few law tracts with possible connections to shellfish regulation. There are differences in interpretation concerning whether or not shellfish is a requirement for a rock to be deemed ‘productive.’ If, as put forward by Kelly (2011, 107), a ‘productive rock’ is defined by the presence of both seaweed and shellfish, then this resource adds value to a coastal land area and, therefore, any land adjacent. Murray (2000), however, only indicates the necessity for seaweed to be present for a ‘productive rock’ to be considered.

Another law dealt with the regulation of colours which may be worn by different ranks. Red, or *derg*, is allowed for the sons of lords and purple, or *corcra*, is allowed for the sons of kings. Purple, specifically ‘Tyrian purple’ was widely associated with kingship on the continent and was created using *Murex* and *Purpura* shellfish in the Mediterranean. A similar shell found in Ireland, *Nucella lapillus* or the common dog whelk, can be used to extract dye, though depending on how long it is left to set it may produce either purple, fit for a king, or red, fit for a lord. While the evidence suggests that most of the dye used in Ireland was of vegetable origin, it may be suggested that this law would have been applied regardless of the source of the dye (Murray 2000; Kelly 2016, 263).

6.2.2 Canonical Law

The primary early canonical laws which are potentially relevant to shellfish gathering are those known as the ‘Law of Sunday,’ or the *Cáin Domhnaig*. This restricted the observant populace from ‘sea-picking,’ or *cnúasach mara*, on Sundays. Kelly (2016, 298) believes that this would have included the gathering or hunting of shellfish, crabs, shrimp, seaweed, and other foodstuffs. The fine for gathering on the sea or land on

Sunday was ‘a half-ounce of silver’ or a full ‘ounce of silver if it [was loaded] on the back’ (O’Keefe 1905, 207; Murray 2000, 173).

Fasting is another area in which canonical law may play a part. Times of ritual fasting in the early church included three Lents during the year (forty days before Christmas, forty days before Easter, and forty days after Pentecost) and two days during the week regularly. These two days were known in Irish as *Cétaín*, ‘the first fast’ or Wednesday, and *Aín dídine*, ‘the last fast’ or Friday. While monks may have fasted on nothing more than bread and water during some of these times, laymen who observed these fasts could not consume flesh meat or meat of the land, though seafood was allowed. Various laws, such as the *Bretha Crólige*, indicate specific restrictions during certain fasts for those of various ranks (Kelly 2016, 346–7). The reason for the differentiation between seafood and land meat in the early church is linked to 1 Corinthians 15:39 in the canonised New Testament: ‘Not all flesh is alike, but there is one flesh for human beings, another for animals, another for birds, and another for fish’ (“The Holy Bible” 1989). This in itself may have been derived from Judaism’s separation of *fleishig* (land-locked mammals and fowl) and *pareve* (foodstuffs without *fleishig* or dairy, including fish) (Merriam-Webster 2022a, 2022b).

6.2.3 Myths, Sagas, and Hagiographies

The stories of magic, miracles, saints, and heroes from the Early Medieval period make little reference to shellfish, though freshwater pearls are occasionally mentioned. Pearls are referenced when describing the river at which St. Patrick and others were said to have met to write the law tracts of *Senchus mór* (Petrie 1839, 76, *Anon.* 1865, 2; Lucey 2005, 1). This river, Nithnemannach, is known today as the River Dee in County Louth (Lucey 2005, 51). The river is again mentioned as containing pearls in the *Annals of Inisfallen* (MacAirt 1977, 48).

In the *Bodleian Dinnshenchas* — a collection of legends dated to somewhere between the eighth and twelfth century in origin — the pearls in both Lough Leane, Co. Kerry and the River Dee, Co. Louth were said to be the hammer scale of blacksmiths. The pearls of Lough Leane were derived from the making of the vessel of Fann the long-haired and those of the River Dee were from the making of the cup of Conor mac Nessa (Stokes 1892; Lucey 2005, 51).

6.2.4 Contemporary Histories

Bede, in his eighth-century *Ecclesiastical History of the English Nation* described ‘many kinds of shell-fish’ (Bede 2014, 13) from Britain and said that ‘Ireland both in extent of its breadth, wholesomeness and fineness of air, far passeth Britain’ (*ibid.* 19). He indicates mussels bearing pearls of assorted colours and *cochleae*, or snails, which produce crimson dye (*ibid.* 12–3). Many have assumed that these lines refer to ‘the situation of [both] Britain and Ireland’ as suggested by the chapter title and by the way in which Bede suggested that Ireland was similar, yet milder to Britain (*ibid.* 11).

Nennius of Wales referred to freshwater pearls from Ireland in his ninth-century text, *Historia Britonum*. He indicates that they could be harvested from Lough Leane, Co. Kerry and that they were worn in the ears of kings (Lucey 2005, 1). Whether these kings were contemporary, such as those of *Eóganacht Locha Léin*, or from earlier dynasties referenced in texts copied by Nennius (see Lucey 2005, 66-7 in discussing O’Conor 1814 and Morris 1980), the fact remains that the adornment of high status individuals by native pearls was recognised in ninth-century Ireland.



Figure 6.1: Gerald of Wales' depiction of the birth of barnacle geese (Giraldus Cambrensis 1188, MS 13 B VIII)

In the twelfth century, Gerald of Wales wrote his *Topographia Hiberniae* which indicated that Irish religious men were able to eat barnacle geese during times of fasting from flesh meat, which usually includes the meat of birds. This is because this particular goose species was considered a fish based on observations of the goose barnacle, *Lepas anatifera*. Because barnacle geese nest in Canada, no evidence of their rearing could be found regionally and the goose barnacles looked similar to the geese. This led to the belief that the geese were born out of the barnacles and were, therefore, seafood (Figure 6.1) (O'Meara 1982, 41–2; Moriarty 1997, 77; Murray 2000, 165; Kelly 2016, 300).

6.3 The Archaeology of Early Medieval Shell Middens

Forty-eight shell midden features within 32 sites date to the Early Medieval. Seven shell midden sites are not discussed here though they have potential Early Medieval dates: Windmill Lands, Co. Dublin (DU003A–B), St Macdara's Island, Co. Galway (GA039), Kilmoremoy, Co. Mayo (MO035), Horse Island, Co. Sligo (SO021), Settlement 6, Co. Sligo (SO075), and Settlement 11, Co. Sligo (SO087). The latter two had radiocarbon dates with unknown relationships to the midden. Horse Island produced an Early Medieval radiocarbon date from the midden, though a Neolithic hollow scraper was also found and the raw date is unavailable for recalibration. The remaining four sites were dated only due to their proximity to known Early Medieval sites without direct dating evidence within the shell middens themselves. One other deposit, Settlement 1, Co. Sligo (SO066) produced a radiocarbon date that was transitional between the Early and Late Medieval, though it is unclear if the dated sample was from the midden layers or elsewhere within the test pit and is therefore not discussed here.

The next two sections will examine the distribution and chronology of these sites based on the data available. This, along with key case studies and available collated data, will inform the broad patterns and discussion. The distribution is based on site coordinates given by the National Monuments Services for Ireland and Northern Ireland. The chronology is based upon radiocarbon dates and artefact associations cited in the available records.

Site Name, Townland	County	SMR	Catalogue ID	Date (AD)	Date LOC
Potter's Cave, Ballintoy Demesne	Antrim	ANT004:014	AN002A-C	7 th -12 th c.	C
Masked Rock Shelter, Ballintoy Demesne	Antrim	ANT004:127	AN003A-B	7 th -12 th c.	C
The Moat, Minnis North	Antrim	ANT030:013	AN005	7 th -16 th c.	C
Park Cave, White Park	Antrim	MRA001:035	AN009B	7 th -12 th c.	C
Portbradden Cave, Templastragh	Antrim	ANT003:034	AN010A	7 th -13 th c.	C
Larrybane Head, Knocksoghey	Antrim	ANT004:005	AN015A-C	5 th -12 th c.	B
Dunshammer, Ballintoy Demesne	Antrim	ANT004:096	AN016	7 th -12 th c.	C
An Carraig Fhinn	Donegal	DG032-009	DL022	10 th -13 th c.	B
Dooey, An Dumhaigh	Donegal	DG065-003003	DL040	5 th -8 th c.	B
Rinnaraw	Donegal	DG016-016002	DL053A, C-D	8 th -10 th c.	C
Lambay Island	Dublin	DU009-001004	DU002	5 th -7 th c.	C
Dalkey Island	Dublin	DU023-029002	DU009A	6 th -13 th c.	B
Nundrum, Mahee Island	Down	DOW017:005	DW004A-B	7 th -12 th c.	A
Oughtymore	Derry	LDY001:002	DY001	7 th -16 th c.	A
Culfin	Galway	GA010-048	GA005A	5 th -6 th c.	C
Cartoorbeg	Galway	GA021-008	GA008	10 th -11 th c.	C
Gooreenatinny	Galway	GA021-021	GA009	11 th -12 th c.	C
Creggoduff	Galway	GA048-004	GA026	11 th -13 th c.	C
Doonloughan; Truska	Galway	GA048-008001	GA027C, E-F	5 th -11 th c.	A/B
Rathgurreen, Cottage	Galway	GA095-009	GA074A-C	4 th -9 th c.	A-C
Illaughntannig	Kerry	KE019-002008	KY004	5 th -12 th c.	C
Rossbehy	Kerry	KE063-001	KY048	5 th -12 th c.	C
Canroe, Beginish	Kerry	KE079-031003	KY051B-C	7 th -10 th c.	B
Illaunloughan, Portmagee	Kerry	KE087-036007	KY053A, C	8 th -13 th c.	A/C
Inis Gé Thuaidh	Mayo	MA023-012	MO028	9 th -10 th c.	B
Bailey Mór, Inis Gé Thuaidh	Mayo	MA023-011	MO065	5 th -8 th c.	A
Horse Island	Sligo	SL007-046	SO020	5 th -12 th c.	C
Settlement 15, Culleenamore	Sligo	SL013-089002	SO041E	7 th -11 th c.	B
Coney Island	Sligo	SL014-003*	SO047	5 th -12 th c.	C
Settlement 2, Grange West	Sligo	SL014-153002	SO067	7 th -9 th c.	A
Glebe	Sligo	SL019-005002	SO078A-C	5 th -12 th c.	B/C
Bewley	Waterford	WA029-026002	WA011	6 th -12 th c.	B

Table 6.2: List of all sites discussed in chapter with relevant deposits indicated under Catalogue ID. Date estimates are based on radiocarbon dates where available and are otherwise based upon artefact inclusions discussed in Section 6.3.2. Further information concerning these dates is given in catalogue entries. LOC indicates the Level of Confidence.

6.3.1 Distribution

Of the 32 Early Medieval shell midden sites, seven are found in Co. Antrim (22%); six are found in Co. Galway (19%); five in Co. Sligo (16%); four in Co. Kerry (13%); three in Co. Donegal (9%); two in Counties Dublin and Mayo (6% each); and one in Counties Down, Derry, and Waterford (3% each) (Figure 6.2).

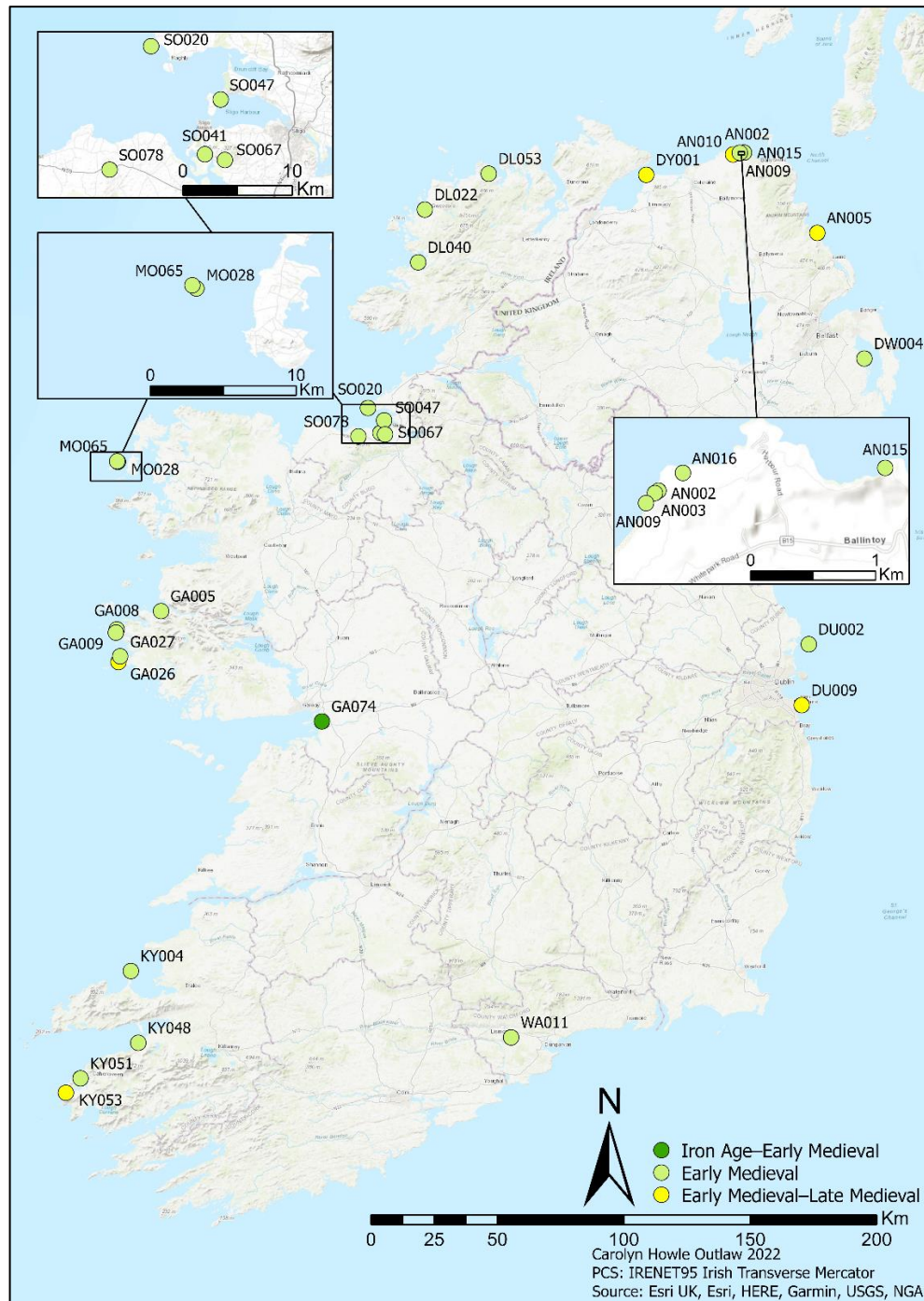


Figure 6.2: Distribution map of Early Medieval shell midden sites with rough estimates of dates. The inset maps show the clusters of sites at Sligo Harbour, Co. Sligo and White Harbour and Ballintoy, Co. Antrim. A third inset shows the proximity of the two sites at Inis Gé Thuaidh, Co. Mayo.

Counties Clare, Cork, Louth, Wexford, and Wicklow lack any sites dated to this period. Early Medieval shell midden features have been recorded in the urban centres of Cork, Co. Cork and Townparks, Co. Louth. There are few shell middens recorded altogether in Counties Wexford and Wicklow. Twenty-five shell middens have been

found in Co. Clare, six of which produced dating evidence from the Mesolithic through the Early Modern period. The lack of Early Medieval dates may be a result of an unknown recording bias or may be indicative of a reduction in shellfish use during this period in this area.

There are two clusters of shell deposition activity: one in Co. Antrim and one in Co. Sligo. Both are similarly located to two shell midden concentrations of later prehistoric date (see Chapter 5). Co. Antrim contains a cluster of six along White Park Bay and the Ballintoy shoreline. This area has been a focus of study for over 150 years with its dune system and natural caves. Sligo, *Sligeach*, or the ‘shelly place,’ is known for its middens and the area around Sligo Harbour, where this cluster of five occurs in an area intensively studied by Burenhult in the 1980s. The concentration of Early Medieval shell middens in Antrim and Sligo probably reflects more intensive research in those areas rather than any regional trend.

6.3.2 Chronology

Eighteen of the 48 Early Medieval deposits were dated with radiocarbon analysis. Eleven of these were also dated by artifact associations or stratigraphy. Thirty deposits were only dated through non-scientific methods, including 13 based on artefact associations, ten with stratigraphic relationships, and seven with both artefacts and stratigraphy.

Settlement 2, Co. Sligo (SO067) provided one Iron Age (79–350 AD; 1830±50 BP; Lu-1699) and one Early Medieval (604–878 AD; 1320±70 BP; Lu-1838) date. The former was from a sample taken directly beneath the bottom shell layer and the latter was taken from stone packing directly on top of the shell layers. The souterrain ware sherds found within the layer support this site as an Early Medieval site rather than Iron Age. Another site in Sligo, Settlement 8 (SO070), also produced one Iron Age (170 BC–124 AD; 2020±55 BP; Lu-1862) and only Early Medieval (663–881 AD; 1260±50; Lu-1756) date. These dates, however, were inverted and no ceramics were uncovered within the deposit. With a potential Iron Age date, Settlement 8 is discussed in Chapter 5, while Settlement 2 is included here.

A few sites which are possibly transitional between the Early and Late Medieval periods are discussed here. These include The Moat, Co. Antrim (AN005), Oughtymore, Co. Derry (DY001), Charraig Fhinn, Co. Donegal (DL022), and

Illaunloughan, Co. Kerry (KY053A). Charraig Fhinn and Illaunloughan both produced transitional radiocarbon dates while everted rim ware was discovered in The Moat and Oughtymore.

Artefacts used to date sites included pottery sherds — souterrain ware and everted rim ware, bone combs and pins, bronze ornaments and shrine pieces, and iron ornaments. Stratigraphic relationships included associations with Early Medieval monasteries, raths and cashels, and dated house structures. Samples used for radiocarbon dating included charcoal, charred grain, charred hazelnut, a human femur, and shells of dog whelk, limpet, mussel, and winkle.

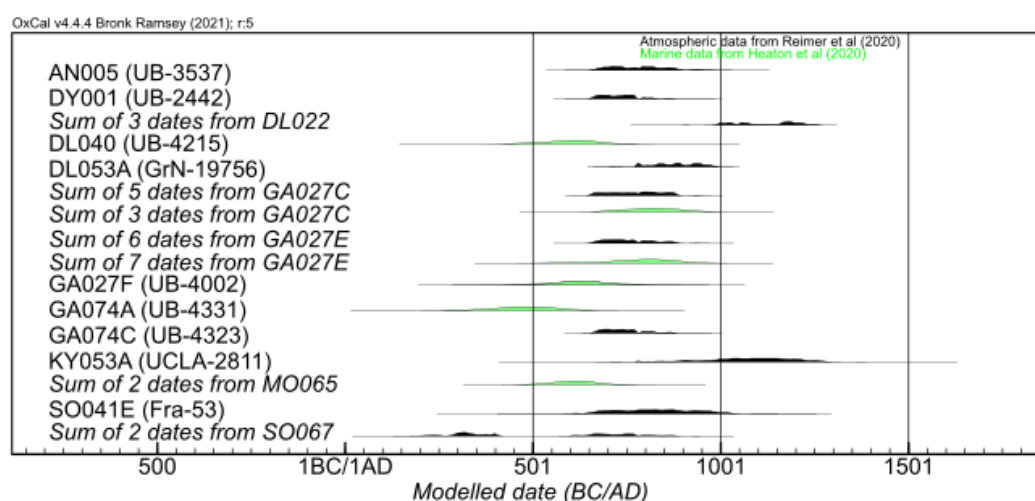


Figure 6.3: Radiocarbon dates of Early Medieval sites in alphabetical order by catalogue ID. Sum probabilities are given where possible for sites with multiple dates. Marine calibrated dates are shown in green.

The earliest Early Medieval radiocarbon date for the period was recovered from Rathgurreen, Co. Galway (GA074A) which dated to 316–645 AD (1925±30 BP; UB-4331) (Figure 6.3). The latest date for sites presented in this chapter was recovered from An Charraig Fhinn, Co. Donegal (DL022). This site produced three total dates with the latest dating to 1161–1273 AD (832±35; UB-3616). The latest non-transitional Early Medieval date came from Rinnaraw, Co. Donegal (DL053A) which dated to 773–979 AD (1160±35 BP; GrN-19756).

6.4 Key Case Studies

The following case studies were chosen due to their importance in interpreting the Early Medieval shell midden sites. The first site was chosen as it contains some of the strongest evidence for production of dog whelk dye, of which there are few details in the archaeological record. The second site is presented to illustrate how shellfish were not only used by the native Irish population but were also extensively used by Vikings who settled here. The final site was chosen as an example of a site containing freshwater shells. This is only one of two dated sites reported with freshwater shells, both of which date to the Early Medieval period. One other site contains freshwater mussels, but it has not been dated. This site is that of Keel Strand, Co. Mayo (MO047).

6.4.1 Inis Gé Thuaidh, Co. Mayo (MO028 and MO065): Dog Whelk Dye

The monastic settlement at Inis Gé Thuaidh, or Inishkea North, Co. Mayo was first surveyed in 1937 by Françoise Henry, who recorded ‘a mound at least 60 feet high, and about 500 feet in diameter, made of a mixture of animal bones, shells and sand’ with small structural remains and engraved slabs on top. This mound, known as Bailey Mór (MO065), was partially excavated the next year by Henry (1945, 131).

Though at first appearance the mound could have been mistaken as one ‘gigantic kitchen midden,’ it was the result of multiple hearths and waste areas being trampled into the dune following the ruin of the structures (Henry 1945, 132). These structures were compared to the beehive huts seen at Skellig Michael (*ibid.* 134–5). The shells found associated with these structures in the unconsolidated dune were primarily limpet and winkle with some dog whelk (*Nucella lapillus*), whelk (*Buccinum* sp.), scallop (*Pecten maximus* and *P. opercularis*), and flat winkle (*Littorina obtusata*) (*ibid.* 154–5). The engraved slabs are the most recognisably dateable structures on the island and, based on the art style, are estimated to date from the 7th or 8th century AD (*ibid.* 152).

In 1950, Henry undertook further excavations on Inis Gé Thuadh of a platform to the northeast of Bailey Mór (MO028). The eroded section face of the platform — caused by local quarrying of shells for lime — revealed alternating layers of burnt clay and thick lenses of broken dog whelk shells (Henry 1952, 163). These deposits continued across most of the platform site, though they were not found within the structures. On the surface of the platform there was a structure said to have an

occupation floor clear of most debris, though a few dog whelks and burnt limpets were noted (*ibid.* 164). Near this structure was a cone-shaped pit with a few broken dog whelks (*Nucella lapillus*) inside and beside it. A possible ‘cellar’ pit was also identified along with an entrance path (Figure 6.4) (*ibid.* 167–8).

Henry interpreted this site as a facility for making dog whelk dye using the aforementioned cone-shaped pit. The ‘cellar’ was suggested as storage for live fish as it was lined with stones and the fish need to be fresh for proper dye extraction (Henry 1952, 176). The presence of burnt limpets throughout the dog whelk deposits (*ibid.* 165–6) may suggest alternative interpretations, though the use of purple dye is recorded in the literature and Bede even suggests that the dog whelks were used for this purpose. The interpretation of the site will be further discussed in section 6.6.

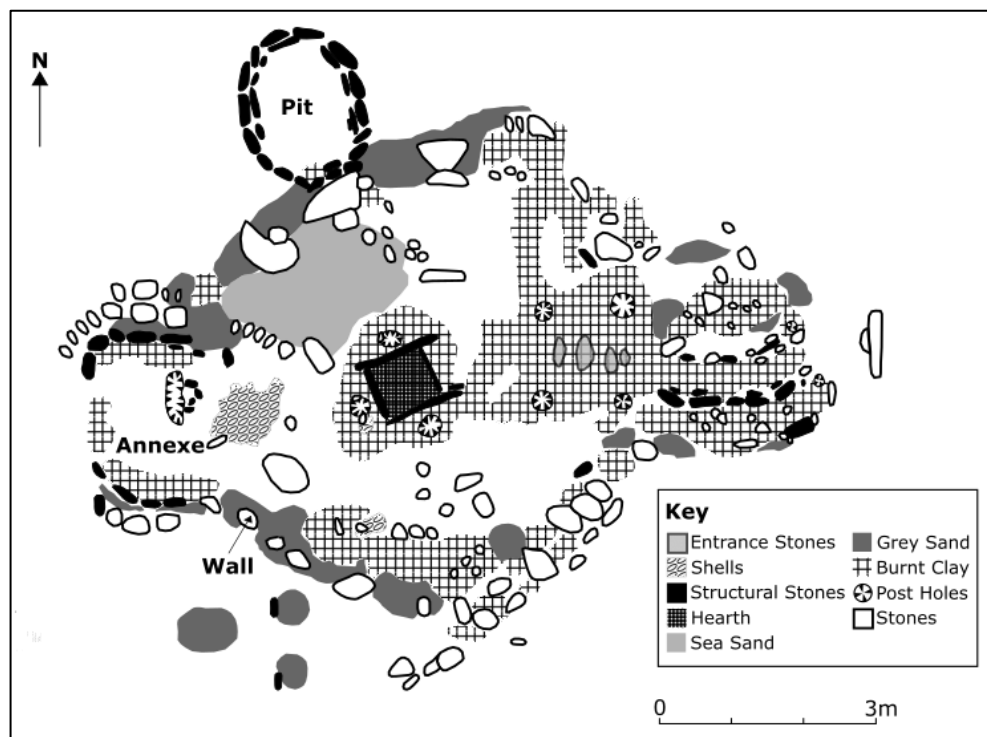


Figure 6.4: Inis Gé Thuaidh, Co. Mayo (MO028): possible dye manufacturing site (after Edwards 2004, 82).

6.4.2 Canroe, Co. Kerry (KY051B–C): Viking Activity

Professor O’Kelly investigated Canroe, Co. Kerry (KY051) in the early 1950s after erosion resulted in the exposure of settlement evidence. The settlement contained eight houses, fifteen cairns, eight animal shelters, two poorly made structures, and extensive field walls. Two houses, Houses 1 and 2, one animal shelter, and one cairn were

excavated. Shell midden evidence was found during the investigation of House 1 (O’Kelly 1956; O’Sullivan and Sheehan 1996, 385).

Prior to excavation, shells, animal bones, and human bones were noted in a spread to the southeast, east, and northeast of the house structure. The structure itself was found to be one primary structure with a secondary, smaller structure added to its north. The surface of the entrance passage was covered in midden material. Beneath the first two midden layers was another layer of sterile sand overlying stone collapse which covered the original occupation surface for the house (O’Kelly 1956, 160–1).

This occupation layer contained shells, animal bones, and charcoal within a black organic matrix. The shells were identified as primarily that of wrinkle (*Littorina littorea*) and limpet (*Patella vulgata*). Other shells included scallop (*Pecten maximus*), oyster (*Ostrea edulis*), and top shell (*Gibbula* sp.) (O’Kelly 1956, 193). Beneath this layer, a hearth was found along with evidence of other small fires. Beneath the hearth layer was what was interpreted as the original sand floor and three refuse pits that contained shells, animal bones, and charcoal (*ibid.* 162).

Further shells and animal bones were found between the entrance of the secondary northern structure and the entrance passage to the primary house. Similar deposits were noted at the west and north walls. The stratification within this secondary structure was similar to that found in the main house including the roughly-built shelters (O’Kelly 1956, 166–7).

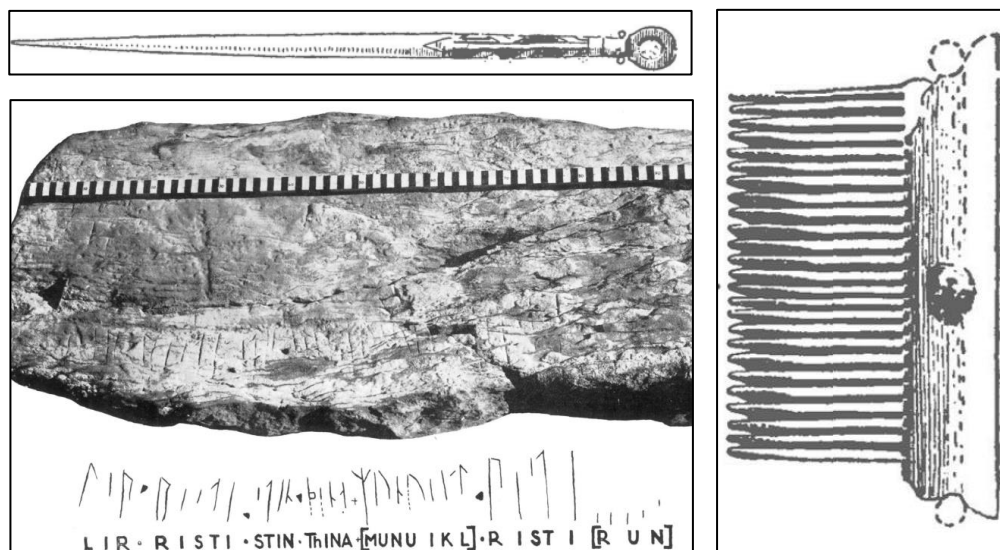


Figure 6.5: Top left: Bone pin. Right: Bone comb (O’Kelly 1956, 176). Bottom left: ‘Detail of Runic inscription with transcription and translation’ on House 1 lintel (*ibid.* Plate XII).

House 1 and its primary occupation layers were estimated to date c.1100 AD based on a Viking rune inscribed on the lintel of the house (O’Kelly 1956, 188–90). An ornamented ivory or bone pin and bone comb may be other associations (Figure 6.5). The comb was described as an ‘ordinary long comb of the Viking Age’ and the pin has similarities to a 9th century pin from Norway. Another significant find was that of a bronze pin with evidence of having been decorated with shell, perhaps mother of pearl (the inside nacre lining of mollusc shells) (*ibid.* 175–7).

6.4.3 Bewley, Co. Waterford (WA011): Freshwater Pearls

Unfortunately, there is little available information regarding Bewley, Co. Waterford (WA011). Ussher excavated the site in 1881 where he describes a refuse heap which he claims was contemporary with a ringfort or rath. This refuse included charcoal, slag, burnt stones, animal bones, pottery sherds, human bones, a stone hatchet, and shells of fresh water mussels (Ussher 1886, 365–6). The rath itself is less than 30m from the northern edge of the River Finisk, less than 3km from the eastern boundary of the River Blackwater, and about 13km to the shoreline at Dungarvan Harbour.

The only other site with freshwater mussels reported, the undated site of Keel Strand, Co. Mayo (MO047), is located less than 90m north of the coastline at Keel East, less than 415m south of Keel Lough, and about 830m west of Gallaghers River. Oughtymore, Co. Derry (DY001), also contained freshwater shells, though freshwater mussels were not reported. This site lies on the Magilligan Strand of the brackish Lough Foyle, less than 2km from the Banon Strand of the Atlantic, and over 20km from the mouth of the River Foyle. The varying distance from the ocean and freshwater sources may indicate that the consumption of the freshwater molluscs is not dependent upon immediate access to rivers, however marine mollusc exploitation is not found at Bewley, which is furthest from the shore.

6.5 Overview of Available Data

The following sections aim to present the available data collected concerning shell middens dating to the Early Medieval period. This includes potential associations, dimensional measurements, inclusions of fauna and flora, artefactual inclusions, and any human remains from within the shell middens themselves. The fauna and flora are

separated into shells, bones, and plant remains. The data is briefly discussed here, but interpretive conclusions are expanded upon in section 6.6.

6.5.1 Associations

There seems to be a close relationship between shell deposition activity and both larger habitation and religious sites (Table 6.3). Of the twenty-two sites with related site type associations known, seven are related to Christian religious sites. This is followed in number by relations to known habitation sites including Viking/Hiberno-Norse settlements and settlement platforms. Other site associations include promontory forts, ringforts, and cave sites.

Catalogue ID	Cave Site	Christian Church Site	Habitation Site	Promontory Fort	Ringfort
AN002	X				
AN003	X				
AN009	X				
AN010	X				
AN015				X	
AN016			X		
DL040			X		
DL053					X
DU002		X			
DU009				X	
DW004		X			
GA009		X ⁺			
GA074					X
KY004		X			
KY051			X		
KY053		X			
MO028		X			
MO065		X			
SO041			X		
SO067			X		
SO078			X		
WA011					X
TOTAL:	4	7	6	2	3

Table 6.3: Early Medieval shell midden sites with potentially associated site types. + indicates a site related to a holy well.

6.5.2 Dimensions

Only 18 out of 48 (38%) shell midden features dated to the Early Medieval period have any published dimensional data (Table 6.4). Of these, seven (39%) have all three dimensions, seven (39%) have only length and thickness recorded, and four (22%)

have only thickness recorded. Gooreenatinny, Co. Galway (GA009) was the largest deposit measuring 88m by 18.3m by 0.9m with an estimated volume of 1449.4m³. One deposit at Dooley, Co. Donegal (DL040) was longer than this, however, with a length of 125.7m. Glebe, Co. Sligo (SO078C) was the thickest deposit at 1.2m. The shortest deposit was Coney Island, Co. Sligo (SO047) with a length of 1m. Doonloughan, Co. Galway (GA027E) had the smallest thickness at 0.03m. Of the 14 shell midden features with at least two recorded dimensions, nine (64%) meet either the area (10m²) or volume (2m³) threshold to be considered large shell mounds or middens (see Chapter 2). All deposits with all three dimensions known met these requirements.

Catalogue ID	Length (m)	Width (m)	Thickness (m)	Area (m ²)	Volume (m ³)
AN002A	–	–	0.8	–	–
AN002B	–	–	0.3	–	–
AN005	6.9	4	0.3	27.6	8.3
DL040	125.7	2	0.8	251.4	201.1
DU009A	6	–	1	6	–
DY001	10	–	0.3	3	–
GA005A	25	–	0.5	12.5	–
GA008	33	18	0.5	594	297
GA009	88	18.3	0.9	1610.4	1449.4
GA026	30	–	0.4	12	–
GA027E	–	–	0.03	–	–
KY048	8.9	3.8	0.2	33.8	6.8
KY051B	6.8	6.8	0.5	46.2	23.1
KY053A	3	–	0.7	2.1	–
SO020	5.5	–	1	5.5	–
SO041E	20	15	1	300	300
SO047	1	–	0.2	0.2	–
SO078C	–	–	1.2	–	–
TOTAL:	14	7	18	14	7
Average:	26.4	9.7	0.6	193.6	326.5

Table 6.4: Dimensional measurements available for shell midden features dating from the Early Medieval period. The total number of features with each measurement is given at the bottom followed by the average. All measurements have been rounded to the nearest tenth.

6.5.3 Fauna and Flora

Where the information is available shell, bone, and plant species of later prehistoric shell middens are presented below. Common English names are used here (see Chapter 3). Most species are in fact only identified to genus and species groups such as fish

and bird are presented together due to the infrequency that these are differentiated in the available texts. Where these groups have been differentiated, the data is presented in relevant catalogue entries.

Shells

Eight of the 48 (17%) Early Medieval deposits have no available molluscan species information. Within the 40 that do include this information (Table 6.5), limpet and winkle are the most common species. Most of the deposits in which one of these species is found also contains the other: 25 of the 33 (76%) deposits which contain either species, contain both. Both species can be found on rocky intertidal zones.

Oysters, dog whelks, and cockles are the next most common species. Though dog whelks were reported in the same number of deposits as cockles and in five less deposits as oyster, they were a dominant species more frequently than either oyster or cockle. Dog whelks can be found in similar environments to limpet and winkles. Oysters, however, are typically found in the near to far shore attached to hard substrates in estuarine environments. Cockle can be found in the intertidal zone, but this species burrows in sand rather than attaching to rocks.

ID	<i>Patella vulgata</i>	<i>Littorina littorea</i>	<i>Ostrea edulis</i>	<i>Nucella lapillus</i>	<i>Cerastoderma edule</i>	<i>Mytilus edulis</i>	<i>Pecten sp.</i>	Fresh Water	Other/ Unidentified
AN002A	D‡	X‡	—	—	—	—	—	—	—
AN002B	D‡	—	—	—	—	—	—	—	—
AN002C	D‡	D‡	—	—	—	—	—	—	—
AN003A	D‡	D‡	—	—	—	—	—	—	X
AN003B	D‡	D‡	—	—	—	—	—	—	—
AN005	X	D	X‡	—	—	—	—	—	X
AN009B	D‡	D‡	—	—	—	—	—	—	—
AN010A	D	D	—	X	—	X	X	—	X
AN015A	D‡	—	—	—	—	—	—	—	—
AN015B	D‡	—	—	—	—	—	—	—	—
AN015C	D‡	—	—	—	—	—	—	—	—
AN016	D‡	—	—	—	—	—	—	—	—
DL022	D‡	D‡	D‡	D‡	—	—	—	—	—
DL040	X‡	X‡	X‡	D	—	X‡	—	—	X
DL053A	—	D	—	—	D‡	—	—	—	X
DL053C	D*	D	—	—	—	—	—	—	—
DL053D	—	D	—	—	—	—	—	—	—
DU002	—	—	—	—	—	—	—	—	/
DU009A	—	—	—	—	—	—	—	—	/
DW004A	—	—	D‡	—	—	—	—	—	—
DW004B	—	—	D‡	—	—	—	—	—	—
DY001	X	D†	X	X	D	D	X^	X	X
GA005A	X‡	X‡	X‡	D‡	X‡	—	—	—	—
GA008	D‡	X‡	—	—	X‡	—	—	—	X
GA009	D	X	—	—	X*	—	—	—	X
GA026	—	—	—	—	—	—	—	—	/
GA027C	—	—	—	—	—	—	—	—	/
GA027E	X‡	D‡	—	X‡	—	—	—	—	—
GA027F	—	—	—	D*	—	—	—	—	—
GA074A	X	X	X	D	X	X	—	—	X

ID	<i>Patella vulgata</i>	<i>Littorina littorea</i>	<i>Ostrea edulis</i>	<i>Nucella lapillus</i>	<i>Cerastoderma edule</i>	<i>Mytilus edulis</i>	<i>Pecten</i> sp.	Fresh Water	Other/ Unidentified
GA074B	D	X	X	X	X	X	—	—	X
GA074C	X	D	X	X	X	X	X†	—	X
KY004	—	—	—	—	—	—	—	—	/
KY048	—	X‡	X‡	—	D‡	X	—	—	X
KY051B	D	D	X	—	—	—	X	—	X
KY051C	—	—	—	—	—	—	—	—	/
KY053A	D‡	D‡	X‡	—	—	—	X	—	—
KY053C	—	—	—	—	—	—	—	—	/
MO028	X*	—	—	D	—	X‡	X	—	—
MO065	—	—	—	D	—	—	—	—	—
SO020	D‡	D‡	—	—	—	—	—	—	X
SO041E	X*	X*	D*	—	X*	X*	X*	—	—
SO047	D‡	X‡	X‡	—	X	—	—	—	—
SO067	—	X*	D*	—	X*	—	—	—	—
SO078A	D‡	D‡	X‡	—	—	—	—	—	X
SO078B	—	D‡	—	—	—	—	—	—	—
SO078C	—	—	—	—	—	—	—	—	/
WA011	—	—	—	—	—	—	—	D‡	—
TOTAL:	30	29	17	12	12	9	7	2	23
Dominant:	21	18	5	7	3	1	0	1	0

Table 6.5: Shell species identified in Early Medieval shell midden deposits. X indicates the species is present. D indicates that a species was dominant. Under the column 'Other/Unidentified,' X indicates a known shell species other than those listed and / indicates unidentified species. * indicates the genus is known, but the species is not. † indicates that the species listed is present along with similar species (for instance, *Littorina littorea* (common periwinkle) and *Littorina saxitalis* (rough periwinkle) are both present at DY001). ‡ indicates that only vernacular names are used in available sources and scientific species are assumed. ^ indicates that a similar species is found instead of the more common species listed (for instance, *Aequipecten opercularis* (queen scallop) was reported at DY001, but *Pecten* sp. (such as great scallop) was not).

Less common species reported include land shells, flat winkles, top shells, barnacles, ocean quahogs, clams, banded wedge shells, rough winkles, trough shells, otter shells, dog cockles, whelks, razor shells, rayed artemises, carpet shells, golden venuses, and sting winkles (Table 6.6). Barnacles, while only reported in one deposit at Rinnaraw, Co. Donegal (DL053A), is significant as this is the only time this inclusion is reported within a dated shell midden feature. Freshwater shells are also infrequent but are a dominant species in a single deposit while no other uncommon shell species is dominant within any deposit.

Catalogue ID	Shell Species
AN003A	ocean quahog
AN005	land shells
AN010A	flat winkle; top shell
DL040	clam
DL053A	barnacle

DY001	banded wedge shell; dog cockle; ocean quahog; otter shell; trough shell; whelk
GA008	razor shell
GA009	flat winkle
GA074A	carpet shell; sting winkle
GA074B	carpet shell; golden venus
GA074C	carpet shell; flat winkle; golden venus; rayed artemis; whelk
KY048	whelk
KY051B	top shell
SO020	land shells

Table 6.6: Uncommon shell species identified in Early Medieval shell midden features.

Bones

Thirty-six of the 48 (75%) Early Medieval shell-bearing deposits had animal bones recorded. Twenty-four (67%) of these included species information (Table 6.7). Cattle is the most common species followed by pig and sheep/goat. Only one deposit contains either sheep/goat and/or pig without also containing cattle. Less common species include dog, cat, cetacean, seal, hare, and crab. Dog was found at The Moat, Co. Antrim (AN005). Dog and cat were both found at Doonloughan, Co. Galway (GA027C) and Canroe, Co. Kerry (KY051B). Bailey Mór, Co. Mayo (MO065) contained cetacean, seal, hare, and crab remains. None of the less common species were listed as dominant at any site.

Catalogue ID	Cattle	Pig	Sheep/Goat	Fish	Horse	Bird	Deer	Other/Unidentified
AN002A	D	X	D	X	D	–	–	–
AN002B	D	D	–	–	D	–	–	–
AN002C	–	D	–	–	–	–	D	–
AN003A	–	–	–	X	–	–	–	/
AN003B	–	–	–	X	–	–	–	/
AN005	D	–	–	–	–	–	–	X
AN009B	–	–	–	–	D	–	–	–
AN016	–	–	–	–	–	–	–	/
DL022	D	–	D	–	–	–	–	–

Catalogue ID	Cattle	Pig	Sheep/Goat	Fish	Horse	Bird	Deer	Other/Unidentified
DL040	X	X	X	X	–	–	X	–
DL053A	–	–	–	–	–	–	–	/
DU002	–	–	–	–	–	–	–	/
DU009A	–	–	–	–	–	–	–	/
DW004A	–	–	–	–	–	–	–	/
DW004B	–	–	–	–	–	–	–	/
DY001	D	X	X	X	X	X	–	–
GA008	–	–	–	–	–	–	–	/
GA009	–	–	–	X	–	–	–	/
GA026	–	–	–	–	–	–	–	/
GA027E	D	–	D	–	–	–	–	–
GA074A	D	X	X	–	–	–	–	–
GA074B	D	X	X	–	–	–	–	–
GA074C	D	X	X	–	X	X	–	X
KY004	–	–	–	–	–	–	–	/
KY051B	X	X	X	X	–	X	–	X
KY051C	–	–	–	–	–	–	–	/
KY053A	–	–	–	D	–	D	–	–
KY053C	–	–	–	–	–	–	–	/
MO028	X	X	X	X	X	X	X	–
MO065	D	X	D	D	–	X	–	X
SO020	X	–	X	X	–	X	–	–
SO047	D	D	–	D	–	–	–	–
SO067	D	D	D	–	X	–	–	–
SO078A	–	–	–	–	–	–	–	/
SO078C	–	–	–	–	–	–	–	/
WA011	X	X	X	–	X	–	X	–
TOTAL:	17	14	14	12	8	7	4	20
Dominant:	12	4	5	3	3	1	1	0

Table 6.7: Bone species identified in Early Medieval shell midden features. Fish and bird are not differentiated to species. X indicates the species is present and D indicates that a species was dominant within the deposit. Under the column 'Other/Unidentified,' X indicates a known bone species other than those listed and / indicates an unidentified species.

Plant Remains

Twenty-four Early Medieval shell midden features had plant remains. Of these, nineteen contained only charcoal. Charcoal was also found within another four deposits along with other plant remains. One shell midden, Horse Island, Co. Sligo (SO020), had cereal remains, but no charcoal (Table 6.8). Other deposits with cereal remains include Potter's Cave, Co. Antrim (AN002A), Oughtymore, Co. Derry (DY001), and Settlement 2, Co. Sligo (SO067). Where recorded, these cereals included barley, oat, wheat, rye, and flax. Fruit stones and hazelnuts were also recorded at Settlement 2 while wild taxa were found at Oughtymore. Doonloughan, Co. Galway (GA027C) contained unburnt wood. Seaweed was also recorded at two deposits in

Doonloughan, Co. Galway (GA027C, E). Seaweed harvesting was recorded taking place at Gooreenatinny, Co. Galway (GA009) in the early 20th century (Brunnicardi 1914, 198).

Catalogue ID	Cereals	Barley	Oat	Wheat	Rye	Flax	Stones	Hazelnut	Wild Taxa	Wood	Charcoal
AN002A	X	—	—	—	—	—	—	—	—	—	X
DY001	—	X	—	—	X	—	—	—	X	—	X
GA027C	—	—	—	—	—	—	—	—	—	X	X
SO020	X	—	—	—	—	—	—	—	—	—	—
SO067	—	X	X	X	—	X	X	X	—	—	X

Table 6.8: Plant remains identified in later prehistoric shell midden features. Shell midden deposits only reporting charcoal are not included in the table.

6.5.4 Artefacts

Artefacts were recorded in 33 of the 48 (69%) Early Medieval shell midden features (Table 6.9). Ceramics were found within the most deposits. Souterrain ware was the most common ceramic type, found in 50% of deposits with ceramics. Stone was the next most common artefact type, though six of the deposits with stone artefacts only included fire cracked rocks. Evidence of metallurgy included moulds, crucibles, a tuyere fragment, pig iron, and iron slag. Evidence of textile work included spindle-whorls and buttons.

Catalogue ID	Ceramics	Stone	Bone	Metal	Lithics	Glass
AN002A	souterrain	—	—	—	—	—
AN002B	—	—	—	—	Meso tools*; BA tools*	—
AN002C	—	—	pin	—	Meso tools*; BA tools*	—
AN003A	souterrain	—	—	—	—	—
AN003B	souterrain	—	object	—	blade	—
AN005	souterrain; everted rim	—	pin	—	flakes	—
AN009B	souterrain	—	object	—	blade	—
AN010A	souterrain	—	—	—	—	—
AN015B	sherds	—	—	—	—	—
AN016	souterrain	quern	comb	—	—	—
DL022	sherd	—	harp peg	bronze pin	—	—
DL040	crucibles; moulds	—	combs; pins; spindle-whorl; knife handles	bronze ornaments; iron ornaments; iron knives; iron fishhooks; slag	arrowheads	beads
DL053A	sherds; tuyere	—	points	iron handle; iron knife; slag	—	—
DU002	B-ware	—	—	—	—	—
DU009A	—	—	pin; objects	—	—	—

Catalogue ID	Ceramics	Stone	Bone	Metal	Lithics	Glass
DW004A	souterrain	—	—	—	—	—
DW004B	souterrain	tracked; polishing; engraved tablet	—	slag; pig iron	—	—
DY001	souterrain; everted rim	bracelet; fcr	combs; ring; spindle—whorl	—	flakes; cores	bracelet
GA005A	—	fcrs	—	—	—	—
GA008	—	—	—	bronze ringed pin	—	—
GA009	glazed	fcrs	—	—	—	—
GA026	—	fcrs	—	—	—	—
GA027C	—	fcrs	object	bronze brooch; iron knife	—	—
GA027E	—	fcrs	—	—	flake	beads
GA074C	crucibles	—	—	—	—	—
KY051B	—	line sinker; net sinkers; perforated	comb; pin; points; ring	bronze ornament; iron knives; objects; iron nail	—	—
KY053A	—	bracelet	comb; beads	bronze brooches; iron knife; slag	—	—
MO028	—	buttons; spindle-whorls; fcrs	—	bronze brooch; bronze handle; iron wire; iron bowl; iron objects	—	—
MO065	sherd	quern; spindle-whorls	comb; disc; pins; spindle-whorls	iron nails; iron dagger; iron knife; iron fragments	—	—
SO020	—	fcrs	—	iron nail	debitage	—
SO067	sherds	whetstones; hammer; object	—	iron fragments; slag	retouched tools	—
SO078C	—	—	spindle-whorl; pin; object	—	—	—
WA011	sherds	hatchet; fcrs	—	slag	—	—
TOTAL:	20	15	14	13	10	3
Summary:	10 souterrain; 2 everted rim; 1 B-ware; 6 sherds; 1 glazed; 2 crucibles; 1 moulds; 1 tuyere	2 bracelets; 2 spindle-whorls; 2 querns; 1 tracked; 1 polishing; 1 engraved tablet; 1 line sinker; 1 net sinker; 1 perforated; 1 buttons; 1 hammer; 1 whetstones; 1 hatchet; 1 object; 8 fcrs	7 pins; 5 objects; 6 combs; 1 harp peg; 4 spindle- whorls; 1 knife handle; 1 points; 2 rings; 1 beads; 1 disc	1 bronze pin; 2 bronze ornaments; 1 iron ornaments; 6 iron knives; 1 iron fishhooks; 6 slag; 1 iron handle; 1 pig iron; 1 bronze ringed pin; 3 bronze brooches; 2 objects; 3 iron nails; 1 bronze handle; 1 iron wire; 1 iron bowl; 1 iron dagger; 1 iron fragments	2 Meso tools*; 2 BA tools*; 2 blades; 3 flakes; 1 arrowheads; 1 retouched tools; 1 debitage; 1 cores	2 beads; 1 bracelet

Table 6.9: Artefact types found within Early Medieval shell midden features.

* indicates artefacts typical of earlier periods. 'FCR' indicates fire cracked rocks.

Thirteen of the 33 deposits containing artefacts were recorded with ornaments. The ornaments were made from bone, metal, stone, and glass. The metals used were both iron and bronze, though bronze was used more often than iron. Ornaments included bone beads, bone pins, bronze brooches, stone bracelets, bone rings, and iron brooch, glass beads, and glass bracelets.

6.5.5 Human Remains

Few deposits contained human remains during the Early Medieval period. Four of the 48 deposits were reported to have human remains. Two of these had disarticulated remains. Two of these deposits contained articulated burials. The burial at Cartoorbeg, Co. Galway (GA008) may have been near the midden rather than within it. The burials at Inis Gé Thuaidh, Co. Mayo (MA068) were within an occupational layer which also contained a large volume of shells; it is unclear if this deposition was intentional or if the shell waste was spread like in many other areas of the site (Henry 1945, 135). Inis Gé Thuaidh also contained disarticulated remains.

6.6 Discussion

It has been intimated... that even in prehistory the Phoenicians traded with the ancient Irish exchanging the secrets of producing purple (Tyrian) dye from the juice of shellfish for native Irish pearls (Lucey 1998, 1 after O'Connor 1814, xvii).

The literature of the Early Medieval does not explicitly mention the use of shellfish as a food source. This has been suggested to be due to the lack of status given to such foodstuffs. This theory does appear to have some merit with other foodstuffs found in the archaeological record being directly referenced in the literature such as seaweed, horse, meat, dairy, bread, and whale meat. There are, however, references to other uses for molluscs such as the collection of pearls from freshwater mussels, the use of dog whelks for dye creation, and the use of goose barnacles in folklore to explain the bird of barnacle geese and their status as 'seafood.'

Seaweed is reported for the first time in this period. This may be indicative of the importance placed upon seaweed as a resource (Murray 2000 and Kelly 2011 discuss this in detail). This may also be due to recording, sampling, or taphonomic biases. Another ecofact seen for the first time in this period are barnacles. Again, this may be

due to biases beyond the control of this thesis, but barnacles, specifically goose barnacles, do appear in the literature and may have been discussed due to an increase in use of these molluscs due to a cultural shift.

Freshwater mussels have been recorded in a single dated shell midden site in Bewley, Co. Waterford. As this shellfish species is ‘largely inedible and [have] only been used as an article of food in desperate times’ (Lucey 2005, 65), their collection in large numbers can be assumed to be related to the search for pearls. There is some indication that these shells have been used as spoons and as lime, but the former would not require such numbers and the latter would leave little of the shells intact. The small number of recorded sites with freshwater molluscs may be due to a lack of trained archaeomalacologists on sites.



Figure 6.6: Top: The interior and exterior of freshwater mussels (*Margaritifera margaritifera*) (Meijer 2007a, 2007b). Bottom: The interior and exterior of otter shells (*Lutraria lutraria*) (Zell 2021a, 2021b).

When studying coastal middens in particular, archaeologists expect to see marine shells which can bias their identification and reporting. The freshwater mussels, along with other freshwater shells, may resemble marine shells, especially in the field. For instance, the freshwater mussels look similar to otter shells (Figure 6.6). Without

sampling and scientific identification in a laboratory setting, freshwater molluscs may be overlooked or misidentified. With such research into potential areas near freshwater mussel sources in particular (see Lucey 2005, 10–2 for a discussion on their distribution), further evidence of midden creation from pearl extraction may become known.

The use of dog whelks for purple dye creation in the Early Medieval is a prevalent theory in both archaeological and historical research. Emily Murray (2000 363–413) discusses this theory in great detail in her thesis, ‘Early evidence for Coastal Exploitation in Ireland,’ and the following discussion is based primarily on her work. There is little scientific backing for such an assumption. It has been proven through many studies and experiments that the secretions from the hypobranchial gland of dog whelks does in fact create a pigment which can vary from reds to blues through photooxidation (*ibid.* 363). Bede referenced the use of shellfish to create dye in Britain and it seems that all other literature to follow refers back to Bede or to early references to Bede as proof of the shellfish’s use (*ibid.* 379–80). There are, however, no other contemporary sources which support this assertion. The only other literary support comes in the laws which reference purple dye in general, but do not discuss where the dye originated. There are some linguistic indications, however, that the use of *corcair/corcar* to refer to the purple of high-status garments may originate from the use of shellfish to create such a colour (*ibid.* 385).

Both microscopic and macroscopic studies of Irish manuscripts have been used to estimate the source of purple pigments used (Hartley 1885; Laurie 1914, 1922, 1935; Roosen-Runge and Werner 1960; Cains 1990). One study also used a colour spectrometer to analyse the colour spectra in different possible dyes and compare them to that seen in the manuscripts (Fuchs and Oltrogge 1994). Only one study (Laurie 1914, 1922, 1935) supported the purple coming from dog whelks, while the others all ruled out the use of the shellfish for this purpose (Murray 2000, 394–7).

There has only been a single shellfish dyed textile identified in either Britain or Ireland, a Roman tapestry from England. It has been suggested that more such textiles may be identified if more high-quality items were analysed (Murray 2000, 401). Other purple items which have been analysed are primarily found to be coloured by lichen (Walton 1988; Casselman 1996; Walton-Rogers 1997). One piece from York was dyed using a combination of woad (used for blues) and madder (used for reds) (Taylor 1989, 402). If the etymology of *corcair* is derived from the use of shellfish dye, perhaps it

was from knowledge of the Mediterranean use of *Murex* shells rather than direct local use.

Other researchers have suggested that dog whelk dye may have been used for dyeing animals (Sullivan 1996, ccccv), creating tattoos or body paint (Knowles *et al.* 1899, 437) or as a cosmetic (Jackson 1917, 8; Born 1937, 117) such as lipstick or blush as was potentially done in Rome with similar dye (Abbott 1954, 13; Aloupi *et al.* 1990, 490). There is no evidence of this in the Irish context and even the ‘painted’ Picts of Britain were said to have used woad (Jones 1951, 295; Ritchie 1993, 5).

With these studies and interpretations in mind, it is difficult to support Henry’s (1952) interpretation of the Inis Gé Thuaidh site as a site used for dye production. Dog whelks can also be used as food and bait (Murray 2000, 371). If the site on Inis Gé Thuaidh was used for the purpose of cooking dog whelks, along with the burnt limpets identified at the same site, the broken state of the dog whelks could be easily explained. The shell of the whelk becomes brittle when cooked and breaking the spire would allow for the fish to be extracted without breaking off pieces of it (*ibid.* 361). Similar species, and even the same dog whelk species, are known to have been eaten in continental Europe (Cole 1685, 1284; Lovell 1884, 207; Jensen 1963, 106; Evans and Renfrew 1968; Spanier and Karmon 1987, 133; Becker *et al.* 2001), though there is no such tradition in Ireland (Murray 2000, 373). The use of the shellfish as bait from Inis Gé Thuaidh in particular seems less likely than their use as food with the pit and trough evidence. There is also some suggestion that the secretions of the dog whelks, which is the source of their dye, is in fact a deterrent for other fish and their flesh would, therefore, not make good bait (Bigger 1895; Reese 1980, 79; Murray 2000, 374).

With the frequency of Early Medieval shell midden sites being related to early Christian locations such as monasteries and holy wells, it is important to reflect on the canonical laws which may explain this phenomenon. As mentioned above, this association may be due to the ease of dating such midden sites with reference to the archaeological visible and distinct Early Medieval Christian sites, but the literature does support the consumption of seafood in general by those in the holy orders and observant lay persons. Seafood was allowed during the many yearly and even weekly fasts associated with the early church and shellfish such as limpets and winkles, the most common species found in the deposits of the time, are an easy resource to add substance and variety to the diet during these times. It is, perhaps, counterintuitive that the gathering of coastal resources was unlawful on Sundays, but as this day was meant

to be a day of rest and reflection and many other activities were forbidden on the day, it is not surprising that this labour was restricted.

It was not only the monks, nuns, and observant lay people who used shellfish during the Early Medieval period. Canroe's Viking settlement with extensive shellfish deposition is a clear indication that no single group of people held a monopoly on molluscan exploitation. Other secular settlement sites containing shell deposits such as ringforts, promontory forts, and smaller scale settlement platforms also support the widespread use of shellfish during the period. These may all have related to Christian fasting practices, but it is more likely that the people living in Ireland continued the consumption of shellfish that had been seen in previous millennia and which continue today.

Chapter 7: Late Medieval Shell Middens

Introduction

This chapter focuses on shell midden sites dating to the Late Medieval period in Ireland. The Late Medieval is defined here as 1100–1550 AD, with the beginning of the period distinguished by religious changes associated with the influence of Benedictine orders and political shifts leading to and including the Anglo-Norman invasion. The end of the period was marked by the Tudor plantations, the beginning of the printed word in Ireland, and the fall of ascetism/ the rise of secularisation.

The chapter begins with an overview of the archaeological research history of the time period in general and a history of excavating and survey of Late Medieval shell middens in particular. This is followed by a look at historical references to shellfish from the period. The distribution and general chronology of these sites is then discussed. The case studies and raw data presented in the next two sections. The chapter concludes with interpretations of the use and significance of coastal shell middens in Late Medieval Ireland. This includes an examination of the significance of shell-bearing sites in the economy and society of Late Medieval Ireland.

7.1 A History of Research

Changes in religious organisations, settlement nucleation, agricultural advancements, professionalisation of crafts, and new architectural styles were seen during the Late Medieval. Due to these many shifts, the Early Medieval and Late Medieval is more archaeologically visible than the end of the Late Medieval. The archaeological visibility also allows for the identification of shell middens dating from the period.

7.1.1 A Brief Overview of Late Medieval Chronology

The beginning of the twelfth century saw rapid changes in religious organisation in Ireland. The bishops of Dublin and Waterford were consecrated by the archbishop of Canterbury in the late eleventh century. One of these bishops, Malchus, was one of the leading reform bishops at the time. He was elected as the first bishop of Waterford in 1095 (Breen 2009; Downham 2017, 280). By the early twelfth, the Irish church had developed its own episcopal hierarchy, a move which was encouraged by Irish churchmen and kings alike. Several synods were held in the early twelfth century,

including that of Cashel in 1101 which attempted to introduce clerical celibacy and canon marriage laws to Ireland for the first time. This was followed by the Synod of Ráith Bresail in 1111 and of Kells-Mellifont in 1152 which focused on the organisation of Ireland's diocese (*ibid.* 280–1).

At the same time that these internal changes were taking place, the first monastic reform orders were introduced to the island. Malchus taught Malachy, then vicar of Armagh, the programme of Gregorian Reform and monasticism (Farmer 2011). After spending time with the Cistercian abbot of Clairvaux, Benard, Malachy went on to found the Cistercian Abbey at Mellifont, Co. Louth in 1142, the first Benedictine monastery in Ireland (*ibid.*; Downham 2017, 338). Augustinian houses soon followed and prior to the Anglo-Norman invasion of 1169 more than ten Cistercian and forty Augustinian canons were established in Ireland (*ibid.* 482).

One of the relevant changes thought to have been brought in by the Cistercians is the use of sand and shells for manuring arable fields, a practice already common in France at the time (Cooper and Davis 2004, 9). This practice may have aided in the increase of agricultural productivity seen throughout much of Europe beginning in the tenth century into the thirteenth. This increase in productivity of arable farming and international trade also coincided with the colonisation of new lands, all of which led to those in power gaining further wealth and control and to an increase in urban centre populations. These economic changes were primarily seen in Ireland in the areas with the most fertile lands in the south and midlands which were colonised by the Anglo-Normans after 1169 (Downham 2017, 183).

The differences seen between the English and Gaelic nucleation of land was not only due to economic and cultural factors. Sprawling settlements were more adapted to the less fertile lands which often remained under Gaelic rule. Having centralised resources would also have put the Gaelic lands under greater risk of attack. With the shift of power moving once again back to the Gaelic rulers in the fourteenth century, they too began to nucleate their settlements (Downham 2017, 189). The shift in power from English to Gaelic lords was due to both internal and international events, including both political strife and natural calamities. The natural disasters included the Great European Famine of 1315–7, the Dublin famine of 1331–2, and the Black Death which reached Ireland in approximately 1348 (*ibid.* 184).

The religious reform of this period saw widespread and rapid architectural changes. The Benedictine and Augustinian orders from the Continent brought with them the

claustral layout for monasteries (O’Sullivan and Downey 2021, 24). Large, cruciform shaped churches with aisled naves were preferred to the earlier single celled structures. Patrons of the church also chose continental architectural styles such as Romanesque and Gothic in order to visually indicate their support for European reform (Downham 2017, 329-38).

Changes in occupation structures of the period were slower and more region dependent. In the Gaelic ruled areas, ringforts and crannógs continued to be used or were reoccupied. New ringforts were also created at the beginning of the Late Middle Ages (Downham 2017, 189). This construction, however, was minimal and a move towards unenclosed settlements was seen in the Gaelic areas after c.1000. In the English ruled areas, most ringforts and crannógs were abandoned while some ringforts were remade into ringworks, mottes, or manorial centres (*ibid.* 223). The stone castle was also introduced to Ireland by the Anglo-Norman invaders starting in the late twelfth century, but primarily built in the thirteenth century (National Monuments 2012). These inspired the stone-built tower houses which began being built in both Anglo-Norman and Gaelic led areas in the late fourteenth century, though they primarily date to the sixteenth century (Downham 2017, 189).

The urban centres, along with many of the monastic centres, saw an increase in professionalisation of crafts including ironwork and pottery; with a rapid increase in the production of the latter (Downham 2017, 194–6). The artistic styles seen in metalwork, stone, leather, bone, wood, and paint were in a similar tradition to that seen in earlier Irish and insular art with repair and updates seen on old works and new forms of similar styles being created. Gothic art of the continent, which is most often linked with architectural styles, influenced some of the changes brought into the Irish art style during this period (*ibid.* 328–9).

7.1.2 A History of Survey and Excavation

Three Late Medieval shell midden sites were discovered by antiquarians between 1866 and 1873 (Table 7.1). A shell midden was recorded earlier in 1841 at Currabally, Co. Cork (CO010) by the Ordnance Survey of Ireland. No scientific excavations were conducted on these sites, but later surveys were undertaken, and three were sampled for dating. Two sites were uncovered due to quarrying: Inis Doire, Co. Mayo (MO010) in 1944 and An Rinn Bhuí, Co. Donegal (DL006) in 1983. The latter was then

excavated in 1984 when the shell midden itself was discovered. Cartoorbeg, Co. Galway (GA007) was reported by an informant in 1954 and three others were reported between 1983 and 2020. Killadangan, Co. Mayo (MO059) was also noted by an informant, though no further research has taken place. Surveys uncovered six sites, three of which were later excavated and one of which was sampled for dating. The remaining 27 sites were found during excavation, eight of which were commercial. No other research took place at any of these sites.

Catalogue ID	Method of Discovery	Further Research
CE011	Commercial 2012–4	—
CE025	Commercial 2001–8	—
CO004	Commercial 1955	—
CO006	Antiquarian 1870	Antiquarian 1870 1912, 1938 Excavation 1929 Survey 1838 1975
CO010	Survey 1841	Survey 1973 1975, 1983, 2019 Dating 2007
CO013	Antiquarian 1873	Survey 1938 1940 Dating 2007
CO018	Survey 1973	Survey 1975 1986, 2019 Dating 2007
CO041	Excavation 1998–9	—
CO043	Excavation 1990	—
DL006	Quarrying 1983	Excavation 1984
DL035	Antiquarian 1866	Survey 2001
DL051	Commercial 1998	—
DL053	Excavation 1987–92	—
DU004	Commercial 2002	—
DU010	Commercial 2010–3	—
DY003	Survey 1984	Excavation 1984
GA007	Informant 1954	Survey 1983 2014, 2020
GA010	Excavation 1995–2009	—
KY011	Survey 1986	—
KY020	Commercial 2005–6	—
KY053	Survey 1987	Excavation 1992–5
KY055	Commercial 1985	—
LH001	Survey 1948	Excavation 2000
MO010	Quarrying 1944	—
MO059	Informant 1967	—
WA006	Survey 2015	—
WX004	Excavation 1982–2007	—

Table 7.1: Method of discovery and further research of Late Medieval shell midden sites. For more information for each site see Table 7.2.

7.2 Historical Sources

The Archbishop of Cashel was the first to implement English law across all of English territories in Ireland in the 1270s, though it was not until the 1290s that Edward I allowed for English law to be granted, if requested, to all Irishmen. In 1331, the same law as applied in England was ordained as applying to all those with free status living in Ireland as well (Downham 2017, 216). Prior to this widespread application of English law across the island, many of the Gaelic laws were revised versions of those used in the Early Medieval period (Simms 1990). The applicable laws under the Brehons were addressed in Chapter 6. The English laws concerning shellfish applicable to the Late Medieval period, though they are few, are given in section 7.2.1 below.

Part of the Gregorian religious reform was an official adoption of a single codified canon law throughout the Catholic church (Simms 1990, 52). Thompson's English translation of Gratian's *Decretum* DD. 1-20 is the primary source used for canon laws here, though it does not contain all of the *Concordantia discordantium canonum* of Gratian of Bologna (Gratian 1993). The full text formed the basis of much of Catholic canon law and the introductory texts referenced here formed the basis of many law studies since its compilation in c.1140 (Christensen 1993, ix; Gratian 1993, 52).

Though there are a few cookbooks in Western culture from as early as the fourth century BC (Albala 2013, 114), the earliest surviving recipes are from a Roman text from 830 AD with recipes dating back to the fourth century (NYAM 2016). The oldest medieval cookbook is late twelfth or early thirteenth century, written in either Latin or French (Carlin 2022). The earliest cookbook in English dates to the end of the fourteenth century (British Library 2022). The oldest Irish language recipes are from the seventeenth century (Shanahan 2015, 197). The English recipe books dating from the fourteenth to fifteenth century were searched for recipes containing shellfish which are discussed below in section 7.3.2. While the earlier French recipes may have made their way onto Irish shores, those same recipes were most likely included in the English books. Household accounts from the period are also briefly discussed in this section.

The final primary source referenced in this section is that of the art and architecture of the time. This includes a mitre containing pearls, statues and carvings of St. James Major, coats of arms, and carvings of scallops. This does not seek to be an exhaustive

list of the art and architecture depicting shells of Late Medieval Ireland, but instead give examples of the iconography associated with shellfish at the time.

7.2.1 Secular Law

One of the English laws applicable to this study continues to be a matter of discussion and controversy. The early law texts compiled in the *Bracton*, a thirteenth century treatise seeking to integrate English and Roman law ideals, relied heavily on commentaries from c.1200 AD concerning Justinian's sixth-century *Institutes*. In this earlier text, the authors show a difference of opinion on whether or not the sea shore is owned by no one or by everyone in common (McSweeney 2012, 1141–56). It was not until the reign of Queen Elizabeth I that it was commonly held that the foreshore was primarily in the ownership of the Crown (Moore *et al.* 1888, 28–9) (see Chapter 8). The foreshore was, however, granted by the crown into private ownership in many cases throughout the period both in Britain and Ireland (*ibid.* 69–110).

The only regulation directly relating to shellfish was a time restriction placed on how long shellfish could be offered for sale. This was implemented in the fifteenth century along with rules regarding the sale of fresh and salted fish (Serjeantson and Woolgar 2006, 123). The only species considered to be the sole property of the Crown were whales and sturgeons and no shellfish is considered under dispute during the Late Medieval period (Woolrych and Polson 1853, 97–100).

Deer was another resource controlled by the Crown at this time. In 1198, people caught hunting deer on Crown controlled lands were sentenced to blinding and castration by law. This was reduced in the 1217 Forest Charter to only a heavy fine or a day and a year in prison, but the deer were still protected. This may explain the general lack of deer bones in the midden sites discussed below (Eves 2022).

7.2.2 Canonical Law and Church Doctrine

Gratian's twelfth century *Decretum* clearly states that seafood may be eaten during Lent and other times of fasting, an allowance already acknowledged in the earlier church (see Chapter 6). This source goes on to indicate that such food should not be eaten for pleasure, but instead for simple sustenance and that only small fish are allowed (Gratian 1993, 14–5). The more general days for fasting, however, are less strict than previously observed. The text indicates that no fasting regimen is more

acceptable than another as long as it follows the local customs (*ibid.* 46). The local customs of fasting in Ireland during the Early Medieval (see Chapter 6) period may have, therefore, remained the same in later centuries.

From the eleventh century through at least the fourteenth century, fishing was seen by the Church as a holier pursuit than hunting. A letter to the Archbishop of York written c.1006 indicated that clergymen could not hunt, but could fish, following the Biblical example of the fishermen Peter and Andrew. Wycliffe (c.1324–84) preached that fishing was nobler than hunting and that fish was more closely related to the foods of heaven than meat (Serjeantson and Woolgar 2006, 102–4).

The *Extents of Irish Monastic Possessions 1540–41* recorded an instance of shellfish being used as tithes (White 1943, 345). Before the dissolution of St Catherine's in Waterford in 1539, tithes of oysters were given to this priory from 'the rectory of Tempell Breachan,' 'Inspyke and... another small island.' Such tithes were collected in 'Lady Skydder.' Tempell Beachan and Laby Skydder are now known as Ballybrickan and Ringaskiddy respectively in Cork Harbour. Letters of the Crown leased Cork Harbour oyster fisheries to Patrick Sherlock in 1574 (Went 1962, 205).

7.2.3 Cookbooks and Household Accounts

At least nine English cookbook manuscripts dating from c.1381–1468 contain recipes which call for molluscs. The oldest English language cookbook, *The Forme of Cury*, dates from the fourteenth century and contains shellfish recipes. Forty-five recipes are found in the nine cookbooks, though many of them are variations on the same dish. These primarily use oysters and mussels, though whelks and cockles are also indicated. The fish are prepared in broth, in a stew ('potage'), in gravy, boiled in their shells, and in a sauce (Myers *et al.* 2022).

Household accounts also note the purchase and consumption of shellfish by nobles in Britain. Oysters were often on the menu throughout winter and spring, though some chose to only eat shellfish during Lenten season (Dyer 2006, 206). The records of Joan de Valance, Countess of Pembroke, indicate the inclusion of mussels, oysters, and whelks within her diet in 1295–6. Joan Holland, Duchess of Brittany, seemed to have an even larger appetite for shellfish with records indicating cockles, mussels, oysters, razor shells, and whelks heavily featured in her diet in 1377–8 (Serjeantson and Woolgar 2006, 119).

7.2.4 Art and Architecture

The scallop shell became a ubiquitous symbol of Christianity, pilgrimage, and the cult of St. James Major throughout Medieval Europe. Ireland was no exception with many carvings, statues, and even coats of arms being created with the shell during the Late Medieval period. There is a twelfth century baptismal font with scallop shells at St Audoen's in Dublin (Cunningham 2018, 85). A fifteenth century carving with a scallop shell and an angel in a boat can be found at Inishkeen, Co. Fermanagh (Figure 7.1) (*ibid.* 139). Numerous depictions of St James with a pilgrim's scallop shell on his hat have been identified in Ireland by Hunt (1974). It has been suggested any church or chapel dedicated to St James would have had a statue or depiction of the saint that often included the scallop, most of which do not survive (Cunningham 2018, 85).



Figure 7.1: Carving from Inishkeen, Co. Fermanagh with scallop shell (Cunningham 2018, 139).

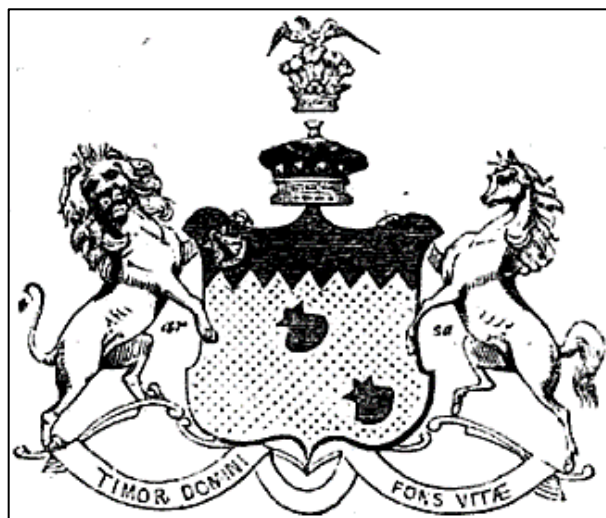


Figure 7.2: Arms of the Barony of Dunboyne showing scallop shells (Sharpe 1833).

The practice of heraldry was brought to Ireland by the Anglo-Normans and various families, titles, and guilds were granted coats of arms. The Barony of Dunboyne, held by the Butler family, was created in 1324. By at least 1541, the family coat of arms included scallop shells (Figure 7.2) (Sharpe 1833). The Guild of Cooks, founded in 1444, was combined with the Society of Vintners in 1565 and received a grant of arms in c.1608. These arms displayed scallop shells and the Guild was connected with this imagery from their founding. The swearing-in day of new members took place on the feast day of St James, suggesting they may have been pilgrims on the Santiago de Compostela pilgrimage in the fifteenth century (Cunningham 2018, 119).



Figure 7.3: The O'Dea mitre with freshwater pearls (The Hunt Museum 2022)

Scallop shells were also used as badges of pilgrims. Though these personal adornments are no longer evident, the admonition of Desiderius Erasmus in the early sixteenth century of the practice is proof of how widespread it was. He created a character who pointed out the following to a pilgrim: ‘You’re ringed with scallop shells, chocked with tin and leaden images on every side, decked out with straw necklaces, and you have snake eggs [a rosary] on your arms’ (Cunningham 2018, 152).

The pearl was a source of personal adornment in the Early and Late Medieval periods. An example is the mitre of Conor O’Dea, Bishop of Limerick, dating to c.1418. The mitre is decorated with precious metals and stones with pearls forming leaves along the designs (Figure 7.3).

7.3 The Archaeology of Late Medieval Shell Middens

Forty-four shell midden features across 27 sites date to the Late Medieval period in Ireland (Table 7.2). In the next two sections (7.3.1–2), the distribution and chronology of these sites will be addressed. This, along with key case studies (section 7.4) and available collated date (section 7.5), will inform the discussion presented in section 7.6. The distribution is informed using site coordinates given by the National Monuments Services for Ireland and Northern Ireland. The chronology is based upon radiocarbon dates and artefactual inclusions cited in the available records.

Site Name, Townland	County	SMR	Catalogue ID	Date (AD)	Date LOC
Doolin Pier, Balaghaline	Clare	CL008A006	CE011A	15 th –17 th c.	C
Scattery Island	Clare	CL067-024024	CE025B-G	16 th –17 th c.	B/C
Carrigtohill	Cork	CO075-068	CO004	13 th –14 th c.	B
Brown Island, Ballintubbrid West	Cork	CO076-012	CO006	12 th –15 th c.*	C
Currabally	Cork	CO076-032	CO010	11 th –15 th c.	C
Rathcoursey East	Cork	CO076-040	CO013	12 th –15 th c.	C
Curraghbinny	Cork	CO087-056	CO018	13 th –16 th c.	C
Kilcoe	Cork	CO140-032	CO041B-C	12 th –16 th c.	A
Skeam Island, Skeam West	Cork	CO149-011003	CO043	16 th –17 th c.	B
Ann Rinn Bhui	Donegal	DG008-006	DL006	13 th –17 th c.	C
Castlequarter	Donegal	DG046-038	DL035	16 th –17 th c.	B
Magheracar	Donegal	DG109-001001	DL051	13 th –17 th c.	B
Rinnaraw	Donegal	DG016-016003	DL053B	14 th –18 th c.	C
Robswalls	Dublin	DU012-012 DU012-062	DU004A-C	12 th –16 th c.	B/C
Malahide	Dublin	DU012-023002	DU010A-C	12 th –19 th c.	B
Ballymulholland	Derry	LDY001:004	DY003	13 th –17 th c.	C
Cartoorbeg	Galway	GA021-007	GA007A-B	12 th –15 th c.	C
High Island	Galway	GA021-026022	GA010A-G	11 th –16 th c.	C
Fahamore	Kerry	KE027-003	KY011	12 th –13 th c.	C
Tawlaght	Kerry	KE028-028	KY020A	13 th –14 th c.	C
Illeaunloughan, Portmagee	Kerry	KE087-036007	KY053B	12 th –16 th c.	C
Abbey Island	Kerry	KE106-077005	KY055	13 th –14 th c.	B
Liberties of Carlingford	Louth	LH005-029001	LH001A	12 th –16 th c.	B
Inis Doire	Mayo	MA010-029001	MO010	12 th –13 th c.	B
Killadangan	Mayo	MA087-037003	MO059	11 th –15 th c.	B
Kilmacleague West	Waterford	WA027-090	WA006	12 th –16 th c.	B
Tintern Abbey, Tintern	Wexford	WX045-027001	WX004A-B	13 th –14 th c.	A

Table 7.2: List of all sites discussed in chapter with relevant deposits shown under Catalogue ID. Date estimates are based on radiocarbon dates where available and are otherwise based upon artefacts. LOC indicates the Level of Confidence.

7.3.1 Distribution

Of the 27 Early Medieval shell midden sites, six are found in the South West, five in the South East, five in the East, five in the Lowland West, four in the North, and one in the Highland West (Figure 7.4) (see Chapter 3 for regional categorisations). The small number of sites in the Highland West and the North, specifically between Ballymulholland, Co. Derry (DY003) and Liberties of Carlingford, Co. Louth (LH001), is striking. For instance, of the 16 known sites in Co. Antrim, all but three have dated deposits, including seven with Early Medieval evidence (see Chapter 6). This may indicate a shift away from shell midden deposition in this area.

There is only one notable cluster of Late Medieval shell midden sites. Five sites have been recorded near Cork Harbour, Co. Cork. Shell deposition of this time period may be better traced through the study of contemporary urban centres such as Sligo, Galway, Dublin, and Wicklow which are not within the scope of this thesis (RIA 2011). A movement away from coastal deposition to urban deposition would also explain some of the distributional gaps. The north, however, had fewer Anglo-Norman towns and the low number of sites in this region would not be explained by such movement.

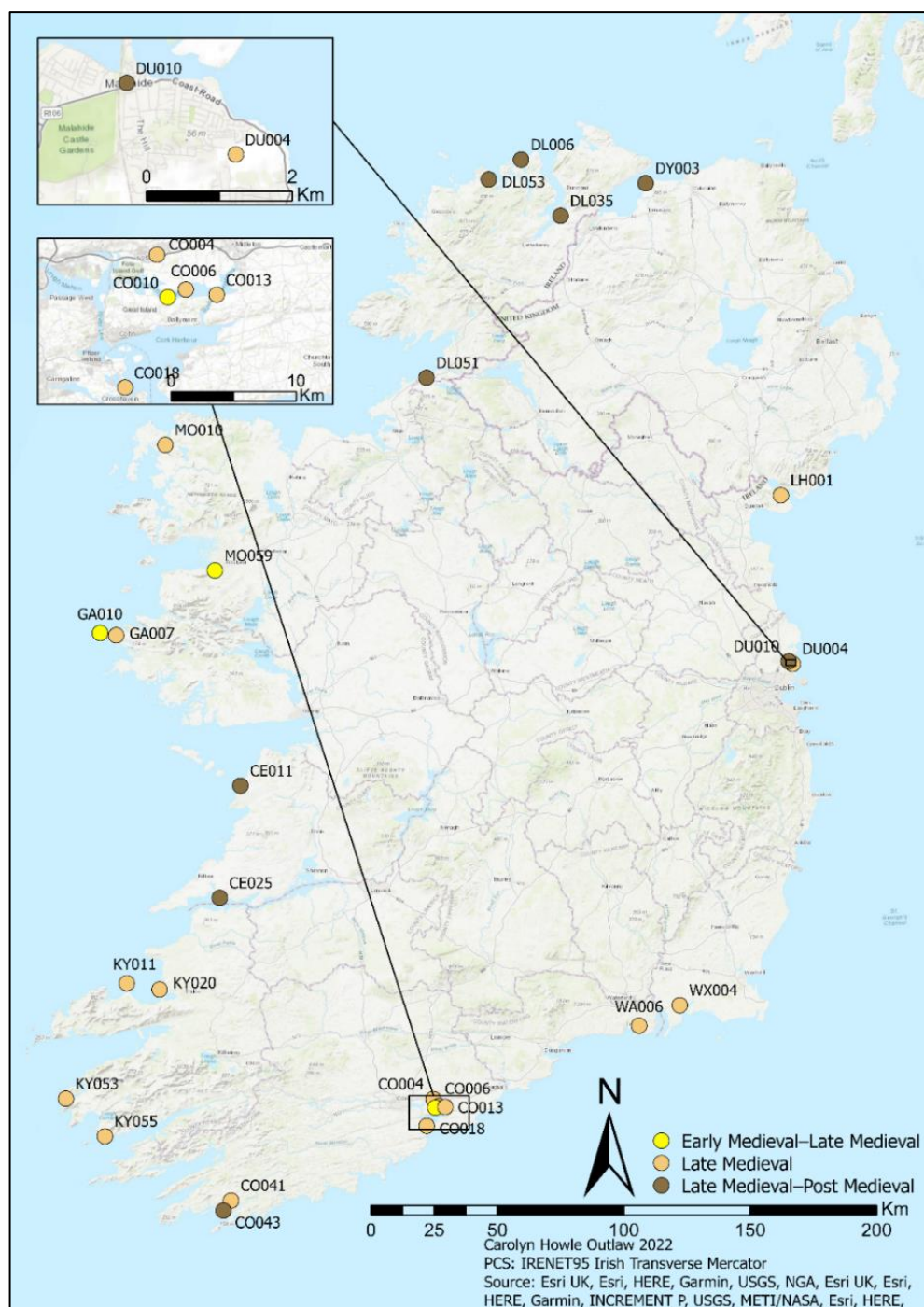


Figure 7.4: Distribution map of Late Medieval shell midden sites with rough estimates of dates. One inset map shows the cluster of sites in Cork Harbour, Co. Cork. The other shows the close proximity between two sites in Malahide, Co. Dublin.

7.3.2 Chronology

Nine of the 44 Late Medieval shell midden features have been dated by radiocarbon analysis. The raw dates are unknown for three of these deposits: Doolin Pier, Co. Clare (CE011A), Castlequarter, Co. Donegal (DL035), and Fahamore, Co. Kerry (KY011).

All of the deposits with known raw dates were derived from shell samples and were recalibrated using the Marine Reservoir curve (Figure 7.5). The date reported from Castlequarter, Co. Donegal (DL035) was supported by artefactual evidence. Another 24 Late Medieval shell midden features were dated using artefactual evidence. The remaining eleven deposit were dated through stratigraphic relationships.

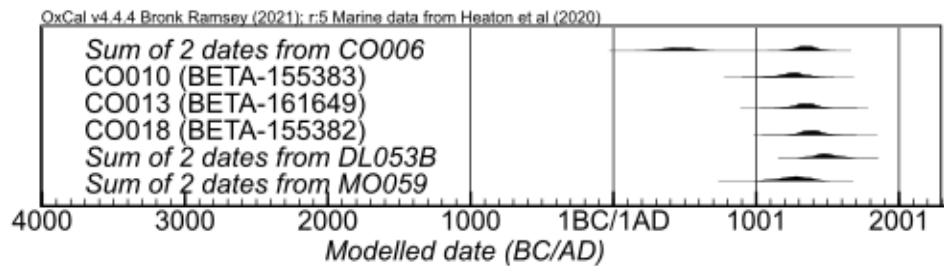


Figure 7.5: Radiocarbon dates of Late Medieval sites in alphabetical order by catalogue ID. Sum probabilities are given where possible for sites with multiple dates. All dates are calibrated using the Marine Reservoir curve.

Three of the deposits dated through radiocarbon analysis used two samples. The site at Brown Island Co. Cork (CO006) contained two disparate dates which cannot be easily reconciled. The date from oyster shell at the base of the deposit calibrated to 207–590 AD (2000±50 BP; BETA-155385), firmly in the Late Iron Age/Early Medieval. The date from the top of the deposit, however, calibrated to 1198–1483 AD (1050±50 BP; BETA-155384). The density and lack of any break evidence in depositional activity within the single deposit suggests such a long lifespan is unlikely. The dating of nine other deposits with similar inclusions and morphology around the Cork Harbour area all suggest Late Medieval to Early Modern deposition, potentially supporting the Late Medieval date for Brown Island. The earlier date may be from an intrusive sample.

Fifteen of the 44 (34%) shell midden features discussed here contain deposits that are potentially transitional between the Late Medieval and Post Medieval. Five of these were dated to this transitional period through radiocarbon analysis: Doolin Pier, Co. Clare (CE011A), Rathcoursey East, Co. Cork (CO013), Curraghbinny, Co. Cork (CO018), Castlequarter, Co. Donegal (DL035), and Killadangan, Co. Mayo (MO059). Nonchronometric dating was used to determine the remaining ten transitional deposits including both artefactual inclusions and stratigraphic relationships.

Among the artefacts used to date Late Medieval shell midden features are pottery sherds including Dublin and Leinster-type wares, everted rim wares, and Saintonge wares; clay pipe stems; a kite brooch; and a carved stone figure. Stratigraphic relationships were primarily based upon other site features with dating evidence such as artefacts and radiocarbon dates. Several of the deposits found at High Island, Co. Galway (GA010) were interpreted as Late Medieval or Post Medieval in date due to their deposition above collapse of the monastic monuments and other feature fills which suggested post-abandonment activity at the site (Sally 1999a).

7.4 Key Case Studies

The following case studies were chosen due to their importance in interpreting Late Medieval shell deposits. The first site was chosen as it includes a high density of deposits associated with post-abandonment. This association is common in the period. The second is a group of shell middens with similar morphologies along Cork Harbour where there is possible evidence of commercial oyster collection. The final site is associated with a Cistercian Abbey that has two Late Medieval shell deposits and one Post Medieval deposit.

7.4.1 High Island, Co. Galway (GA010A–G): Post-Abandonment

Two shell deposits identified at High Island, Co. Galway are dated to the time of monastic occupation. The first (GA010A) was a burnt mound containing shells and a hearth. There is an associated concentration of unburnt shells to the east of the hearth within hut B of the monastery. The hut has been interpreted as a kitchen structure, which together with the stone lined hearth and associated debris, is dated to Phase 2 of the site, between the eleventh and thirteenth centuries (Sally 1998, 2014, 100). A similar deposit (GA010D) within hut A is dated to the same time period (Sally 2014, 134). The other five shell deposits identified on the site were all dated to Phase 4, post abandonment of the monastery.

Two deposits (GA010B and GA010C) were found within layers of structural collapse debris to the north of the enclosure wall (Figure 7.6). Deposits described as transient, post-abandonment middens (GA010E) and hearths were uncovered in Area 4, near the two deposits within the rubble (Sally 1999b). Two fills of monastic period features, a trough and a passage through the enclosure, were also found to contain shell

deposits. One (GA010F), the fill of the trough, was found near hut B in Area 8 and the other (GA010G) was found within a passage in Area 4 near the other three post abandonment shell deposits.

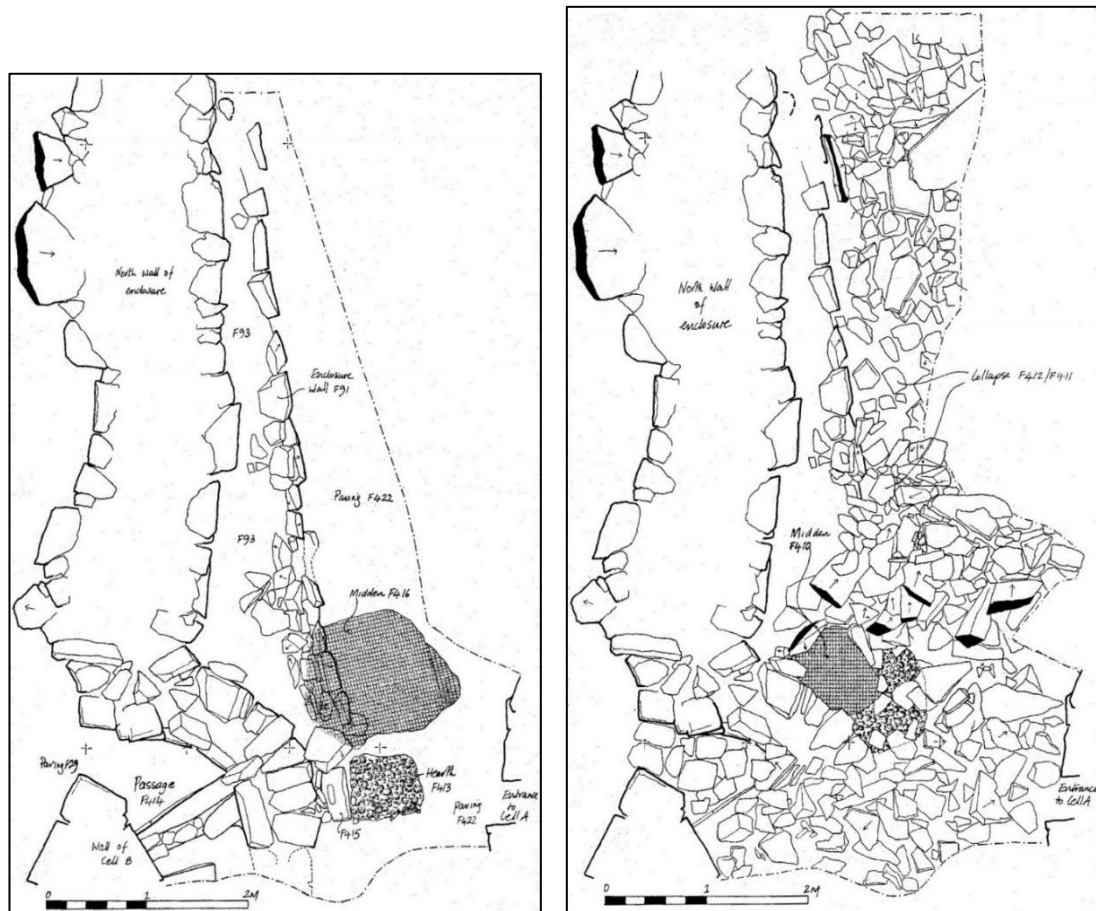


Figure 7.6: Left: High Island, Co. Galway midden GA010B north of Area 1 and west of a hearth (Scully 1999a, Fig. 7). Right: High Island, Co. Galway midden GA011C north of Area 1 and above a hearth deposit (*ibid.* Fig. 8).

All of the shell deposits at the site were found within the northeast part of the excavation (Areas 4 and 8). Those within cells were dated to the primary occupation of the. Those outside of the cells, within collapse rubble, were interpreted as post-abandonment. These later deposits have been interpreted as traces of pilgrimages to the site, which fits well within the trend of increased pilgrimages of the Late Medieval period in Ireland and elsewhere in Europe.

7.4.2 Oyster Middens in Cork Harbour, Co. Cork (CO004, CO006, CO010, CO013, CO018): Commercial Harvesting

Dense oyster middens are found around Cork Harbour. Five of these contain evidence of Late Medieval deposition. The smallest midden found contained within a flagstone-lined pit in Carrigtohill (CO004). The pit measured 5m by 2.25m and had a depth of 0.6m. The midden material was also found within natural hollows around the site indicating deposition may have occurred over various instances throughout the period. All of the spread contained bone and pottery sherds along with the shells. While oyster (*Ostrea edulis*) was the primary species, the site also contained a few other species such as whelks (*Buccinum undatum*), mussels (*Mytilus edulis*), cockles (*Cerastoderma edule*), and winkles (*Littorina littorea*) (O’Kelly 1955, 28–31).



Figure 7.7: A sketch of the Brown Island, Co. Cork (CO006) shell midden from 1870 by Atkinson (1873, 259).

One of the earliest investigated oyster middens along the harbour is at Brown Island (CO006) (Figure 7.7). This was described as measuring approximately 90m long and up to 1.5m thick, with evidence of a great deal of natural erosion and quarrying in 1870. Like Carrigtohill (CO004), oysters (*Ostrea edulis*) were the primary species, but other shells were present such as whelks (*Buccinum undatum*), mussels (*Mytilus edulis*), and cockles (*Cerastoderma edule*) (Atkinson 1873, 258–9). The site was radiocarbon dated by Milner and Woodman (2007, 103) in 2007 and though there were potential issues with the dates (see section 7.3.2), the Late Medieval date is consistent with other sites presented here.

Another three sites were dated by Milner and Woodman. One was found at Currabally (CO010). This site has been truncated by a driveway, with the midden

recorded as measuring over 7.5m long and 0.5m thick (Schlichting 1973, 17). The truncation suggests the midden would have measured over 11m wide as seen in the author's survey. Another site dated by Milner and Woodman was found at Rathcoursey East (CO013). This site was noted by Atkinson (1873) around the same time as he surveyed Brown Island. In 1938, it measured almost 32m long and 1m thick with an estimated width of approximately 2.5m. Erosion caused either by the nearby river or the construction of the East Ferry Road was noted (Coleman 1938, 42). No shell species beyond the oysters have been identified within these two deposits.

Finally, an oyster midden was discovered in 1973 at Curraghbinny (CO018). Similar to Carrigtohill (CO004), potential lining of flag stones was noted at the midden, though it was not contained in pits or hollows. The first survey of the site found that it measured approximately 23m long and 0.76m thick (Schlichting 1973, 17). Also like Carrigtohill (CO004) and Brown Island (CO006), this deposit contained shells other than oyster (*Ostrea edulis*) in small numbers including winkles (*Littorina littorea*) and cockles (*Cerastoderma edule*) (Power *et al.* 1994, 69).

7.4.3 Tintern Abbey, Co. Wexford (WX004A–B)

Tintern Abbey was founded in the early thirteenth century (Lynch 2010, 3), following the same design as that at Mellifont and other Cistercian abbeys with an aisled nave, transepts, and a rectangular chancel making up the church, a crossing tower above the transepts, and a square cloister (Figure 7.8) (*ibid.* 15–30). Excavation in 1982–2007 uncovered two shell-bearing deposits within thirteenth and fourteenth century contexts. One (WX004A), a fill of a medieval drain found to the southwest of the cloister, included oyster (*Ostrea edulis*), mussel (*Mytilus edulis*), cockle (*Cerastoderma edule*), and whelk (*Buccinum undatum*) along with wooden stakes and cut wood, animal bone, ceramics, roofing slates, iron nails, lead fragments, and window glass. The monks appear to have used this drain for general rubbish disposal c.1250–1300 AD (*ibid.* 91).

The other shell-bearing deposit (WX004B) was contained within a pit just north of the medieval drain. The pit was filled with a large number of oysters (*Ostrea edulis*), scallops (*Pecten maximus*), and land snails. Two possible iron nail shanks and two sherds of Wexford-type ware were also found in the pit. The pit had been truncated in the fourteenth-century during clearance of the area, but prior to this time it would have

been used as a refuse pit (Lynch 2010, 95). Unlike the deposit in the drain which contained a large amount of non-shell material, this refuse contained little else.

Post-Dissolution refuse was also found to contain shells at the site. A deposit of building debris, bottle glass, clay pipes, stoneware, and oysters was found to the southeast of the medieval deposits (Lynch 2010, 97). This deposit is much further from the abbey itself and has a much more haphazard character than the refuse dump and infill of the drain seen during the medieval period. It also has a distinctive character to that seen in the post-abandonment pilgrimage deposits at High Island, Co. Galway.



Figure 7.8: Engraving of Tintern Abbey from 1780 by John Hames Barralet (Lynch 2010, 10).

7.5 Overview of Available Data

The raw data available for Late Medieval shell midden features is presented below. This includes deposit measurements, molluscan and other faunal species information, plant remains, and an overview of artefact inclusions. Previous chapters have also included a section on human remains, but due to the nature of the remains present in the Late Medieval deposits, the human bones are discussed in section 7.5.3.

7.5.1 Associations

As in the Early Medieval period, a relationship between Christian sites and shell deposits is evident. Approximately 41% of sites recorded near known monuments were

discovered near Christian religious sites. These included six churches, two ecclesiastical enclosures, a burial ground, a holy well, and a Cistercian religious house. Secular habitation relationships are also seen, though less frequently (30%). This includes three castles, one enclosed settlement, two habitation sites, and two ringforts.

7.5.2 Dimensions

Twenty-four out of the 44 (55%) shell bearing features dated to the Late Medieval period have available dimensions. Of these, twelve have all three dimensions, four have length and thickness, one has length and width, one has only length, and five have only thickness recorded. The largest deposit had a volume of 237.2m³ at Rathcoursey East, Co. Cork (CO013). One deposit, at Tawlaght, Co. Kerry (KY020A) had a larger estimated area of 225m² and one deposit at Cartoorbeg, Co. Galway (GA007A) was longer, measuring 38m. The smallest deposit was found at Robswalls, Co. Dublin (DU004C) with a volume of 0.004m³.

Nineteen Late Medieval deposits have at least two recorded dimensions. Of these, nine (47%) of the Late Medieval deposits with at least two recorded dimensions measure above the midden size boundary discussed in Chapter 2. All deposits with a volume above the boundary of 2m³ also have an area above the boundary of 10m².

Catalogue ID	Length (m)	Width (m)	Thickness (m)	Area (m ²)	Volume (m ³)
CE011A	6.6	2.7	0.2	17.8	3.6
CO004	5	2.3	0.6	11.5	6.9
CO010	7.6	11	1	83.6	83.6
CO013	36.6	2.4	2.7	87.8	237.2
CO018	22.9	1	0.8	22.9	18.3
DL035	23	—	—	—	—
DU010A	—	—	1.1	—	—
DU010B	1.5	0.9	0.2	1.4	0.3
DU010C	—	—	0.7	—	—
KY053B	—	—	0.7	—	—
KY055	1.8	—	0.6	1.1	—
GA010B	1.2	1.1	0.6	1.3	0.8
GA010C	0.7	0.7	0.4	0.5	0.2
MO059	—	—	0.3	—	—
GA010F	0.8	—	0.1	0.1	—
GA010G	—	—	0.4	—	—
DU004A	1.3	0.7	0.1	0.9	0.1
DU004B	1.3	0.7	0.01	0.9	0.01

Catalogue ID	Length (m)	Width (m)	Thickness (m)	Area (m ²)	Volume (m ³)
DU004C	0.7	0.5	0.01	0.4	0.004
DY003	4.8	0.5	0.1	2.4	0.2
GA007A	38	–	0.3	11.4	–
KY011	11	–	1	11	–
KY020A	15	15	–	225	–
LH001A	26	–	0.5	13	–
WA006	1.6	–	0.25	0.4	–
TOTAL:	20	13	23	19	12
Average:	10.3	3	0.5	26	29.3

Table 7.3: Dimensional measurements available for shell midden features dating to the Late Medieval period. All measurements have been rounded to the nearest tenth.

7.5.3 Fauna and Flora

Where the information is available shell, bone, and plant species of Late Medieval shell middens are presented below. Common English names are used here (see Chapter 3). Most species are in fact only identified to genus and species groups such as fish and bird are presented together due to the infrequency that these are differentiated in the available texts. Human remains are also discussed under the subheading ‘Bones.’

Shells

Fifteen of the 44 (34%) Late Medieval shell-bearing deposits have no available molluscan species information (Table 7.4). Within the 29 that do include information, oyster, limpet, and winkle are the most common species. Limpet and winkle can be found in similar environments, on hard substrates in the intertidal zone. Oysters are found on hard substrates further from shore. Cockles are the next most common species and can be found in soft substrates in the intertidal zone.

Eight deposits contained uncommon shell species. These included land shells and tower shells at Doolin Pier, Co. Clare (CE011A); carpet shells at Carrigtohill, Co. Cork (CO004); razor shells at Robswalls, Co. Dublin (DU004A); ocean quahogs at Ballymulholland, Co. Derry (DY003); flat winkles at Cartoorbeg, Co. Galway (GA007A); dog whelks at Tawlaght, Co. Kerry (KY020A); razor shells and clams at Killadangan, Co. Mayo (MO059); and land shells at Tintern Abbey, Co. Wexford (WX004B). The small number of dog whelks during the Late Medieval is in contrast

to the frequency in which they are recorded at Early Medieval sites. Razor shells were the only species recorded at Robswalls, Co. Dublin (DU004A).

ID	<i>Ostrea edulis</i>	<i>Patella vulgata</i>	<i>Littorina littorea</i>	<i>Cerastoderma edule</i>	<i>Mytilus edulis</i>	<i>Buccinum undatum</i>	<i>Pecten</i> sp.	Other/Unidentified
CE011A	—	X†	D	—	X	—	—	X
CE025B	D‡	—	—	—	—	—	—	—
CE025C	—	—	—	—	—	—	—	/
CE025D	D‡	—	—	—	—	—	—	—
CE025E	—	—	—	—	—	—	—	/
CE025F	—	—	—	—	—	—	—	/
CE025G	—	—	—	—	—	—	—	/
CO004	D	—	X	X	X	X	—	X
CO010	D*	—	—	—	—	—	—	—
CO013	D‡	—	—	—	—	—	—	—
CO018	D	—	X	X	—	—	—	—
CO041B	D‡	—	—	D‡	—	—	—	—
CO041C	D‡	—	—	D‡	—	—	—	—
CO043	—	—	—	—	—	—	—	/
DL006	—	—	—	—	—	—	—	/
DL035	—	—	—	—	—	—	—	/
DL051	—	D‡	D‡	—	D‡	—	—	—
DL053B	—	D*	D	—	—	—	—	—
DU004A	—	—	—	—	—	—	—	D
DU004B	—	—	—	—	—	—	—	/
DU004C	—	—	—	—	—	—	—	/
DU010A	—	—	—	—	—	—	—	/
DU010B	D‡	—	D‡	—	D‡	—	—	—
DU010C	D‡	—	X‡	X‡	X‡	—	—	—
DY003	—	X	X	D	—	X	—	X
GA007A	—	D*	X‡	X	—	—	—	X
GA007B	—	D‡	—	—	—	—	—	—
GA010A	—	D‡	—	—	—	—	—	—
GA010B	—	D‡	—	—	—	—	—	—
GA010C	—	D‡	—	—	—	—	—	—
GA010D	—	D‡	—	—	—	—	—	—
GA010E	—	—	—	—	—	—	—	/
GA010F	—	—	—	—	—	—	—	/
GA010G	—	—	—	—	—	—	—	/
KY011	—	D‡	D‡	—	—	D‡	—	—
KY020A	X‡	X‡	D‡	X‡	—	—	—	X
KY053B	—	—	—	—	—	—	—	/
KY055	X‡	X‡	D‡	—	—	—	—	—
LH001A	—	—	X‡	X‡	X‡	X‡	X‡	—
MO010	—	—	—	—	—	—	—	/
MO059	D	D	D	D	X*	—	X*	X
WA006	—	—	—	D‡	X‡	—	—	—
WX004A	D	—	—	D	D	D	—	—
WX004B	D	—	—	—	—	—	D	X
TOTAL:	15	14	14	12	9	5	3	23
Dominant:	13	10	8	6	3	2	1	1

Table 7.4: Shell species identified in Late Medieval shell midden deposits. X indicates the species is present. D indicates that a species was dominant. Under the column 'Other/Unidentified,' X indicates a known shell species other than those listed and / indicates unidentified species. * indicates the genus is known, but the species is not. † indicates that the species listed is present along with similar species (for instance, *Patella vulgata* (common limpet) and *Patella pellucida* (blue-rayed limpet) are both present at CE011A). ‡ indicates that only vernacular names are used in available sources and scientific species are assumed.

Bones

Twenty-four (55%) shell deposits have animal bones recorded for the Late Medieval period (Table 7.5). Ten (42%) of these contained species information. Cattle was the most common species recorded followed by pig and sheep/goat. Late Medieval deposits only contain eight identified species with fish the only marine bones. There is also a noticeable absence of deer reported. The only uncommon bone was that of cat at Tintern Abbey, Co. Wexford (WX004A). The only human remains reported was a single bone within Ann Rinn Bhuí, Co. Donegal (DL006).

Catalogue ID	Cattle	Pig	Sheep/Goat	Fish	Horse	Dog	Bird	Mouse	Cat	Other/Unidentified
CE011A	–	–	–	X	–	–	–	–	–	/
CE025B	–	–	–	–	–	–	–	–	–	/
CE025C	–	–	–	–	–	–	–	–	–	/
CE025G	–	–	–	–	–	–	–	–	–	/
CO004	D	X	X	–	–	X	–	–	–	–
CO041B	–	–	–	–	–	–	–	–	–	/
CO041C	–	–	–	–	–	–	–	–	–	/
DL006	D	–	D	–	D	–	–	–	–	–
DL051	–	–	–	–	–	–	–	–	–	/
DU010B	–	–	–	–	–	–	–	–	–	/
DU010C	–	–	–	–	–	–	–	–	–	/
DY003	D	–	X	–	–	–	–	X	–	–
GA007A	–	–	–	D	–	–	–	–	–	–
GA010A	–	–	–	–	–	–	–	–	–	/
GA010B	–	–	–	–	–	–	–	–	–	/
GA010C	–	–	–	D	–	–	–	–	–	–
GA010D	–	–	–	–	–	–	–	–	–	/
GA010G	–	–	–	–	–	–	–	–	–	/
KY011	D	D	–	–	–	D	–	–	–	–
KY053B	D	–	–	–	–	–	–	–	–	–
KY055	–	–	–	–	–	–	–	–	–	/
MO059	X	D	–	–	–	–	X	–	–	–
WA006	–	–	–	–	–	–	–	–	–	/
WX004A	X	X	X	–	X	–	–	–	X	–
TOTAL:	7	4	4	3	2	2	1	1	1	15
Dominant:	5	2	1	2	1	1	0	0	0	0

Table 7.5: Bone species identified in Late Medieval shell midden features. Fish and bird are not differentiated to species. X indicates presence and D indicates a species was dominant within the deposit. Under the column 'Other/Unidentified,' X indicates a known bone species other than those listed and / indicates an unidentified species.

Plant Remains

Thirteen Late Medieval deposits contained charcoal. The charcoal from Doolin Pier, Co. Clare (CE011A) was identified as primarily oak, blackthorn, willow, and hazel

with some pomaceous fruitwood and ash. Unburnt wood at Tintern Abbey, Co. Wexford (WX004A) was also identified. This site contained oak, hazel, cherry, and willow or poplar. Unburnt straw was identified at Ballymulholland, Co. Derry (DY003). These three deposits were the only shell features to contain plant remains other than charcoal. Doolin Pier (CE011A) contained cereals including barley. Ballymulholland (DY003) contained barley, oat, and rye cereals along with four non-cereal grasses and unidentified seeds. Cereals, hazelnuts, and fruit remains were identified at Tintern Abbey (WX004A). The fruit remains include apples, figs, raspberries, strawberries, blackberries, and sloes.

Catalogue ID	Cereals	Barley	Oat	Rye	Stones	Hazelnut	Wild Taxa	Wood or Straw	Charcoal
CE011A	X	X	–	–	–	–	–	–	X
DY003	–	X	X	X	–	–	X	X	X
WX004A	X	–	–	–	X	X	X	X	X

Table 7.6: Plant remains identified in Late Medieval shell midden features. Shell midden deposits only reporting charcoal are not included in the table.

7.5.4 Artefacts

Artefacts were reported in 25 of the 44 (27%) recorded Late Medieval shell midden features in Ireland (Table 7.7). Ceramics were found within 22 deposits. The ceramics within eleven of these deposits were unidentified beyond a vague reference to ‘medieval’ sherds, though the sherd from Kilmacleague West, Co. Waterford (WA006) was described as red. Metal and stone were the next most common artefact types, found in six deposits respectively. Glass artefacts were only found in two deposits and a lithic scraper was found in a single deposit. No bone artefacts were reported from Late Medieval shell midden features.

The lithic artefact, a scraper, is the only artefact which appears to be residual; as all of the other artefacts within the same deposit, Malahide, Co. Dublin (DU010C) were Late Medieval or Post Medieval pottery sherds. The metal artefacts include those made of iron, bronze, lead, and copper alloy materials. The only personal ornaments from these shell deposits were metal: a pin, a button, and a brooch.

Catalogue ID	Ceramics	Metal	Stone	Glass	Lithics
CE025B	French; applied décor; gravel tempered; red roof tiles	—	—	—	—
CE025C	gravel tempered; glazed redware; clay pipe	iron nail	—	—	—
CE025D	sherd	—	—	—	—
CE025F	sherd	—	—	—	—
CO004	salt glazed	—	—	—	—
CO041B	sherds	—	—	—	—
CO041C	sherds	—	roof slate	—	—
CO043	sherds	—	—	—	—
DL006	everted rim	—	quern; fcrs	—	—
DL051	everted rim	iron fragment	—	—	—
DL053B	sherds	—	—	—	—
DU004A	sherds	—	—	—	—
DU010A	sherds	—	—	fragment	—
DU010B	Dublin type	iron nails; copper buttons	—	—	—
DU010C	Dublin type; Leinster type; Staffordshire-Bristol; glazed redware; North Devon; manganese mottled; yellow ware; German whiteware; stoneware; clay pipe	—	—	—	scraper
DY003	everted rim	—	—	—	—
GA007A	—	kite brooch	fcrs	—	—
KY011	—	—	hone	—	—
KY020A	Saintonge green	—	—	—	—
KY055	green glazed	—	—	—	—
LH001A	sherds	—	—	—	—
MO010	—	—	carved figure	—	—
WA006	red sherd	—	—	—	—
WX004A	sherds	iron nails; lead fragments	roof slates	window	—
WX004B	Wexford type	iron nails	—	—	—
TOTAL:	22	6	6	2	1
Summary:	1 French; 1 applied décor; 3 gravel tempered; 1 red roof tile; 2 glazed redware; 2 clay pipes; 10 sherds; 1 salt glazed; 3 everted rim; 2 Dublin type; 1 Leinster type; 1 Staffordshire-Bristol; 1 North Devon; 1 manganese mottled; 1 yellow ware; 1 German whiteware; 1 stoneware; 1 Saintonge green; 1 green glazed; 1 red sherd; 1 Wexford type				
	4 iron nails; 2 iron fragments; 1 copper buttons; 1 kite brooch; 1 lead fragments				
	2 roof slates; 1 quern; 2 fcrs; 1 hone; 1 carved figure				
	1 fragment; 1 window				
	1 scraper				

Table 7.7: Artefact types found within Late Medieval shell midden features in Ireland. ‘FCR’ refers to fire cracked rocks.

7.6 Discussion

There is only one Late Medieval shell midden site, Ballymulholland, Co. Derry (DY003) in Northern Ireland (see section 7.3.1). This is difficult to reconcile with the historical record with aristocratic household accounts and published cookbooks making it clear that shellfish were being eaten throughout Britain and Ireland during this time. There are also four sites within Co. Donegal and one in Co. Louth. There are a total of 58 known shell midden sites in Northern Ireland, 25 (43%) of which are dated. There may be an unknown Late Medieval cultural shift which saw different patterns of shell deposition in the north in a manner which are less archaeologically visible.

Another trend seen within the distribution of Late Medieval shell midden sites is the relationship with Christian monuments. This is not unique to the Late Medieval period, but it is even more pronounced than in either the Early Medieval (see Chapter 6) or the Post Medieval and Early Modern periods (see Chapter 8). The first attempts at codifying church law during this period reiterates the allowance for seafood, especially small fish, during times of fasting. While this tradition was already established in the Irish church, the reform movement of the Late Medieval may have been stricter on the practice and therefore the number of depositional occurrences from the consumption of shellfish on Christian sites was increased. There was also a vocal force indicating that fishing during any part of the year was better in the eyes of the church than hunting, encouraging further seafood exploitation outside of fasts. An example of a church site with shellfish consumption evidence during this period is that of Tintern Abbey, Co Wexford (WX004).

Pilgrimage was also a large part of the Christian faith throughout Europe during the Late Medieval period with the devout travelling to sacred sites both within their own countries and abroad. Shell deposits, along with contemporary hearths, were seen as evidence of such activity taking place on High Island, Co. Galway (GA010) after the site ceased to be used as a monastery (see section 7.5.1). Evidence of the Irish travelling through Santiago de Compostela has also been found in the form of shells. Scallops, a major symbol of pilgrimage especially through Santiago, have been found within burials of individuals in Ireland. A similar use of an oyster-shell was found in Drogheda, Co. Louth. This may have been an imitation of the scallop just as a cockle was used in a burial in Worcester (Cunningham 2018, 85–8). The end of the Late

Medieval period saw the fall of such pilgrimages and the fall of iconography due to the reformation which swept through Europe in the sixteenth century.

The Reformation may also factor into the distinctive character associated with the dumps of shells and other refuse seen after the dissolution of the monasteries. An example of such a deposit was noted at Tintern Abbey, Co. Wexford (WX004). Though this will primarily be discussed in Chapter 8, it is worthwhile to note that the visit of older monastic sites by visitors as seen pre-Reformation is much more controlled with fewer inclusions beyond the shells.

Scallop was not a dominant species within shell deposits themselves having only been found within four deposits and dominant in one — it is interesting to note that the site with dominant scallops is that of Tintern Abbey, Co. Wexford (WX006B), a Late Medieval monastery. Many locations preferred to use oysters, limpets, and winkles with the occasional use of cockles and mussels. Neither winkles nor limpets, however, feature in the contemporary cookbooks or household accounts. This may be due to these fish being more associated with the poor and the asceticism of monks. This could also be because the meat of limpets and winkles were used for a purpose other than as a food source, such as their use as bait for fishing. Oysters, cockles, and mussels, however, do feature in these documents with a large preference shown for oysters and mussels.

There are even archaeological indications that large scale commercial exploitation of oysters began during this period. The density and volume of the oyster middens along Cork Harbour seems indicative of extensive exploitation often linked to industrialisation and tithes paid to the priory in Waterford. The demand for oysters by the aristocracy, the church, and the general populace would have contributed to the supply demand needed to harvest oysters on such a large scale.

The control of another resource by the aristocracy of the time can also be seen in the inclusions found in shell midden sites. The law protecting the hunting of deer in forests owned by nobles were brought in by the Anglo-Normans. Deer parks were also introduced to hold imported deer species on their lands (Beglane 2015, 152). While wild deer could still be freely hunted in land unclaimed by the Anglo-Normans, these protections may explain why there are no deer bones reported in Late Medieval shell deposits when it was a common species to be included prior to this time.

Chapter 8: Interpreting Shellfish Consumption in Post Medieval and Early Modern Ireland

Introduction

This chapter describes Post Medieval and Early Modern shell deposits in Ireland (dating from 1550 AD onwards). This includes the distribution of the sites, mollusc and animal species, artefact inclusions, and associated monuments. Case studies which typify the sites of the period are given to aid in the interpretation of the sites. These interpretations are based upon the archaeological data, historical context, relevant theories of interpretation, and vernacular accounts of the use of molluscs and their deposition. The chapter begins with an overview of the Post Medieval and Early Modern periods in general followed by a history of survey and excavation of shell midden sites from this period.

8.1 A History of Research

Post Medieval archaeology is a relatively new concept in Ireland. It has primarily been championed by the Irish Post-Medieval Archaeology Group, formed in 1999. This group has used the year 1550 AD to separate the Medieval and Post Medieval periods (IPMAG 2021), the boundary also used for this thesis. While the group does not state the reasoning behind this choice, it is most likely due to the creation of the Tudor plantations which began in the 1550s or to the introduction of the printed word to Ireland in 1551.

8.1.1 A Brief Overview of Post Medieval and Early Modern Chronology

There was no significant change in settlement patterns, economy, or material culture which may reveal themselves archaeologically until the end of the seventeenth century. There was, however, a shift in mentality from 1550 AD onward which even now affects the way in which archaeological monuments of the Post Medieval and Early Modern times are interpreted. This shift included the formation of a singular Irish national identity at this time rather than an island divided across territories. The fall of asceticism and the rise of secularisation played a large role in the forming of this new identity. This included the creation of an Irish Observant vicariate in 1460 and Third

Orders for lay followers between 1426 and 1540 and the generation of books by monks for secular clients for two decades (Lyons 2018, 504–9). The plantation of Ireland, starting under the Tudors in the 1550s and continuing through 1657 with the Cromwellian plantations also lead to a national Irish identity. It introduced the first conquest strategy applied to Ireland which sought to create a single state entity throughout the island rather than individual lords ruling over key regions (McNeill, T 2007, 9–10; Ranelagh 2012, 393–6).

The shift to the Early Modern period is defined here as 1800 AD following the Act of Union and the periodic uprisings against English rule beginning with the 1798 rebellion. The Post Medieval and Early Modern periods are discussed together because of the cultural shifts which overlapped the two periods. This included the Penal Laws which lasted until Emancipation in 1829 and the continued rule of the United Kingdom over Ireland until the creation of the Irish Free State in 1922 and eventually the Republic of Ireland in 1948 (Ranelagh 2012, 393–6). Shell deposits were created throughout this time with similar trends throughout.

8.1.2 A History of Survey and Excavation

Two Post Medieval/Early Modern shell midden sites were first reported by antiquarians. Ceathrú An Teampaill, Co. Galway (GA066) was discovered by Kinahan in 1866 and An Bun Beag, Co. Donegal (DL021) was discovered by Knowles in 1889 who returned to the site in 1898. The latter was again visited in the 1940s before commercial excavation took place on the site in 2002. The Ordnance Survey of Ireland mapped a shell midden at Brown Island, Co. Cork (CO007) in 1841. This site was surveyed another four times and was sampled for dating in 2007.

Informants reported eight sites between 1967 and 2014, three of which were later excavated. Seven sites were discovered through survey, three were found due to erosion, and one was found after a bulldozer revealed the shell midden. Ten sites were found through excavation, seven of which were for commercial purposes. Geophysics was undertaken at a single site, Shelly Valley, Co. Sligo (SO037), in 2015.

Catalogue ID	Method of Discovery	Further Research
CE009	Informant 2014	Survey 2014
CE020	Survey 2001	Commercial 2001
CE025	Commercial 2001–8	—
CO002	Erosion 1945	—

Catalogue ID	Method of Discovery	Further Research
CO003	Survey 1975	Survey 1991 2019
CO007	Survey 1841	Survey 1973 1975, 1983, 2019 Dating 2007
CO023	Erosion 1937	Survey 1984 Dating 2007
CO041	Excavation 1998–9	—
CO047	Survey 2021	—
DL021	Antiquarian 1889/1898	Antiquarian 1940s Commercial 2002
GA014	Survey 2014	Survey 2020
GA056	Commercial 2013–4	—
GA059	Informant 1980	Survey 1998 Commercial 2000
GA061	Informant 1986	—
GA066	Antiquarian 1866	—
GA071	Excavation 1996–9	—
KY015	Commercial 1998	—
LH002	Bulldozing 1977	Excavation 1977
LH010	Commercial 1993	—
LH011	Commercial 1992 1994, 1998	—
MO043	Survey 2010	Excavation 2018 Survey 2020
MO050	Informant <i>n.d.</i>	Survey 1991
SO001	Informant 1967	—
SO015	Informant 1991	Excavation 1993 2000–1
SO016	Commercial 2009	—
SO035	Survey 2014	—
SO037	Informant 1984	Survey 1989 2003, 2020 Geophysics & Dating 2015
SO054	Commercial 2012–4	—
SO074	Informant 2001	Commercial 2001
SO084	Survey 1985	Survey 1994 Informant 2000
WX004C	Excavation 1982–2007	—

Table 8.1: Method of discovery and further research of Post Medieval and Early Modern shell midden sites. For more information concerning each site see Table 8.2.

8.2 Historical Sources

Contemporary policies concerning shellfish consumption are important for interpreting the Post Medieval and Early Modern shell midden sites. Landlord-specific regulations, Crown shore rights, Penal Laws, and Catholic traditions and Cannon Laws all affected ways in which people interacted with the coast and mollusc consumption.

The following is a brief introduction to such policies in order to ground the archaeological evidence.

8.2.1 Landlord Specific Regulations

Many of the landlord-specific regulations were not formal, written laws but were instead indicated through spoken proclamation and implemented through direct acts. There are examples within the National Folklore Collection of landlords controlling the coastal resources around their lands. One example of this was reported in The Schools' Collection which told the story of a landlord near Cleggan, Co. Galway preventing tenants from taking shellfish from the shore (v.0006, p. 115). Another such example was reported near Creeslough, Co. Donegal. Here, the landlord was said to have sent armed men to prevent people from gathering shellfish on his land during the Famine (Póirtéir 1995, 70–1). This idea of the landlord controlling access to shellfish resources can now be seen in popular culture as an accepted truth, though it may not have been so widespread (for examples of this in popular culture see: Lally 1997 and others listed in McNamara 2009, 151).

8.2.2 Shore Rights

Legal grounds for landlords restricting access to the shoreline and its resources might be found in laws which saw the shoreline, specifically that which lies between low and high tide, as owned by the Crown unless granted to others by the Crown as any other area of land might be (Coulson and Forbes 1902, 14–21). The public are cited as having access to fish (including shellfish) on Crown owned shores, but the taking of shells remained in question in 1902 (*ibid.* 43, 48, and 345). This latter was still being debated in courts as late as 1933 (Oireachtas 1933).

There are many stories from the nineteenth century of members of the public gathering shellfish on the shores in areas where landlords were not enforcing the idea of the Crown's or their personal ownership. Robert Patterson (1839) noted that the poor of Larne, Co. Antrim and other areas of the county and of Co. Down collected limpets, winkles, and muscles for both personal use and sale in the years 1835–7. The year of 1837 was said to have been a difficult economic year, causing a greater number of the population to turn to the shore for sustenance and income than seen previously (*ibid.* 231). Similar collection occurred during the Great Famine by those both familiar

and unfamiliar with the foodstuffs (examples can be found in The Schools' Collection: v.0157, p.25; v.0190, p.237; v.0290, p.172; v.0391, p.20; v.0392, p.20; v.0437, p.7; v.0465, p.123; v.1110, p.60). Shellfish gathering also occurred more generally outside of the Famine by those familiar with the coastlines. This was often done by those holding to traditions on certain Saint's Days and holidays.

8.2.3 Penal Laws (1695–1829)

No specific wording against the consumption of shellfish was written into the Penal Laws. Some of the acts, however, did restrict gatherings and events which were often associated with the eating of molluscs. Such restrictions were meant to limit the observance of Saint's Days (8.01: 7 Will III c.14 (1695)) and the gathering at holy places such as wells (8.03: 2 Ann c.6 (1703)). Those that worked on the sea did at least see one exemption from the Penal Laws which others would not have. In the act calling for the removal of papists from Limerick and Galway (7.08: 2 Ann c. 6 (1703)), fishermen, seamen, and more general day labourers were allowed to remain provided their dwellings were worth less than 40 shillings a year.

8.2.4 Catholic Traditions and Canon Law

There are seventeen known examples of Post Medieval shell midden sites being associated with Catholic holy sites such as wells, monasteries, churches, children's burial grounds, and graveyards. This should come as no surprise given the traditions associated with certain Saint's Days and holidays. According to Canon Law, first codified in 1917, a practice of prayer, penance, and abstinence from meat is meant to be observed on every Friday of the year (Beal *et al.* 2000, 1448). This abstinence tradition was mandatory on Ash Wednesday and on Good Friday, but could be substituted for other penitent practices throughout the rest of the year. It was often continued on Fridays throughout the Lenten season regardless of potential substitutions (*ibid.* 606 and 1448). In the 1917 code, abstinence from meat is also meant to be observed on Feast Days (Church and Peters 2001, 422). Meat is usually defined by readers of Canon Law as flesh from mammals and birds. This to some includes all meat products from these animals as well, an inclusion which was explicitly stated in the 1917 code. It is usually accepted that fish, shellfish, and cold-blooded animals are not included within the definition of meat (Anon. 2021).

Examples of traditions surrounding these codes can be found in the Folklore Collection and in other contemporary sources. On Good Friday in Rossbrin, Co. Cork, it was said that people would gather on the shore to gather and eat the shellfish. They would boil them in a pot quickly after washing them (v.0288, pp.404 and 417). Brunnicardi noted that shellfish were still being collected and cooked by pilgrims to a holy well along the coast of Gooreenatinny, Co. Galway in 1912 (GA009) (Brunnicardi 1914, 198). In 1872, Kinyhan noted similar traditions at St. Columbkille's well in Banraghbaun South, Co. Galway (GA008) and at a well in Keeraunngark South (GA048) (Kinahan 1872, 10).

8.3 The Archaeology of Post Medieval–Early Modern Shell Middens

Thirty-three shell midden features in 31 shell midden sites have been dated to the Post Medieval or Early Modern periods (Table 8.2). Three shell midden deposits are not discussed here though they have potential Post Medieval or Early Modern dates. Deposits at Ashgrove/Ballyellane, Co. Cork (CO012) and Mannin Beg (MN4), Co. Galway (GA022D) both produced Post Medieval or Early Modern radiocarbon dates, but the relationship between the sampled shells and the midden deposits is unclear. The shell midden at Curraghbinny, Co. Cork (CO017) was suggested to be Early Modern by surveyors, but the reasoning is unknown.

The next two sections will examine the distribution and chronology of Post Medieval and Early Modern sites based on the data available. This, along with key case studies and available collated data, will inform the concluding discussion. The distribution is based on site coordinates given by the National Monuments Services for Ireland and Northern Ireland. The chronology is based upon radiocarbon dates and artefact associations cited in the available records.

Site Name, Townland	County	SMR	Catalogue ID	Date (AD)	Date LOC
Aughinish	Clare	CL003-010003	CE009	post-17 th c.	C
Scattery Island	Clare	CL067-024020	CE020A	16 th –19 th c.	B
Scattery Island	Clare	CL067-024024	CE025A	17 th –19 th c.	C
Ballinlough	Cork	CO074-063	CO002	18 th –19 th c.	B
Carrigrenan	Cork	CO075-024001	CO003	18 th –19 th c.	A
Brown Island, Ballintubbrid West	Cork	CO076-013	CO007	19 th –20 th c.	C
Rostellan	Cork	CO088-022002	CO023	19 th –20 th c.	C
Kilcoe	Cork	CO140-032	CO041A	18 th –19 th c.	B

Site Name, Townland	County	SMR	Catalogue ID	Date (AD)	Date LOC
Carrigrenan	Cork	CO075-095	CO047	post-20 th c.	B
An Bun Beag	Donegal	DG032-007	DL021	16 th –19 th c.	B
Gooreen	Galway	GA021-044	GA014	post-19 th c.	B
Oranmore	Galway	GA095-110	GA056	16 th –19 th c.	C
Cill Éinne	Galway	GA110-168	GA059	16 th –19 th c.	B
Cill Éinne	Galway	GA119-017	GA061	18 th –19 th c.	B
Ceathrú An Teampaill	Galway	GA119-121	GA066	post-17 th c.	B
Eochail	Galway	GA111-002001	GA071C	16 th –18 th c.	B
Castlegregory	Kerry	KE027-008	KY015A	post-19 th c.	B
Liberties of Carlingford	Louth	LH005-038	LH002	18 th –19 th c.	C
Ghan House, Liberties of Carlingford	Louth	LH005-042012	LH010	post-18 th c.	C
Liberties of Carlingford	Louth	LH005-042009	LH011A-C	15 th –19 th c.	B/C
Caraun Point, Tóin an tSeabhail	Mayo	MA043-004013	MO043	18 th c.	A
Gob Na hAirde	Mayo	MA065-035001	MO050	15 th –18 th c.	C
Mullaghmore	Sligo	SL002-025	SO001	18 th –19 th c.	C
Staad Abbey, Agharrow	Sligo	SL005-022004	SO015A	15 th –17 th c.	B
Grange	Sligo	SL005-035	SO016	19 th –20 th c.	B
Carrowmably	Sligo	SL012-124	SO035	16 th –19 th c.	B
Shelly Valley, Carrowdough	Sligo	SL013-032	SO037A	16 th –19 th c.	C
Culleenamore	Sligo	SL014-136	SO054A-E	19 th –20 th c.	A/C
Grange North	Sligo	SL014-160002	SO074C-D	16 th –19 th c.	B/C
Tanrego East; Carrowmore	Sligo	SL019-057005	SO084	post-17 th c.	B
Tintern Abbey, Tintern	Wexford	WX045-027001	WX004C	16 th –18 th c.	A

Table 8.2: List of all sites discussed in chapter with relevant deposits indicated under Catalogue ID. Date estimates are based on radiocarbon dates where available and are otherwise based upon artefact inclusions discussed in Section 8.3.2. Further information concerning these dates is given in catalogue entries. LOC indicated Level of Confidence.

8.3.1 Distribution

Sites that have been dated to the Post Medieval and Early Modern periods cluster around Cork Harbour, Co. Cork, Sligo Harbour, Co. Sligo, and the Aran Islands, Co. Galway (Figure 8.1). Only one site is located in the North, on the west coast of Co. Donegal. Four sites are located in the East, though no sites are found between Liberties of Carlingford, Co. Louth (LH002) and Tintern Abbey, Co. Wexford (WX004). Five sites are located in the South East and two in the South West. The majority of shell midden sites of this period are on the west coast: ten in the Highland West and nine in the Lowland West.

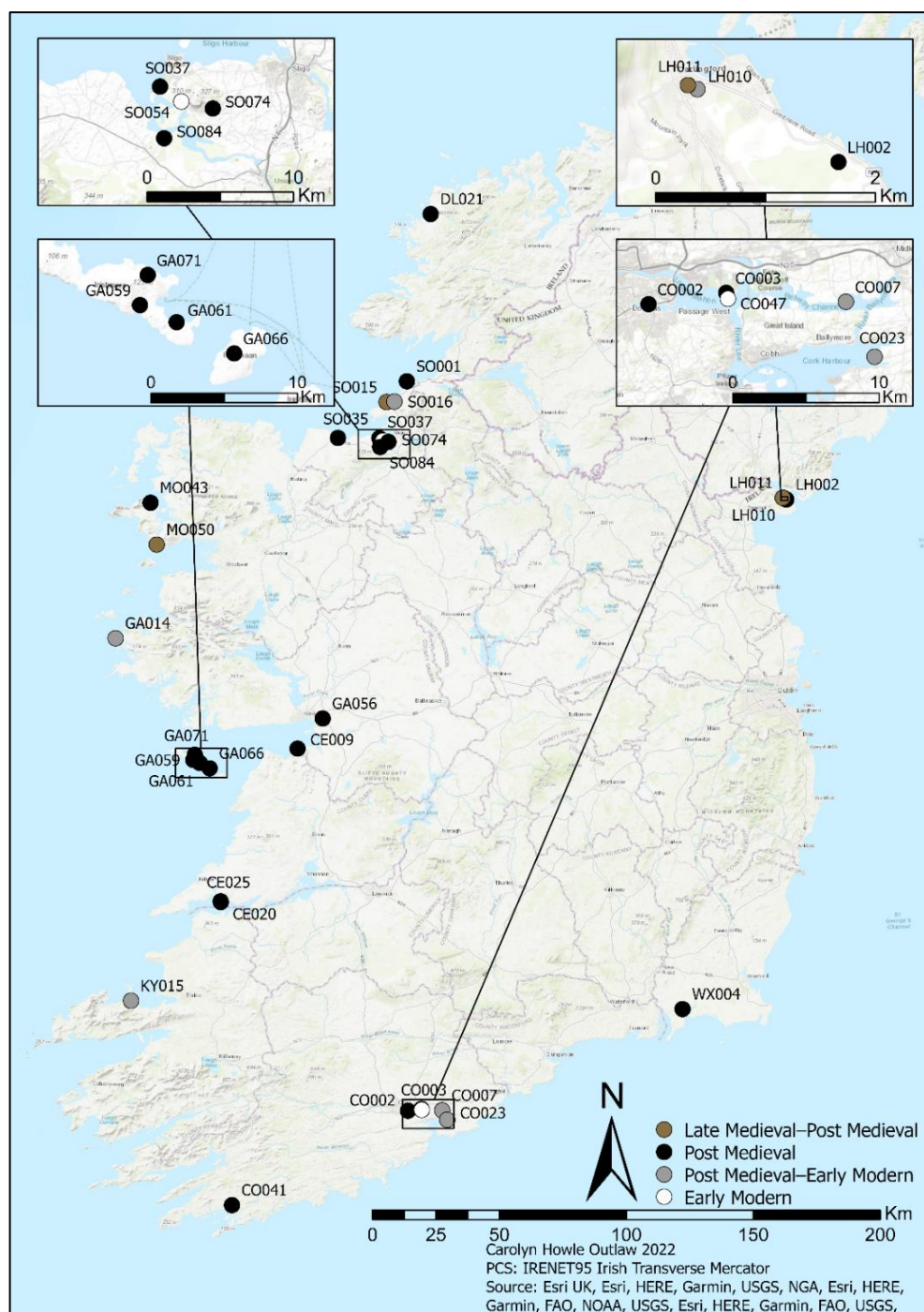


Figure 8.1: Distribution map of Post Medieval and Early Modern shell midden sites with rough estimates of dates. The inset maps show the cluster of sites at Sligo Harbour, Co. Sligo; the Aran Islands, Co. Galway; and Cork Harbour, Co. Cork. Three sites within close proximity to each other in Co. Louth are also shown.

The absence of sites recorded in Northern Ireland is a trend continued from the distribution of Late Medieval sites (see Chapter 7). The lack of sites in Dublin is most likely due to the urbanisation of the city. Shell deposits have been recorded in areas such as Ringsend, Co. Dublin and Dalkey, Co. Dublin which do date to the Post

Medieval or Early Modern, but are not within the scope of this thesis. The absence of sites in the north is more difficult to interpret, though perhaps is due to the abundance of plantation and estate towns that arose from the sixteenth century onward. It may also be due to a recording bias caused by the relatively new study of Post Medieval sites within archaeology (see Section 8.1).

8.3.2 Chronology

Only four of the 33 (12%) shell midden deposits were dated using radiocarbon analysis. Shelly Valley, Co. Sligo (SO037A) was dated using two samples, one of wood charcoal and one of a pony hoof bone. Staad Abbey, Co. Sligo (SO015A) was also dated using a horse bone while oyster was sampled for the other two radiocarbon dated desposits. Artefacts were used to date 26 (79%) of the deposits and the final three (9%) were dated through stratigraphic relationships.

Artefacts used to date deposits included pottery sherds such as creamware and delft ware, clay pipes, glass bottle fragments, a copper alloy token, and a coin dated to 1672. Stratigraphic relationships included a shell midden abutting a seventeenth century church at Aughinish, Co. Clare (CE009) and refuse directly outside of an extant nineteenth or twentieth century house at Culleenamore, Co. Sligo (SO054C–D).

8.4 Key Case Studies

Three sites have been selected as representative of different Post Medieval and Early Modern site types. The first case study is that of Caraun Point, Co. Mayo (MO043) which is associated with a vernacular village. Large midden complexes are also common during this time. Shelly Valley, Co. Sligo (SO037) is discussed as an example of such a complex. Ghan House, Co. Louth (LH010) is then presented as an example of higher status shell consumption and disposal.

8.4.1 Caraun Point, Tóin An tSeanbhaile, Co. Mayo (MO043)

Tóin An tSeanbhaile literally translates to ‘Bottom/Back of the Old Town.’ The modern village known by this name is found to the southeast of the machair on which an old settlement site can be found (Figure 8.2) (Campbell and Howle 2018, 19). The village was said to have moved ‘back’ away from the promontory known as Caraun

Point to its present location after erosion began affecting the old site (*ibid.* 20; The Schools' Collection 2018, v.0086, p.265).

Six drystone buildings have been identified at the site of the Old Town by the sea. These buildings have been identified by the National Monuments Service as three structures (MA043-004011-; MA043-004014-; MA043-004016-), one building (MA043-004006-), and two houses (MA043-004012-; MA043-004015-). Another possible contemporary site at the north-western tip of the promontory is a children's burial ground (MA043-004002-). Ten shell midden sites (MO038–45 and MO067–68) have also been recorded on Caraun Point. While it is unclear whether or not all of these middens were contemporary with the settlement site, one of the sites was confirmed to be contemporary with two of the drystone buildings through excavations in 2018 (Campbell and Howle 2018).

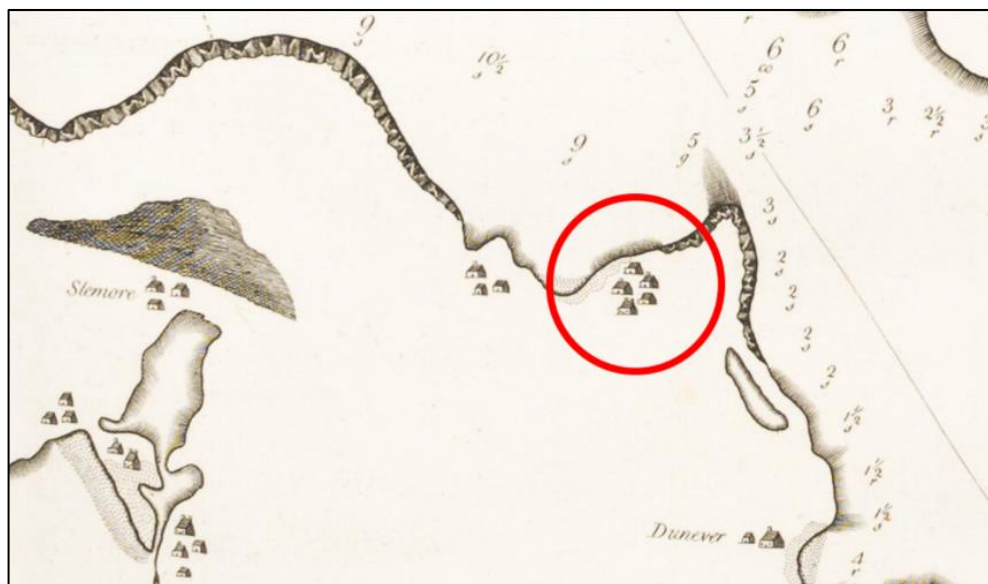


Figure 8.2: MacKenzie's (1776) Maritime Map showing houses at Caraun Point.

The drystone house structure MA043-004015-, known as Building 3, was investigated in 2018 along with a trial trench to the north of this structure, through the shell midden MO043. The midden, dated through artefactual inclusions to the 18th century, was located to the north and west of structure MA043-004012-, known as Building 1. A glass bead, a clay pipe stem fragment, a glass sherd, and an iron nail were located from primary midden layers. Surface finds from around the midden included a slane or turf spade and a fragment of kelp slag. Shells and animal remains found within the occupation layers of the house and within the midden itself were

similar. Limpet (*Patella* sp.) and winkle (*Littorina littorea*) shells were the most common in both and the bones included cattle, sheep/goat, pig, hare, and fish.

The midden was large and included at least two fire pits (one seen in section in 2018 and another excavated within the trench). On visiting the site in 2020, another possible fire pit was seen in section. All three of these features were found to the west of Building 1. This building had a north facing doorway. Given the vernacular tradition, seen throughout Achill, of waste being kept for fertilisation purposes just outside of a home's doorway, it comes as no surprise that the midden is spread to the north. The western concentration of midden material and fire pits may be an indication of outdoor meals and food preparation. Shells clustered near interior hearth evidence in Building 3 may indicate that similar meals were prepared inside as well. In 2020, a building (MA043-004006-) eroding from the cliff-face on the western edge of the promontory was also seen to include evidence of shell refuse directly outside of its walls.

Given the evidence, it may be suggested that the people living in the Old Town often supplemented their diets with shellfish from the local rocky shoreline and individual households would cook and eat their meals close to the house structure itself. The middens may have accumulated as the village came together at the different houses for meals rather than the accrual of many single-family meals. The large size and density of MO043 might give more evidence to larger gatherings, though many smaller meals over time might also produce such a deposit. The glass bead found within the excavated midden site, and a similar bead found within Building 3, may have been from rosaries used for prayer as one partook of a 'meatless' meal on Fridays or Holy Days. A potentially strong Catholic tradition is evident at the site with the proximity of the children's burial ground to the settlement itself.

8.4.2 Shelly Valley, Carrowdough, Co. Sligo (SO037A)

An area of sand dunes known as Shelly Valley can be found behind the beach at Carrowdough, Co. Sligo. This area has been investigated many times due to a heavy concentration of distinct midden deposits. In 1980–1, Burenhult and Malmberg excavated four hearths in the valley (Burenhult 1984). In 1989, Timoney reported that multiple hearths and midden sites were periodically exposed due to the shifting nature of the sands. In 2003, Keenan recorded seven distinct areas of exposed midden material over an area measuring approximately 400m by 200m (Keenan 2007). In

2006, Moore reported fifteen distinct shell bearing sites (Moore 2006). In 2014–15, Napora led a more in-depth investigation of the area which allowed for the dating of the largest deposit (Napora *et al.* 2017).

The most recent study included a geophysical survey prior to coring (Figure 8.3 and Figure 8.4). This located what the researchers established as six larger midden sites and six smaller shell spreads (Hogan and Bonsall 2016). Ten cores were then taken from the sites to establish the depth of the deposits, to investigate geophysical anomalies, to allow for zooarchaeological analysis, and to gather dating samples (Napora *et al.* 2017, 4). The largest of the midden sites was radiocarbon dated through the sampling of a pony coffin bone found on its surface and charcoal found in a lower layer. The bone was dated to 1524–1800 AD (250 ± 25 BP; UGAMS-24423). The charcoal dated to 1455–1630 AD (370 ± 20 BP; UGAMS-27125) (Napora *et al.* 2019).

All surveys agreed that the primary shell species in all deposits were that of winkle (*Littorina littorea*) and limpet (*Patella vulgata*). Oyster (*Ostrea edulis*) and cockle (*Cerastoderma edule*) were also quite common (Moore 2006; Keenan 2007; Napora *et al.* 2017). Cockles would have been gathered from the sandy inlet behind the Carrowdough peninsula whereas the other major resources may have been gathered from the rocky shoreline directly in front of Shelly Valley. Limpets, winkle, and even mussels could have been collected easily along the exposed rocky coast at low tide in tidal pools or on the temporarily dried rocks. Oysters are usually less likely to be exposed during low tide, but are still found within shallow waters near the coast, up to 50m deep, on rocks or other hard surfaces. Bones in the area have been reported as including primarily cattle and sheep/goat along with pig, hare, bird, fish, and pony. Some of these were reported as showing evidence of butchery (Malmberg 1981; Keenan 2007; Napora *et al.* 2017). Fire cracked rocks were also reported by most of the surveys along with evidence of burning such as charcoal spreads and hearths (Burenhult 1984; Moore 2006; Keenan 2007; Napora *et al.* 2017).

While only one of the midden sites has been definitely dated (Burenhult took a radiocarbon date from one of the hearths, but this is contextually unclear and not well reported (see Catalogue entry SO037)), the similarity within the deposits according to content and location may suggest that many of them are contemporary. With the inclusion of fire evidence interspersed throughout the middens of various sizes, it can be interpreted as a site of both food preparation and food consumption similar to Caraun Point, Co. Mayo (MO043). Given that there is evidence to suggest the

consumption of mammal and bird meat in the area, it is more likely to be a secular site than one related to the observation of any holy day. Perhaps local inhabitants simply enjoyed meeting for a feast containing local shellfish and a communal day at the shoreline. Or perhaps, just as today, locals might have taken their children to enjoy the beach with a family picnic in an area frequented for many similar excursions.

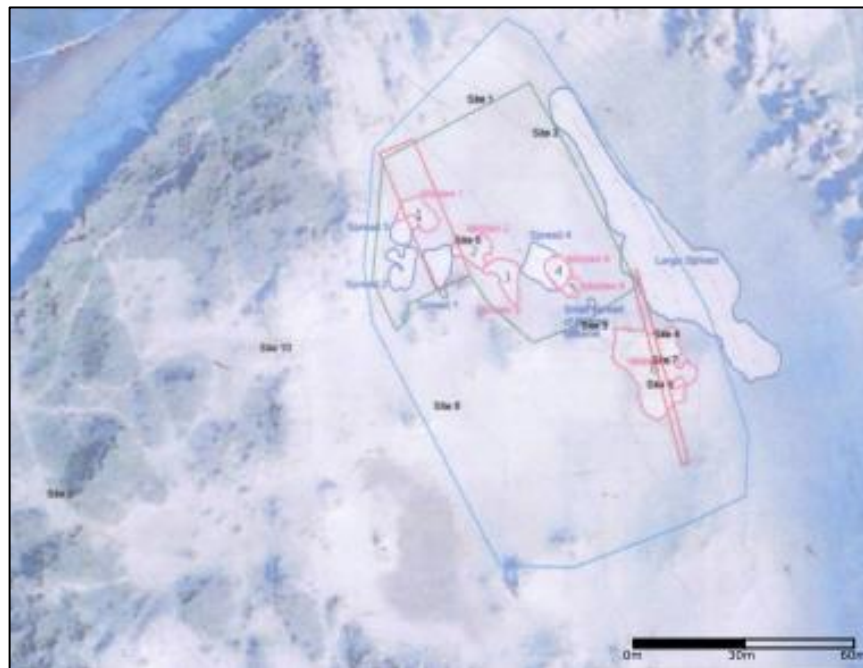


Figure 8.3: Detailed location map of shell deposits in Shelly Valley created for detection licence 15R0053 (Hogan and Bonsall 2016).



Figure 8.4: Location of cores taken in Shelly Valley under excavation licence 15E0235 (Napora *et al.* 2019, 25).

8.4.3 Ghan House, Liberties of Carlingford, Co. Louth (LH010)

Ghan House is an example of a manor house with quite a large contemporary midden deposit (LH010). The house itself was built around 1726 by William Stannus, a Dublin politician. There was a report from that year of Stannus stealing flagstones from the nearby Abbey for use as pavement at his front door. There is a local tradition that the house was built on the grounds of an old Nunnery, but there is no archaeological evidence of this (Ghan House 2022).

The front lawn was excavated in 1993 to facilitate the creation of an ornamental pond. This revealed a water course, a mortared stone wall, a cobbled area, and two layers of shells separated by a thin gravel layer. The shell layers were found within an area measuring thirteen metres long and nine metres wide approximately 40m northeast of the house (Figure 8.5). The excavation only investigated an area measuring 9.5m by 1.2m. The uppermost layer abutted the cobbled area in the north. Also in the north, a pit lined with stones was seen cut into the midden. This contained charcoal and three large bone fragments. The shell layers themselves were primarily of oyster shells with winkles and limpets also present. Two unidentified bones were found. The midden was dated to the 18th century by green glass bottle fragments and a glazed blackware pottery sherd (Gibbons 1994a, 1994b).

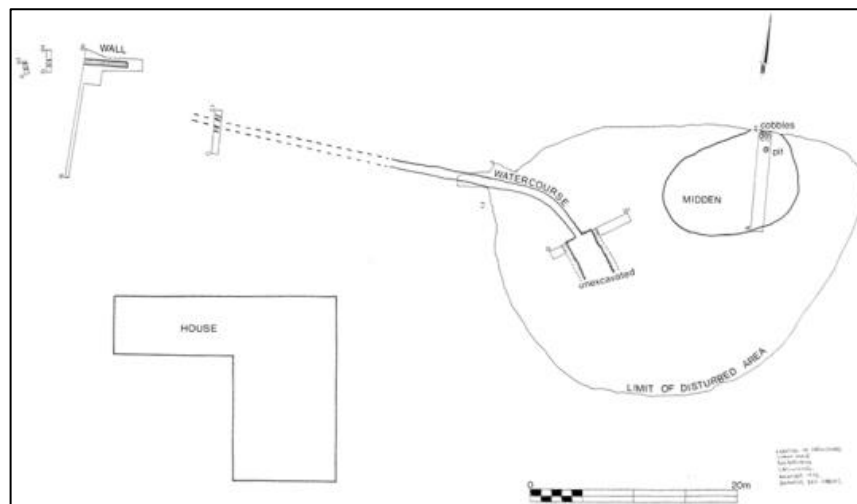


Figure 8.5: Plan of excavations at Ghan House with shell midden (Gibbons 1994a).

8.5 Overview of Available Data

The following sections aim to present the available data collected concerning shell middens dating to the Post Medieval and Early Modern periods. This includes potential

associations, dimensional measurements, inclusions of fauna and flora, and artefactual inclusions. Previous chapters have contained a section concerning human remains, though this category is not relevant to the Post Medieval or Early Modern deposits. The fauna and flora are separated into shells, bones, and plant remains. The data is briefly discussed here, but interpretive conclusions are expanded upon in section 8.6.

8.5.1 Associations

The site type most commonly associated with shell middens of the Post Medieval and Early Modern periods are those of secular sites. A total of 14 shell middens were found around settlements, tower houses, castles, and country homes. One further site was part of a larger midden complex. Caraun Point, Co. Mayo (MO043) was identified as part of a larger midden complex within a vernacular settlement which contained a children's burial ground at its edge. This burial ground was one of a total of seven Christian sites with potentially related shell midden deposits.

Catalogue ID	Church/ Monastic Sites	Children's Burial Sites	Settlements	Tower Houses	Other Castles	Midden Complexes	Country Homes
CE009	X	—	—	—	—	—	—
CE020	—	—	X	—	—	—	—
CE025	—	—	—	X	—	—	—
CO003	—	—	—	X	—	—	—
CO023	—	—	—	X	—	—	X
CO041	—	—	—	X	—	—	—
GA056	—	—	—	X	—	—	—
GA059	X	—	—	—	—	—	—
GA066	—	—	X	—	—	—	—
GA071	X	—	—	—	—	—	—
KY015	—	—	—	—	X	—	—
LH010	—	—	—	—	—	—	X
LH011	—	—	X	—	—	—	—
MO043	—	X	X	—	—	X	—
SO015	X	—	—	—	—	—	—
SO016	X	—	—	—	X	—	—
SO035	—	—	X	—	—	—	—
SO037	—	—	—	—	—	X	—
SO074	—	—	—	—	X	—	—
WX004	X	—	—	—	—	—	—
TOTAL:	6	1	5	5	3	2	2

Table 8.3: Post Medieval and Early Modern shell midden sites with potentially associated site types.

8.5.2 Dimensions

Measurements are known from 26 Post Medieval and Early Modern shell midden features. All three dimensions are known from eleven deposits, ten have recorded length and thickness measurements, and thickness is the only known dimension from five deposits. The largest shell midden feature is that of Shelly Valley, Co. Sligo (SO037A) with a volume of 1350m³, though Brown Island, Co. Cork (CO007) produced a larger estimated area of 811.8m². Aughinish, Co. Clare (CE009) was longer than either of these middens with a length of 80.9m. The smallest deposit by volume is An Bun Beag, Co. Donegal (DL021) which measured 0.4m³. Two deposits at Culleenamore, Co. Sligo (SO054C–D) had the smallest area of 0.1m². The thinnest deposit was at Liberties of Carlingford, Co. Louth (LH011C) measuring 0.03m thick.

Catalogue ID	Length (m)	Width (m)	Thickness (m)	Area (m ²)	Volume (m ³)
CE009	80.9	0.2	0.5	40.5	8.1
CE020A	35	–	0.3	10.5	–
CO002	1.8	–	0.1	0.2	–
CO003	66	2	0.5	132	66
CO007	39.6	20.5	1.2	811.8	974.2
CO023	–	–	0.6	–	–
CO041A	2.8	2	0.8	5.6	4.5
CO047	18	4	0.1	72	7.2
DL021	10	1.1	0.04	11	0.4
GA014	17	–	0.5	8.5	–
KY015A	3.7	1.5	1.5	5.6	8.3
LH002	8	8	0.4	64	25.6
LH010	13	9	1	117	117
LH011B	–	–	0.1	–	–
LH011C	–	–	0.03	–	–
MO043	24	4.5	1	108	108
SO015A	40	–	1.2	48	–
SO035	2.5	–	0.2	0.5	–
SO037A	27	20	2.5	540	1350
SO054A	2	–	0.1	0.2	–
SO054B	–	–	0.1	–	–
SO054C	0.6	–	0.12	0.1	–
SO054D	0.5	–	0.2	0.1	–
SO074C	–	–	0.4	–	–
SO074D	3	–	1	3	–
SO084	40	–	1.2	48	–
TOTAL:	21	11	26	21	11
Average:	20.7	6.6	0.6	96.5	242

Table 8.4: Dimensional measurements available for shell midden features dating from the Post Medieval and Early Modern periods. The total number of features with each measurement is given at the bottom followed by the average. All measurements have been rounded to the nearest tenth.

8.5.3 Fauna and Flora

Where the information is available shell, bone and plant species of Post Medieval and Early Modern shell middens are presented below. Common English names are used here (see Chapter 3). Most species are only identified to genus and species groups such as fish and bird are presented together due to the infrequency that these are differentiated in the available texts. Where these groups have been differentiated, the data is presented in relevant catalogue entries.

Shells

Five of the 33 (15%) Post Medieval and Early Modern shell midden deposits have no available molluscan species information. Where recorded, oyster and winkle are the most common species followed by limpet, cockle, and mussel (Table 8.5). Oyster was dominant in all but one deposit in which it was recorded. This species can be found in the nearshore or far-shore attached to hard substrates. The other common species are found in the intertidal zone. Cockles burrow in the sand (Figure 8.6) while the other species attach to hard substrates.



Figure 8.6: A photograph of cockle pickers in Dublin or Wicklow c.1900 (Clarke 1890; Image source: National Library of Ireland).

Nine shell midden features contained shell species which were reported in less than five deposits. Scallop and flat winkle were reported within four deposits; land shell, top shell, and clam in three; dog whelk and razor shell in two; and dog cockle, otter

shell, carpet shell, cowrie, bonnet snail, and trough shell were recorded in a single deposit each. Bonnet snail was dominant at Ceathrú An Teampaill, Co. Galway (GA066).

ID	<i>Ostrea edulis</i>	<i>Littorina littorea</i>	<i>Patella vulgate</i>	<i>Cerastoderma edule</i>	<i>Mytilus edulis</i>	<i>Buccinum undatum</i>	Other/Unidentified
CE009	D	D	X*	X*	X*	X*	X
CE020A	D‡	D‡	X‡	X‡	—	—	—
CE025A	D‡	D‡	—	—	—	—	—
CO002	D‡	—	—	—	—	—	—
CO003	D	X	—	X*	X*	—	—
CO007	D	X‡	—	X‡	X‡	X*	X
CO023	D‡	—	—	—	—	—	—
CO041A	D	D	D	—	—	—	—
CO047	D	X	—	—	X*	—	—
DL021	D‡	D‡	—	D‡	—	—	—
GA014	—	D	D*	—	X*	—	X
GA056	D‡	D‡	—	X‡	X‡	—	X
GA059	—	D‡	—	—	—	—	—
GA061	—	—	—	—	—	—	/
GA066	—	D‡	—	—	X‡	—	D
GA071C	—	D‡	D‡	—	—	—	—
KY015A	—	D‡	—	—	—	—	—
LH002	D	X	X	—	X	X	X
LH010	D‡	X‡	X‡	—	—	—	—
LH011A	—	—	—	—	—	—	/
LH011B	D‡	—	D‡	—	—	—	—
LH011C	D‡	—	—	—	—	—	—
MO043	X	D	D*	X*	X*	X*	X
MO050	—	—	—	—	—	—	/
SO001	—	—	—	—	—	—	/
SO015A	—	X	D	X	X	—	—
SO016	D‡	D‡	—	D‡	—	—	—
SO035	—	D‡	D‡	—	—	—	—
SO037A	D	D	D	D	X	X	X
SO054A	D‡	—	—	—	—	—	—
SO054B	D‡	—	—	—	—	—	—
SO054C	D‡	—	—	—	—	—	—
SO054D	D‡	—	—	—	—	—	—
SO054E	—	—	—	D‡	—	—	—
SO074C	D‡	X‡	—	X‡	X‡	—	X
SO074D	—	—	—	—	—	—	/
SO084	D‡	X‡	X‡	—	—	—	—
WX004C	D	—	—	—	—	—	—
TOTAL:	25	23	13	12	12	5	14
Dominant:	24	15	8	4	0	0	1

Table 8.5: Shell species identified in Post Medieval and Early Modern shell midden deposits. X indicates the species is present. D indicates that a species was dominant. Under the column 'Other/Unidentified,' X indicates a known shell species other than those listed and / indicates unidentified species. * indicates the genus is known, but the species is not. ‡ indicates that only vernacular names are used in available sources and scientific species are assumed.

Bones

Twenty of the 33 (61%) Post Medieval and Early Modern shell-bearing deposits had animal bones recorded. Thirteen of these sites contained no species data. Where

species were recorded, cattle was the most common. In every deposit in which cattle was present, it was a dominant species. Sheep/goat and pig were also common. Only one deposit contained bone species not found in any other Post Medieval or Early Modern shell-bearing deposit. Caraun Point, Co. Mayo (MO043) contained hare, mouse, and crab remains. The fish from Staad Abbey, Co. Sligo (SO015A) included ballan wrasse, herring, hake, salmon, scad, and *Gadidae*. All of these fish are marine species, though salmon can be fished from freshwater during spawning season.

Catalogue ID	Cattle	Sheep/Goat	Pig	Fish	Horse	Bird	Other/Unidentified
CE009	D	—	X	—	—	—	—
CE020A	—	—	—	—	—	—	/
CE025A	—	—	—	—	—	—	/
CO002	D	X	D	—	—	—	—
CO041A	D	—	X	X	—	—	—
GA014	—	—	—	—	—	—	/
GA056	—	—	—	—	—	—	/
GA061	—	—	—	—	—	—	/
GA066	D	D	—	—	—	—	—
GA071C	—	—	—	—	—	—	/
LH010	—	—	—	—	—	—	/
LH011A	—	—	—	—	—	—	/
LH011B	—	—	—	—	—	—	/
LH011C	—	—	—	—	—	—	/
MO043	D	D	X	X	—	X	X
SO015A	D	D	—	X	D	X	—
SO035	—	—	—	—	—	—	/
SO037A	—	—	—	—	D	—	—
SO074C	—	—	—	—	—	—	/
SO074D	—	—	—	—	—	—	/
TOTAL:	6	4	4	3	2	2	14
Dominant:	6	3	1	0	2	0	0

Table 8.6: Bone species identified in Post Medieval and Early Modern shell midden features. Fish and bird are not differentiated to species. X indicates the species is present and D indicates that a species was dominant within the deposit. Under the column 'Other/Unidentified,' X indicates a known bone species other than those listed and / indicates an unidentified species.

Plant Remains

Seven Post Medieval or Early Modern shell midden features contained charcoal. One of these, Staad Abbey, Co. Sligo (SO015A) also had cereal remains including barley and oat. Unidentified seeds and weed seeds were also reported along with straw. No other plant remains are known from Post Medieval or Early Modern shell-bearing deposits.

8.5.4 Artefacts

Artefacts were reported from 31 of the 33 (94%) Post Medieval and Early Modern shell midden features (Table 8.7). Ceramics were the most common, identified in 24 deposits, though 14 of these only reported vague references to Post Medieval or Early Modern pottery sherds. Nine shell midden features contained metal artefacts of iron, brass, tin alloy, copper alloy, and lead. Glass was found in seven deposits and included bottle fragments and beads. Artefacts of stone, lithics, and bone were found in negligible amounts. Only a single deposit reported stone artefacts beyond fire cracked rocks. Lithic flakes were found at only two sites. One of the deposits containing flakes, Eochail, Co. Galway (GA071C) also contained the stone artefacts which were not fire cracked rocks and the single bone artefact.

Catalogue ID	Ceramics	Metal	Glass	Stone	Lithics	Bone
CE009	pearlware; English/Irish	—	—	—	—	—
CE020A	sherds	—	—	—	—	—
CE025A	creamware; pearlware; slipware; salt glazed; glazed redware; Merida ware; cookware; gravel tempered; Bristol/Stuffs; transfer ware; roof tile; clay pipe	—	—	—	—	—
CO002	sherds; slob brick	—	bottles	—	—	—
CO003	creamware; English/Irish	—	—	—	—	—
CO007	—	—	—	frs	—	—
CO041A	sherds	—	—	—	—	—
CO047	—	bullet casing	—	—	—	—
DL021	sherds; clay pipe	—	—	—	—	—
GA014	whiteware	—	—	—	—	—
GA056	—	iron nail	—	—	—	—
GA059	clay pipe	iron spike	—	—	—	—
GA061	sherds	slag	—	—	—	—
GA066	—	brass pin; coin	—	—	—	—
GA071C	delftware; stoneware; creamware; redware; sherd; clay pipes	tin alloy strip; copper alloy strip; copper alloy fishhook; iron barbed fishhook; iron tanged chisel; iron bracket; iron clamp; slag	bead	polishing; whetstone; mortar	flakes	needle
KY015A	sherds	—	—	—	—	—
LH002	sherds	—	—	—	—	—
LH010	sherd	—	bottle	—	—	—
LH011A	sherds	—	—	—	—	—

Catalogue ID	Ceramics	Metal	Glass	Stone	Lithics	Bone
MO043	clay pipe	iron nail	bead; fragments	fcrs	flake	—
MO050	—	lead musket ball; bronze fragments	—	fcrs	—	—
SO001	sherds	—	—	—	—	—
SO015A	sherds	—	—	—	—	—
SO016	clay pipe; milk dish	—	—	—	—	—
SO035	clay pipe	—	—	—	—	—
SO037A	—	—	—	fcrs	—	—
SO054E	sherds	—	fragment	—	—	—
SO074C	sherds; clay pipes	spur; horseshoe; iron ring; iron nails	fragment	—	—	—
SO074D	sherds	—	—	—	—	—
SO084	—	copper alloy token	—	—	—	—
WX004C	stoneware; clay pipes	—	bottle	—	—	—
TOTAL:	24	9	7	5	3	1
Summary:	2 pearlwares; 2 English/Irish; 15 sherds; 3 creamware; 1 slipware; 1 salt glazed; 1 glazed redware; 1 Merida ware; 1 cookware; 1 gravel tempered; 1 Bristol/Staffs; 1 transfer ware; 1 roof tile; 9 clay pipes; 1 slob brick; 1 whiteware; 1 delftware; 2 stoneware; 1 redware; 1 milk dish	1 bullet casing; 3 iron nails; 1 iron spike; 2 slag; 1 brass pin; 1 coin; 1 tin alloy strip; 1 copper alloy strip; 1 copper alloy fishhook; 1 iron barbed fishhook; 1 iron tanged chisel; 1 iron bracket; 1 iron clamp; 1 lead musket ball; 1 bronze fragments; 1 spur; 1 horseshoe; 1 iron ring; 1 copper alloy token	3 bottles; 2 beads; 3 fragments	4 fcrs; 1 polishing; 1 whetstone; 1 mortar	2 flakes	1 needle

Table 8.7: Artefact types found within Post Medieval and Early Modern shell midden features. ‘FCR’ indicates fire cracked rocks.

8.6 Discussion

When considering recent archaeology which may have a direct folk memory within the modern populace, it is often necessary to review such sites as they may currently be viewed by popular observation. Some of the influences which may affect such views are strongly rooted in politics contemporary with the creation of such sites and the psychology of the prejudices from which these political movements sprang. These policies (as seen in Section 8.2) and prejudices (as discussed below) affect the popular interpretation of shell middens. Throughout the nineteenth and twentieth centuries, these biases also affected the academic interpretations of the sites.

The colonisation of Ireland began in the twelfth century and intensified in the sixteenth and again in the nineteenth centuries. Kiberd, following primarily on Ngugi

(1986), discusses the steps from colonisation to liberty as starting with assimilation and moving through nationalism to eventual liberation (Kiberd 1997, 18). Assimilation is the first way in which a colonised people may gain back some semblance of control. While this step can cause self-estrangement, as a people work towards being seen as civilised within terms that the coloniser might accept in order to show an aptitude for self-governance. The release of the cognitive dissonance created within a people suffering from such self-estrangement can then lead to nationalism. In this stage, the colonised people will often see the criticisms of the coloniser as a source of pride. Many negative feelings which were once turned inward turn to hatred for their conquerors and any traits which may be seen as belonging to that group. There is still a sense during this stage that the colonised people must stress their civilised traits and prove their worthiness (*ibid.* 19–22).

The final stage is the least understood and the one that most previously colonised nations are working towards. There is a danger inherent in nationalism to sentimentalise the pre-colonial culture that once was, often as a mythicized and romanticised version of the past. While such sentimentality can help shape a national identity, it can work against the forward momentum required for the stage of liberation (Kiberd 1997, 27). This potential stagnation of ideals is not unique to the space between nationalism and liberationism but can begin during assimilation.

The self-hatred which may appear during assimilation can also create long lasting negative feelings related to different traits ingrained in the nation as backwards or barbaric. These feelings may be expressed in extremes or as more minor prejudicial thoughts. They may be applied to oneself or to other members of the group (such as Allport's example of 'lace curtain Irish' looking down upon the 'shanty Irish') (Allport 1954, 152). The latter application of prejudice towards subgroups of one's own group is, in fact, most prevalent during times of relative ease from outside persecution of the group as a whole (*ibid.* 153). This form of self-hatred, therefore, may be most expected during the strive for liberation after nationhood.

The word 'stereotype' was defined by Allport as 'an exaggerated belief associated with a category. Its function is to justify (rationalize) our conduct in relation to that category' (Allport 1954, 191). Allport defined 'prejudice,' specifically in its negative form, as 'an avertive or hostile attitude towards a person who belongs to a group, simply because he belongs to that group, and is therefore presumed to have the objectionable qualities ascribed to the group' (*ibid.* 7). It can be understood, through

the combining of these two definitions, that stereotypes act to both create and justify prejudices. In reference to such circular logic, Lebow has described the ‘perceptual prison’ which stereotypes can often create. These ‘perceptual prisons’ act to justify the stereotypes through the prejudicial policies they create (Lebow 1976, 74 and 81–2). In order to become thus ingrained, Lebow recognised three stages a stereotype must go through: conscious innovation, self-fulfilment (often through policy choices), and self-justification (*ibid.* 74–5).

The steps towards the self-justification of the stereotypes associated with the Irish began with the conscious innovations of Henry II. This helped to create the wide-spanning idea that the Irish were backwards, barbarous, and unchristian as early as the twelfth century (Lebow 1976, 74–5). Such ideas were drawn out of the caricatures already created of the continental Celt. The reformation added a new way to differentiate between the two groups with the ‘superstitious’ Catholic Irish and the ‘upstanding’ Protestant English (*ibid.* 76).

Through various English political endeavours since that time, Ireland became politically and economically dependent upon their neighbouring island. The policies which made Ireland so dependent were often designed with the stereotypes in mind (Lebow 1976, 76–7). These included the outdoor relief schemes of the Russel administration which, due to a belief in the laziness of the Irish, sought to avoid making relief seem so attractive as to tempt the abuse of it. This led to a policy that anyone owning more than one-quarter acre of land could not access the relief. This meant that anyone with the potential to eventually work their way out of government relief with a good harvest, had to give up such potential in order to feed themselves in times of need. The policy itself created a system in which long term dependence on the state was necessary in order to gain short term relief. Similarly, rents were often such that if an Irishman improved the land on which he made his living, the landlord could increase his rent or evict him to offer it to someone who would pay a higher rent. This meant that there was an incentive to make no improvements which could have eventually helped the renter move up economically. The lack of land improvements to achieve an improved station in life seemed to the English to prove the Irish’s indolence and laziness. It also supported the idea that, somehow, the Irish were content with their poverty and found happiness in only fulfilling their most basic needs (*ibid.* 78). With the creation of such proof, it is no wonder that anyone with such preconceived ideas might easily find at least surface level evidence to support their beliefs upon visiting

or reading accounts of the island: self-justification (*ibid.* 81–2).

Overall, the stereotypes attributed to the Irish were often the same as those applied to many other colonised groups such as Africans and Native Americans (Lebow 1976, 104). In order to justify treating others in a way you might never treat your own citizens, the coloniser must make a distinction between the two groups. This is often done by viewing them as unchristian, in which the justification comes from bringing them Christianity; uncivilised, in which justification is found in bringing civilisation and modern improvements; or child-like, in which justification is made for disciplining, teaching, and controlling the people as a parent might a challenging child. For the Irish, the overall stereotypes often included characteristics which allowed all three justifications: ‘cunning but ignorant, cowardly but brazenly rash, religious and superstitious, indolent, complacent and addicted to both violence and alcohol’ (*ibid.* 64).

Shellfish which could be easily obtained at low tide have been known as *cnuasach mara*, or ‘sea pickings’ and as *bia bocht*, ‘poor man’s food.’ While oysters may have been a choice meal for even the aristocracy, shellfish such as limpets, winkles, and mussels were thought to indicate desperation as early as the 16th century (O’Tuama and Kinsella 1981; Mac Con Iomaire 2005; Napora *et al.* 2017). Given the prominence of oysters found in Post Medieval and Early Modern sites, this interpretation may seem like somewhat of a contradiction to the facts presented. Folk memory and the prejudicial thoughts associated with them are not based upon knowing general statistical facts about the sites, only with the stories which surround them. Such stories are often shrouded in the prejudices of the time.

On visiting sites at Dog’s Bay, Co. Galway (GA034, GA036, and GA037) and while excavating one of the middens at Tóin An tSeanbhaile (MO043), the author was asked several times without prompt whether the shell deposits were from the Famine Period as ‘*they had to eat those kinds of things then.*’ Those in Dog’s Bay have not yet been dated and the site in Mayo predates the Famine. There are still negative associations with midden sites to this day. Perhaps it is the outdoor setting of the midden deposits, indicating that someone gathered the food and ate it all within an area lacking certain comforts. This might potentially invoke the stereotypical image of an Irishman content with fulfilling no more than his basic needs and finding no happiness in such potential comforts. Perhaps it is the folk memory of those unfamiliar with shellfish, gathering them during the Famine and making themselves sick rather than

satiating their hunger (see Section 8.2 for examples of such in the Schools' Collection). Perhaps, however, it is rooted further in prejudices.

During much of the nineteenth and early twentieth century, research on shell midden sites made assumptions concerning the origins of these deposits based on popular views. The sites were either interpreted as originating in the Mesolithic Period or from times of desperation. If the former, it is from a time prior to modern civilisation, a time before Christianity, and a time before the agrarian ideal came to Ireland. These associations would not fit well with the nation building narrative of the early twentieth century. If the middens are associated with such 'barbaric' ideas, how could later midden sites be rationalised? By associating later middens with the desperately poor and possibly uneducated and superstitious (prejudicial thoughts about a subgroup of the Irish by the Irish), the idea that shell middens are associated with a lack of civilisation is easily confirmed. In this sense, the sites were thought to belong to a marginal subset of the populace, which would not reflect such negative stereotypes on the Irish nation as a whole.

Further irony and possible 'cognitive dissonance' are the application of these stereotypes on the sites even as they are being expanded. There are reports of nineteenth and twentieth century shellfish gathering, consumption, and disposal along the coast, especially as it relates to Christian tradition. The archaeological evidence supports these reports. It is unclear how this contradiction between the reality and contemporary prejudices was/ is resolved. Through dissemination of the archaeological interpretations not only of Post Medieval shell middens, but of middens related to all economic statuses through thousands of years of Irish history (see Chapter 9), the author hopes to help change the popular narrative around shell middens from one of self-deprecation to one accepted in the narrative of cultural liberation.

Because of the negative stereotypes and folk memories often associated with coastal sites in Ireland, especially those most obviously from the Post Medieval Period, this archaeology is often overlooked. The 'nationalistic archaeology' of the twentieth century in particular had little room for these sites which often held memories of English control (in the form of ports and fortifications generally and in the form of landlord control and Penal Laws in relation to shell bearing sites) and native depravity (in the idea that middens were created during times of desperation by marginalised peoples) (Breen 2007, 205; Milner and Woodman 2007, 109). It is important to bring these sites back into focus alongside the other archaeological sites of the time period

with balanced interpretations. Folk memory cannot be discarded from the narrative, but it can be further grounded in the archaeological evidence.

In general, many of the Post Medieval shell bearing sites can be associated with small communal gatherings in vernacular villages or at sites of pilgrimage. Shellfish of shallow water (*i.e.* oyster) or intertidal zones (*i.e.* limpets, winkles, mussels) local to the area would be gathered and fires would be set where the meal was to take place. This could be inside a home (as seen in Caraun Point, Co. Mayo (MO043)), against an old structure to shield from the wind, or in an open area known locally as a gathering place (as seen in Shelly Valley, Co. Sligo (SO028)). Such meals may have taken place on specific holy days when practicing Catholics were to abstain from the meat of mammals and birds. These religious meals may have been a time of solemn prayer at places of pilgrimage or more joyful celebrations of family and tradition at vernacular settlement sites.

In the sites that do date to the Famine Period, desperation may not be the only available interpretation. In the few areas where landlords restricted access to shellfish, the gathering of these resources was an act of defiance as well as survival. When this resource was exploited by those more familiar with coastal foodstuffs, it was a source of strength and could help satiate the hunger which might otherwise have taken over. Even the fishermen who sold their gear for short term relief at the beginning of the Famine would have been able to find sustenance on the shoreline instead. For those not familiar with the resources, it may have caused illness if improperly prepared or eaten on a stomach not used to such foodstuffs, but it still tells a story of people striving to survive in desperate times. Small changes in perception in the face of potential ‘self-hatred’ formed through the stages of colonisation, may help bring about a more balanced view of even the most negative of remembrances.

The aristocrats of the time also enjoyed many of the same shellfish as those residing in poorer residences. Though, they may have developed their sites somewhat differently than the travelling pilgrim or the coastal inhabitant. Shells found outside of tower houses, country homes, and castles were most likely deposited outside after their contents were consumed within the comforts of their homes. The inhabitants of these residences may not have gathered the shellfish themselves, but they exploited the species local to them just as others of the time were doing. The reasoning behind such meals may have also been similar in that practicing Catholics of all economic statuses

were called upon to practice abstinence from meat for, at the minimum, Ash Wednesday and Good Friday.

One of the unifying characteristics of the Irish during most of the Post Medieval Period was the practice of Catholicism. It is fitting then, that this may also be what unifies many of the shell middens sites from this period. Even if the reasoning behind the gathering and consumption of shellfish was not always for abstinence and penitence, the creation of the middens is an indication of communal meals and local gatherings. Community within a nation fighting for freedoms and searching for national identity would have been critical, even if such gatherings were against the laws of the time. As that same nation moves towards cultural liberation, it is time to take a new, non-prejudicial look at what shell middens may teach us of the nation's past.

Chapter 9: Discussion

Introduction

The scale of this study, covering 8000 years of shell deposition along the c.7500km length of the Irish coastline, necessitates the discussion of only broad patterns across different time periods. This chapter explores those patterns suggested by the data as it currently stands. The significant categories of interpretation are first discussed, followed by a comprehensive overview of temporal trends. The Irish evidence is then placed into a wider European and global context of shell deposits. A summary discussion concludes the chapter.

9.1 Significance of Shell Deposits

The significance of shell deposits has long been overlooked due to common preconceptions concerning their date and socio-economic contexts (Chapter 2). Shell deposits can give insight into the role shellfish played in the food economy both directly and indirectly. Inclusions of animal and plant remains can also be preserved in the sites, providing insight into these potential dietary resources. A discussion of food supply is given in section 9.1.1, followed by a discussion of craftworking activities in section 9.1.2. The latter has been identified on several shell midden sites. Shells themselves have also been used as a raw material. Settlements associated with shell middens are then considered in section 9.1.3. This discussion concludes in section 9.1.4 with a look at shell deposits as ritual space and shells as symbolic objects.

9.1.1 Molluscs as Food and In the Food Economy

The most common interpretation of shell deposits is that they are refuse dumps of food waste, hence the name ‘kitchen middens’ in older literature. In many instances, the connection between shellfish and food is appropriate, though it may not always be a direct one. There is a great deal of evidence to suggest that oyster, winkle, cockle, and some other molluscs, were sought after as a direct source of protein. Other species such as mussel and limpet may instead have been used as bait to catch fish or crustaceans. This does not take them out of the food chain, but it does remove them as a direct source of human nutrition. Beyond their nutritional value, shellfish have been used for medicinal purposes at various times in the past. The use of shells directly or

incorporated with sand or seaweed may have been part of the agricultural process through their use as manure.

Other food remains found in shell middens include mammal, fish, and bird bones and the remains of cereals, nuts, and fruits. There is also indirect evidence of food remains in the deposits. For instance, evidence of seaweed collection interpreted from the presence of small, epifaunal shells may suggest that this sea vegetable was part of human diet at various times. Bones with evidence of butchery have been identified in shell deposits and a few deposits contain the skeletal elements to suggest butchery took place on site. Burnt shells and bones, and fire cracked rocks are also identified, suggesting cooking also took place on site. Food processing of plant domesticates occurred at shell midden sites as indicated by the discovery of querns and cereal remains. The evidence of domesticated foods, both plant and animal, at various sites indicates the co-use of wild and farmed resources rather than the traditional view of marginalised coastal dwellers. The use of wild resources in the diet is indicated by hazelnuts, fruit seeds or stones, fish bone, and crab. Pig has also been found in numerous shell middens through time. Wild pig, however, is difficult to distinguish between domestic pig archaeologically (Rowley-Conwy *et al.* 2008).

Though it is not easily traced archaeologically, shellfish may have been traded or sold in inland sites. The movement of shellfish can take place with or without the shell. If transporting shellfish in their shells, less damage may occur to the meat, but there is an added bulk to the transportation. Shellfish can be preserved in many ways for storage or trade, and some can even live outside of their shells for a few days (Murray 2000, 67; Hardy *et al.* 2016, 22). When the shellfish are transported out of their shells, the evidence left on the coast would be similar to shell deposits left behind due to on site consumption. Shell middens identified further inland is usually indicative of molluscs transported in their shells.

The use of shellfish as bait is also not easily recognised archaeologically, but this has been recorded ethnographically as a primary use for many species, particularly those less palatable for human consumption (Boas 1921, 179; Gusinde 1986; Claassen 1998, 176–8). Evidence of fishing taking place has been identified through artefactual inclusions such as fishhooks, potentially indicating that the shellfish were gathered as bait. Fishermen, however, also require food as they work and not all of the shellfish may have been used for the capture of other resources. There are a few shellfish known to be used as bait historically in Ireland including mussels, limpets, whelks, and

winkles. Cockles were also recorded as a source of bait in Britain (Murray 2000, 66–71). Mussels can reportedly stay alive for two days after being removed from their shell and placed on a hook (Lovell 1884, 63). Limpets can be removed from their shell through boiling, allowing the meat to be easily extracted for bait (O’Dowd 1994, 219). Whelks were commonly chosen for long line fishing after their shells were broken open (Hancock 1967, 11; MacPolin 1999, 51). Winkles were recorded as line bait on Aran Island (Robinson 1990, 36 & 85; O’Flaherty 1991, 33). Other species may have been used in prehistory or in smaller numbers and left unrecorded. Intertidal species that live on hard substrates such as rock outcrops are the most likely candidates for bait as they require the least amount of energy to harvest. Such species include the limpet, mussel, and winkle, which were historically used for this purpose, along with dog whelk. The latter species, however, was thought to make a poor choice for bait due to other sea animals avoiding their secretions (Reese 1980, 79; Murray 2000, 374). This is unsubstantiated and may not have influenced early use of this mollusc for bait.

When shellfish were eaten, it may not have always been for nutritional value, but instead for medicinal properties. This is recorded in historical accounts from Scotland, where a broth from limpets was said to increase a mother’s milk and winkles were said to cure jaundice (Fenton 1984, 123; MacLeod 1994, 201; Murray 2000, 134–5). Pliny the Elder, writing in the first century AD made note of oyster remedies used in Europe; oysters may restore appetite, function as a laxative, treat ulcers and rheumatism, treat tonsil and uvula afflictions, reduce tumours, and heal burns and other skin damage. He also states that many shellfish can act as counterpoisons (Pliny the Elder 1855). In the Mediterranean, *Murex* shells, the same which were used for dye (see section 9.1.2), were also used to whiten teeth and the boiled operculum of the shells were used to treat hair loss. In parts of Asia, the shells of cowries are ground into a powder and used as medicine to treat smallpox (Claassen 1998, 211–2). The use of shellfish for their potential medicinal attributes is yet another purpose which is difficult to trace archaeologically, but certain artefacts may help with such interpretations (see section 9.2.5).

The loss or partial destruction of shell middens caused by the quarrying of shells for use as manure has been noted in previous chapters. The Cistercians in Ireland are thought to have introduced the practice of using sand and shells as fertiliser from France in the Late Medieval period (see Chapter 8) (Cooper and Davis 2004, 9). Shells were also shown in nineteenth and twentieth century sources to have been used for

manuring during this time (Murray 2000, 150–2). Shells were also quarried in the Post Medieval and Early Modern periods to burn and create lime for manuring, leather tanning, and white washing (see Chapter 3) (Harte 1866; Claassen 1998, 66; Murray 2000, 152; Cooper and Davis 2004, 12–5; Milner 2012, 226; Woodman and Milner 2013, 40 and 102; Hardy 2017, 264). Seaweed was often used as a fertiliser on sandy soils from at least the 17th century onward (Murray 2000, 119; Pereira and Cotas 2020, 12). Certain shellfish attach themselves to seaweed and may have been collected with the collection of this sea vegetable. Following the extraction of their meat, shells may have been accumulated and stored for future use as manure creating shell deposits along the coast. Seaweed may have been treated similarly, especially if composted prior to its use on farmland (see section 9.2.4) (Murray 2000, 121–2).

9.1.2 Craftworking and Related Activities

Many shell midden sites in Ireland also contain evidence of craftworking. This includes lithic working, metallurgy, and textile work. The shells themselves were also used in the production of ceramics and potentially in dye manufacture. Artefacts could have also been created using the shells as raw materials. Evidence of lithic working include axe roughouts, hammerstones, cores, debitage. Occasionally, completed tools were also left behind on sites, often with traces of use or reworking. Metalworking can be seen through the inclusions of crucibles, moulds, slag, and various metal objects. Pins, needles, and spindle whorls, primarily made of bone, can indicate textile working.

Dye from dog whelks may have been used in processing textiles. Shellfish of the *Murex* genus were used to create dye in the Mediterranean from as early as 1800 BC. Large deposits of these discarded shells are found near large dye workshops in this area and the use of the dye is well attested in both the archaeological record and in contemporary literature (Cooksey 2013). The *Nucella* dog whelks found in Ireland are of the same Muricidae family though their use as dye was never as extensive. The processes used to make the dye were probably known in Ireland during its use elsewhere in Europe and the use of the dog whelk for dye in Post Medieval and Early Modern Ireland is attested in the literature (Cole 1685; Lovell 1884, 129–30; Bigger 1895, 730–1). There has also been evidence of dog whelk dye on a British tapestry dating to the Roman period (see Chapter 6).

Some of the earliest pottery types in Ireland have imprints of shells such as scallop edges (Figure 9.1). Shells are also known to be a source of temper for different pottery types. Shell beads are known from the Mesolithic onwards and a few have been found in shell deposits. In later periods, shells were used to form amulets or badges and their images were carved into statues and architectural features (see Chapter 8). Mother of pearl, or ‘nacre,’ the opalescent interior lining of many shell species, including the freshwater mussel, was also used in the creation of jewellery and other ornaments along with freshwater pearls from the same species (see Chapters 7 and 8). There is also some ethnographic evidence from other parts of the world to suggest that shells could have been used as tools. Shells can be used for scraping hides, digging pits, or serving broth. Some shells were modified prior to their use while others may have been used in their natural state (Figure 9.2) (Claassen 1998, 196; Szabó 2013). While their use in ornament and craftworking is more archaeologically visible than their use as tools, shells may have served various purposes after their collection.

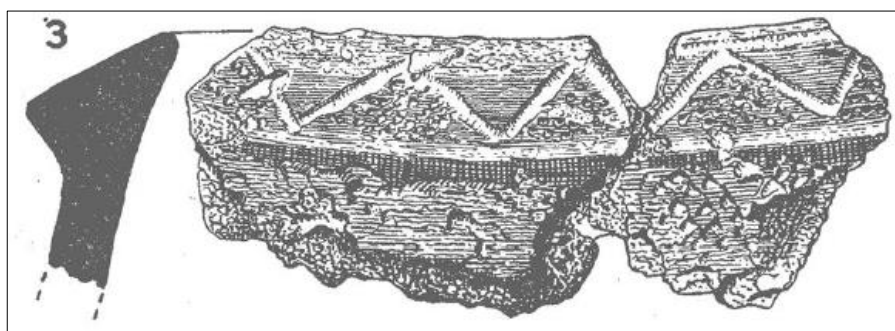


Figure 9.1: Scallop-impressed sherd from Dundrum, Co. Down (Collins 1952, 21).

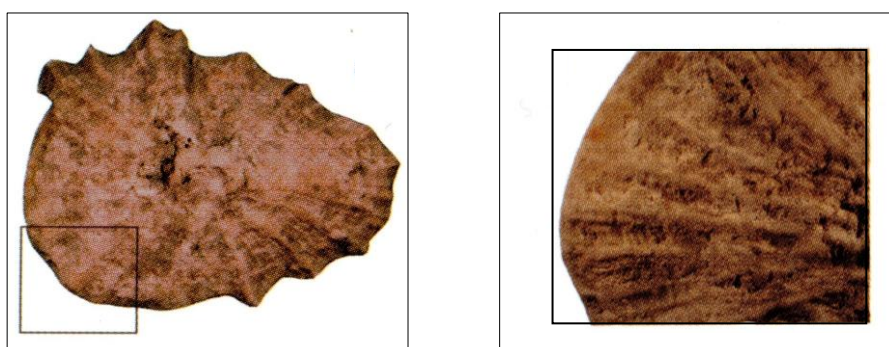


Figure 9.2: Modified shell tool from Gebe Island, Maluka, Indonesia: limpet (*Patella flexuosa*) scraper with 15x magnification of worked edge (Szabó 2013, 282).

9.1.3 Settlement Space

Shell midden sites have been interpreted as temporary occupation sites, procurement sites near base camps, and permanent settlements. Temporary occupations may include camps in caves, pilgrimage sites, and nomadic stopping points. Evidence of small, temporary structures may support this interpretation, but such locations may have also been used with no built structures. Studies have shown that site-tethered foragers will travel a maximum distance of 10km per day, with most cultures foraging approximately 5km a day (Marín Arroyo 2009, 32; Kelly 2013, 96–7, 220, 284). Contemporary settlements within 5–10km of shell midden sites may have been base camps associated with their use. Shell middens have also been found alongside permanent structures such as houses, monasteries, and fortifications. Some structures were also built on top of older shell mounds.

Some of the more insubstantial settlements where there are no obvious structures do have other evidence of occupation. This can be seen in the form of hearths, fire pits, or burnt spreads. These features may be in or next to the shell middens concerned. In Senegal, it has been recorded that structures were created in order to easily move them as shell deposits accumulated and encroached on the structures or the owner died. This would cause ‘blurring’ of structural evidence such as that seen in Denmark (see section 9.3.2) (Rowley-Conwy 2013). Shell-bearing deposits next to permanent buildings may still be associated with more temporary use. This can be the case when monasteries are later frequented as sites of pilgrimage. Other deposits may show evidence of intentional build up around houses in order to be used for secondary purposes such as manuring.

9.1.4 Ritual Space

Many larger shell deposits have been interpreted as sites of communal feasting. This has been noticed ethnographically around the world and may be connected with other ritualistic activities on those sites (see section 9.3). Such activities include burials, of both articulated and disarticulated human remains, and the creation of monumental landmarks.

The monumentality of shell deposits, large shell mounds in particular, is difficult to address archaeologically as this interpretation indicates intentionality. However, whether there was intention behind starting or continuing to accumulate these large

mounds in order to create a visible feature in the landscape may not matter. The fact remains that some deposits, covering 100s or even 1000s of square metres would have acted as a focal point in the landscape due to their size alone. Large shell deposits around the world have been interpreted as some of the earliest ritualistic mounds (Sherratt 1995, 247; Claassen 1998, 230–3; Bailey *et al.* 2013, 2–63; McNiven 2013, 559–60 & 575) (see section 9.3). This may have been the case in Ireland as well (see section 9.2).

Human remains have been found in shell deposits around the world and disarticulated remains in particular have been part of ongoing debate as to intent (see section 9.3). A recent study in the University of York examined several sites containing such remains in Scotland and one in Denmark and found suitable evidence to suggest the inclusion of even single bones may in fact be intentional. An anthropological understanding of how humans interact with the remains of the dead suggests it is unlikely for people to accidentally dispose of such remains or do so in an unintentional manner (Pettitt 2011; Hellewell 2015). While disarticulated remains are most common in Irish shell deposits, there are also articulated burials (see section 9.2). Such inclusion of human remains is often cited as the ritualization of middens through ‘referencing’ (McNiven 2013, 563). The beliefs behind the incorporation of human remains in shell deposits may have included a connection between the liminal space of the coast and the liminality of death, ancestral claim on resources, a warning to seafarers, and a referencing of fertility and rebirth through inclusion of the dead in food waste and possible manure (Brück 1995; McNiven 2013; Hellewell 2015).

There is often overlap between ritual space and what most modern societies might consider more secular or mundane space. Spiritual or religious aspects of life were often not thought of separately from the everyday physical world in many cultures and this was likely true through much of human history. Brück and others have noted that if this dualistic thinking is removed from attempts at archaeological interpretations, ritualistic activity can be better understood. An example of this is the practice of deposited human remains in seemingly mundane areas such as settlements and middens (Brück 1995, 254; Pollard 2008, 43–4; McNiven 2013, 561).

Shells themselves have been interpreted as symbols for various spiritual purposes throughout history. In the Neolithic, shells found in megalithic tombs such as Loughcrew, Co. Meath, have been interpreted as a means of invoking the sea and its transformative properties. Other tombs, such as the chambered tomb of Glecknabae on

the Isle Bute, Scotland, were built on top of a shell mound, possibly to reference the earlier connections with the sea (Fowler and Cummings 2003, 6; Woodman 2013, 303). In some cultures, shells have been used to symbolise fertility, life, death, beauty, and general well-being. Shells have also been known to symbolise more physical concepts such as ‘the breath, sputum, heart, or soul,’ as well as the sun and food (Claassen 1998, 203–11).

In the historic period more of a separation is seen between ritual and settlement spaces, particularly in relation to monastic activities. Shell deposits, however, serve to connect the two spheres as they are found alongside both secular houses and ecclesiastical dormitories. They can also be seen associated with sites of pilgrimage such as abandoned monasteries or holy wells. The reason behind a possible association of shellfish and other seafood with the church can be seen in the literature of the historic period, as other meats were often forbidden during different times of fasting and penance (see Chapters 6 and 7). During these historic periods, we also see the use of shells as a symbol more clearly defined. The scallop shell was associated with St. James the primary due largely to his connection with the Santiago de Compostela pilgrimage. Scallops were also associated with baptisms. Other shells were occasionally used to replace scallops in these uses (see Chapter 7).

9.2 Temporal Trends in Irish Shell Deposition

The following sections are arranged chronologically to identify and discuss temporal trends in shell midden use in Ireland. Where possible, each of the significant interpretive categories discussed in section 9.1 will be examined for each period. A few undated sites of significance as related to the interpretive categories will be discussed at the end of this section.

9.2.1 Early Prehistory

Mesolithic (8000–4000 BC)

There are 15 known Mesolithic deposits, two potentially dating to the Early Mesolithic and 13 dating to the Late Mesolithic. Five of these are part of sites with evidence pertaining to the Mesolithic/Neolithic transition: one at Glenarm, Co. Antrim (AN004A), one at Sutton, Co. Dublin (DU006B), and four at Ferriter’s Cove, Co. Kerry (KY030C, E, G, I). It has been suggested by other researchers that Mesolithic

shell deposits are typically small in size (Woodman and Milner 2013, 38). This is not supported by the recorded dimensions. For instance, the Mesolithic layer at Glenarm (AN004A) has an area of 234m³ and a thickness of 1.5m, which is the thickest shell deposit recorded for early prehistoric Ireland.

Twenty shell midden deposits date to the Mesolithic/Neolithic transition. Fifteen of these are found on sites that have deposits dating more firmly to the Mesolithic and/or Neolithic. One Mesolithic (DU006B) and one Mesolithic/Neolithic deposit (DU006A) were identified at Sutton, Co. Dublin. One Mesolithic/Neolithic deposit (DL027A) and one Neolithic deposit (GA027B) was recorded at Baylet, Co. Donegal. Eleven deposits at Ferriter's Cove, Co. Kerry (KY030A–B, D, F, H, J–O) dated to the Mesolithic/Neolithic transition while others at the site dated to either the Mesolithic or Neolithic. Dalkey Island, Co. Dublin contained two Mesolithic/Neolithic deposits (DU009B, D) along with deposits dating to the Chalcolithic (DU009C) and the Early Medieval/Late Medieval (DU009A). Mesolithic/Neolithic deposits are similar in size to the earliest Mesolithic deposits. The largest of these include Ballymoney, Co. Donegal (DL031) with a volume of 320m³ and Tully Beg, Co. Galway (GA004) with a volume of 461.6m³. Ferriter's Cove, Co. Kerry (KY030) deposits were again smaller than others ranging from 0.14m² to 0.89m².

By definition, Mesolithic sites are reliant upon wild foods. Fanore More, Co. Clare (CE003), contains evidence of different wild foods available for use and of craftworking. Outside of charcoal, the only plant remains identified in this deposit was that of hazelnut, a known marker for wild food reliance (see section 9.1.1). Fish and crab were the only remains of meat identified beyond shellfish at this site. Perforated cowrie shells were found, indicating the use of shell beyond subsistence. Complete and roughout axes were found along with hammerstones, rubbing stones, and lithic flakes indicating that lithic production took place on site.

Ferriter's Cove, Co. Kerry (KY030) contains deposits with evidence of on-site cooking and seaweed collecting. On-site cooking is suggested by the presence of both burnt shell and bone along with fire cracked rocks. Similar evidence for on-site cooking was noted at the Mesolithic site of Kilnatierny, Co. Down (DW036), though fire cracked rocks were not reported. At Ferriter's Cove, McCarthy interpreted the presence of small and immature shell species as evidence of seaweed collection.

Cattle bone is one of the earliest domesticates to be definitively identified in Ireland. Bone was radiocarbon dated from Ferriter's Cove, Co. Kerry (KY030) to the later fifth

millennium BC. There is also an early cattle bone in one of the Mesolithic/Neolithic shell deposits at Sutton, Co. Dublin (DU006A) with an earlier radiocarbon date. There is a possibly associated red deer bone which may indicate that wild animals were brought in from outside of Ireland during the Mesolithic.

A megalithic tomb was built on top of the Mesolithic shell deposit at Rush, Co. Dublin (DU001). This could indicate a Neolithic recognition of the site through re-use or 'referencing,' as seen on the Isle of Bute (see section 9.1.4). Unfortunately, this deposit was reported by an informant after a great deal of destruction. Another potential indicator of earlier ritual activity was the inclusion of a human femur at the shell deposit of Rockmarshall, Co. Louth (LH005).

Dalkey Island, Co Dublin (DU009) contains evidence of craftworking, and the earliest potential ritual activity from an Irish shell midden (see section 9.2.2). The craftworking includes lithic work and the use of shells to create beads and decorated pottery. Lithic evidence at the site included hammerstones, cores, debitage, flakes, and retouched tools. The ritual evidence in deposit DU009B is dated to the Neolithic discussed below. The shell deposit itself, however, dates to the Mesolithic/Neolithic transition indicating that this site may have held significance in the community prior to the ritual activity taking place. Human bone of an adult was dated to the Mesolithic/Neolithic transition in a shell deposit at Ferriter's Cove, Co. Kerry (KY030C). The isotopic levels of the remains indicated a heavy reliance on marine resources, a reliance noted primarily during the Mesolithic and not the Neolithic (Milner *et al.* 2007, 2).

There are no substantial housing structures known from Mesolithic shell midden sites, though there is evidence of temporary shelters in various arrangements of post holes and stake holes. This is seen at Ferriter's Cove, Co. Kerry (KY030), a site dating from the Late Mesolithic to the Early Neolithic. There, linear patterns and one potential arc of stakeholes indicate possible structures. Woodman has suggested these were little more than wind breaks and/or drying racks rather than any type of hut or shelter. The lack of more evidence may be due to the moving of structures regularly as the shells built up (see sections 9.1.3 and 9.3).

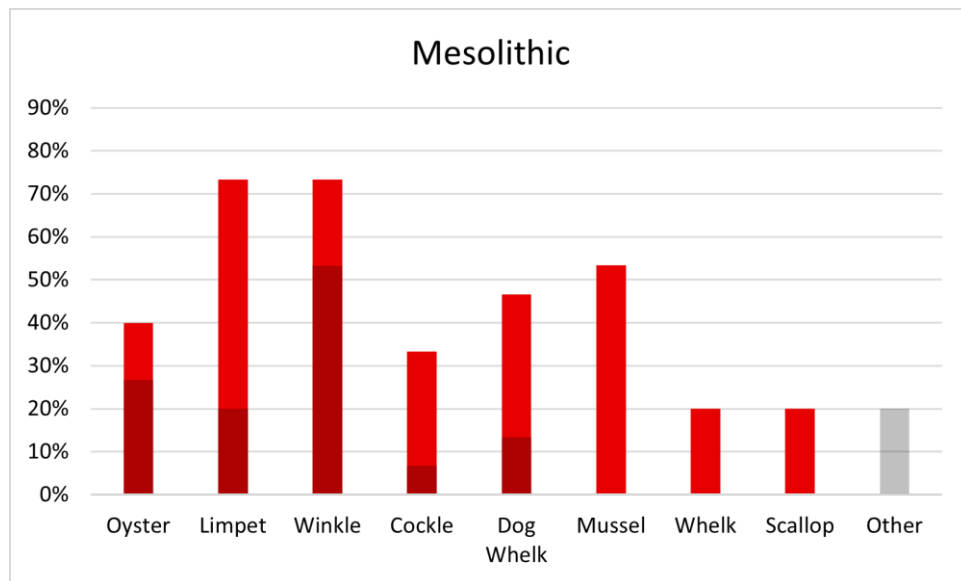


Figure 9.3: Percentage of Mesolithic shell midden features with each primary shell species. Grey overlay denotes the frequency of dominance for each. (n=15)

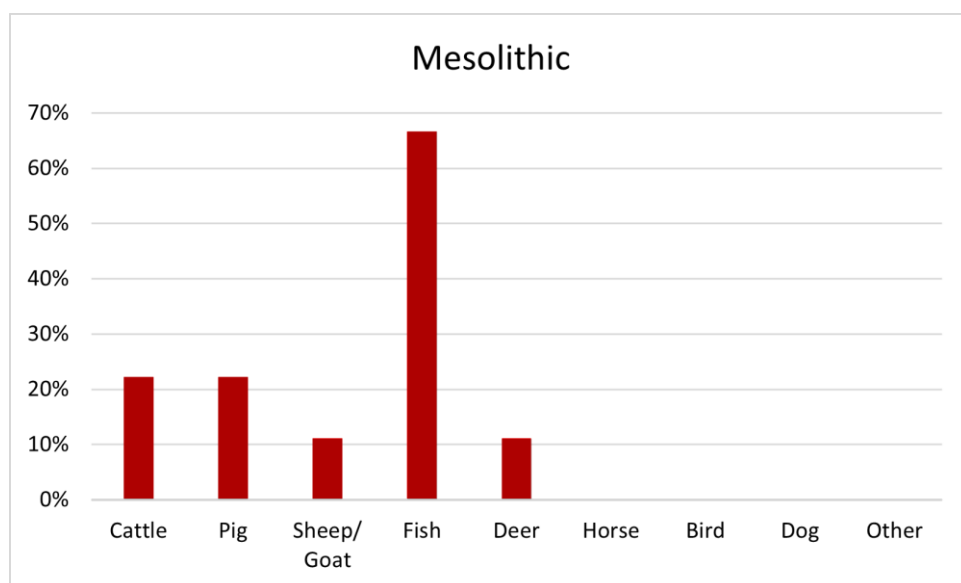


Figure 9.4: Percentage of Mesolithic shell midden features with each primary bone species. Grey overlay denotes the frequency of dominance for each. (n=9)

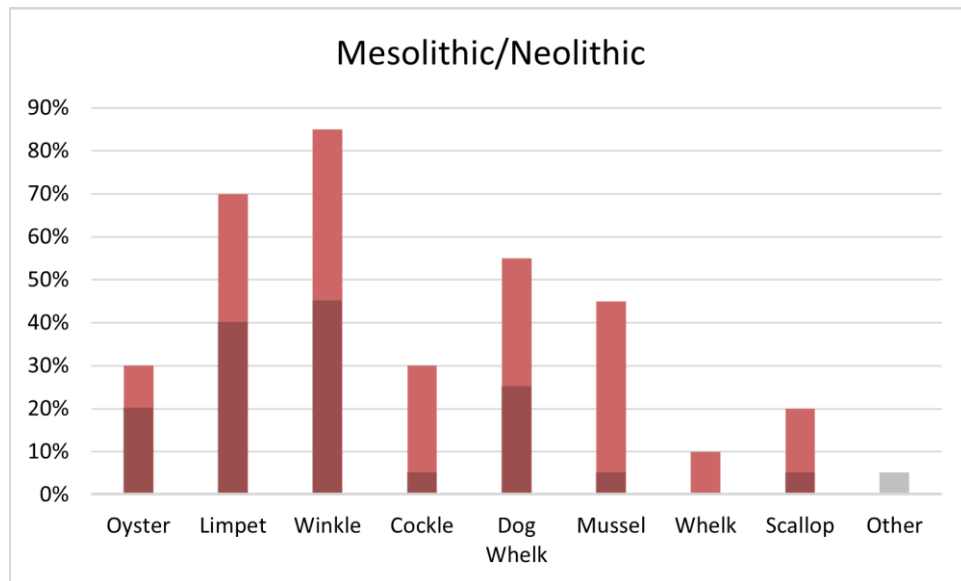


Figure 9.5: Percentage of Mesolithic/Neolithic shell midden features with each primary shell species. Grey overlay denotes the frequency of dominance for each. (n=20)

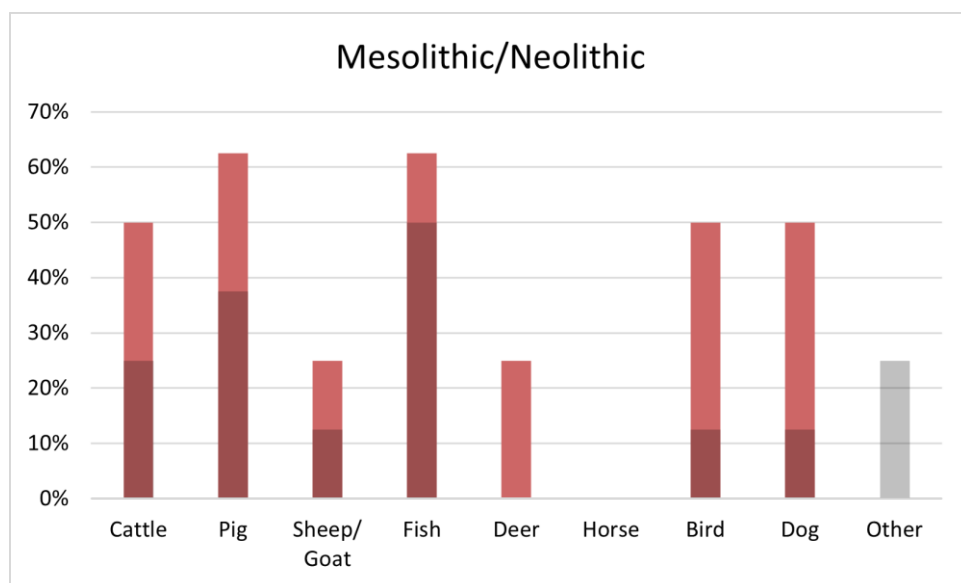


Figure 9.6: Percentage of Mesolithic/Neolithic shell midden features with each primary bone species. Grey overlay denotes the frequency of dominance for each. (n=8)

In conclusion, the overall pattern of shellfish exploitation of the Mesolithic include winkle being the most common shell species. Other dominant species include oyster, limpet, mussel, and dog whelk (Figure 9.3). Fish is the most common animal species identified (Figure 9.4). Hazelnut is the only plant species recorded outside of charcoal. The most common shell species identified during the Mesolithic/Neolithic are similar to those found in the Mesolithic. Winkles are still the most common followed by

limpets, dog whelks, oyster, and mussel (Figure 9.5). Fish was again the most dominant species during the Mesolithic/Neolithic transition (Figure 9.6) and hazelnut shells were again the only plant remains identified beyond charcoal. The earliest reported sheep/goat from a shell deposit was from the Late Mesolithic/Early Neolithic transition at Ringneill, Co. Down (DW002). The dating of this bone is uncertain, however, and this may have been a later addition to the site.

Neolithic (4000–2500 BC)

Twelve shell midden features are dated to the Neolithic. Only one of these dates to the Late Neolithic: Tanrego West, Co. Sligo (SO080). Three deposits cannot be distinguished to a particular time of the Neolithic: Ballygalley, Co. Antrim (AN006), one deposit at Baylet, Co. Donegal (DL027B), and Portaferry, Co. Down (DW006). The Neolithic deposits are smaller than Mesolithic examples with the largest deposit, the Neolithic layer of Glenarm, Co. Antrim (AN004B), measuring only 78m³. There are a few multiperiod sites, however, with Neolithic activity which continued to accumulate into huge sites. For instance, Settlement 15, Co. Sligo (SO041) has a total volume of 9000m³ making it one of the largest shell deposits recorded in Ireland. The site of Portstewart, Co. Derry (DY006) also contains evidence of deposition starting in the Neolithic, though this evidence is reported alongside evidence of Chalcolithic, Bronze Age, and Iron Age deposition (see Chapter 5).

Ferriter's Cove, Co. Kerry (KY030) shows continuation of certain activities through the Late Mesolithic through to the Early Neolithic. This included not only the use of shellfish, but also stone tool production, with lithic deposits dated to the Mesolithic, the Mesolithic/Neolithic, and the Neolithic.

A trend seen throughout the Neolithic sites is a bias for fish as a dominant species along the western Atlantic coastline. This trend continues from the Early Neolithic through to the Early Modern period. Another spatial trend concerning bone species began in the Late Mesolithic and continued through the Early Neolithic with pig bones only dominant in the northeast from Dublin to Antrim.

The ritual activity in the Mesolithic/Neolithic deposit at Dalkey Island, Co. Dublin (DU009B), was dated to the Neolithic through radiocarbon dating of the human remains identified. This is the earliest evidence of human remains, dog bones, and beads buried in a single deposit. These three inclusions are seen in various

combinations through later prehistory. Any deposit reported with both dog bones and beads have all also contained human remains (Figure 9.7). At Dalkey Island, the human remains consisted of a disarticulated adult skeleton with a skull containing winkles in a primarily limpet midden, showing intentional deposition of the remains.

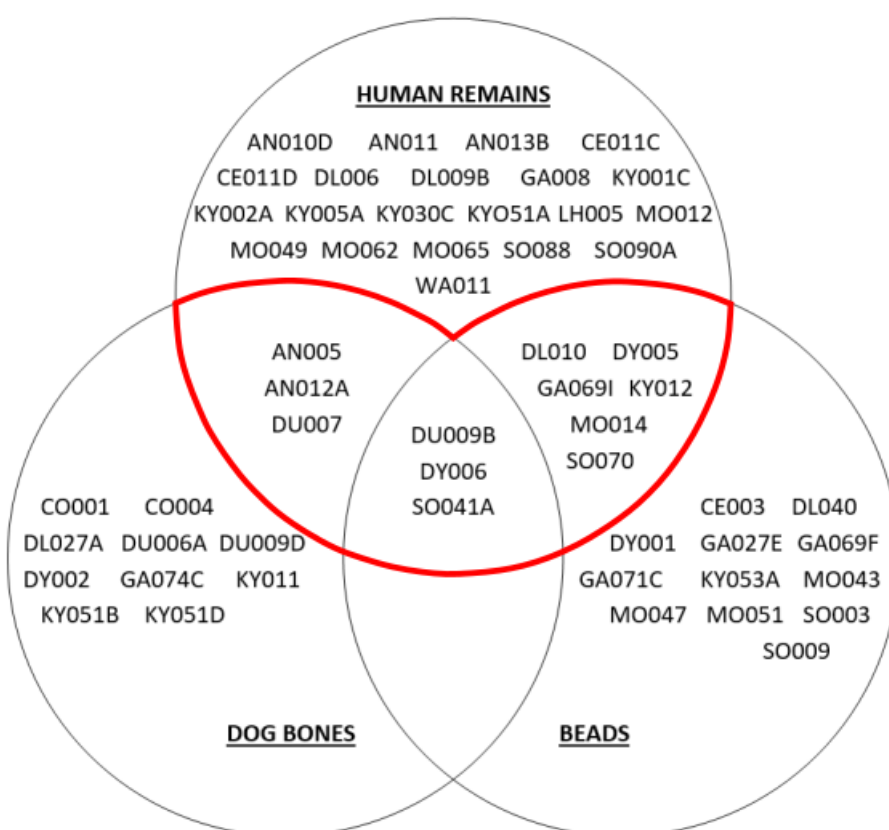


Figure 9.7: Deposits containing human remains, dog bones, and beads. Significant combinations are emphasized in bold red.

Habitation evidence from Neolithic shell midden sites is still weaker than seen in later periods even though more permanent houses are known from the period. This may indicate that shellfish processing sites still functioned as procurement sites during this time rather than permanent settlements. For instance, a Neolithic house from Ballygalley, Co. Antrim is only 1.32km from the Neolithic shell midden known from the Ballygalley coast (AN006). As site-tethered foragers are known to travel up to a maximum distance of 10km a day, with most foraging approximately 5km a day, this seems an easy distance to make use of the coastline (see Chapter 4).

Oyster becomes a more prevalent species in Neolithic shell deposits (Figure 9.8). Winkle and limpet are also still important. Mussels and dog whelks, however, fall off in importance. Pig is the most common bone species followed by cattle, and sheep/goat

(Figure 9.9). Fish declines in importance but is still found in a few sites during the Neolithic. No plant remains other than charcoal were recorded in these Neolithic shell midden features.

Only one deposit dates to the Neolithic/Chalcolithic transition, continuing the reduction in shell deposition activity noted in the Late Neolithic. This shell midden was identified at Dundrum, Co. Down (DW007). Due to the low number of these sites, it is not possible to identify trends overall, though mussel is the dominant at this time, a species which was less important during most of the Neolithic. The shell midden contained cattle, pig, sheep/goat, horse, deer, and dog bones with dominance not reported. No plant remains other than charcoal were noted as in the Neolithic.

The deposit at Dundrum, Co. Down (DW007) shows evidence of craftworking and ritual activity similar to that at Dalkey Island, Co. Dublin (DU009B). Lithic working at Dundrum is noted through the identification of cores, hammerstones, and lithic tools. Pottery with shell decoration was also found in this deposit. Ritual activity was noted through the inclusion of dog bones and human remains. The human remains consisted of a mandible.

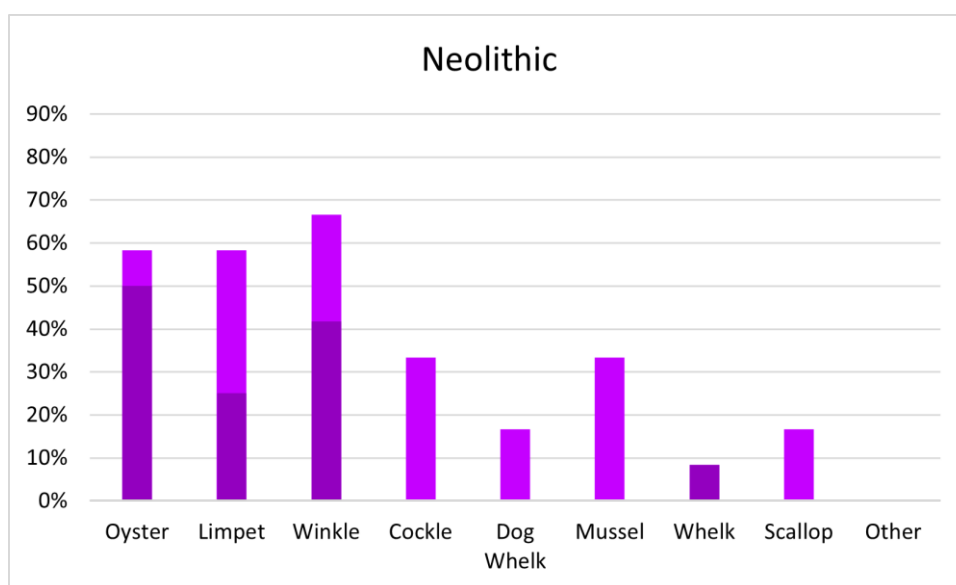


Figure 9.8: Percentage of Neolithic shell midden features with each primary shell species. Grey overlay denotes the frequency of dominance for each. (n=12)

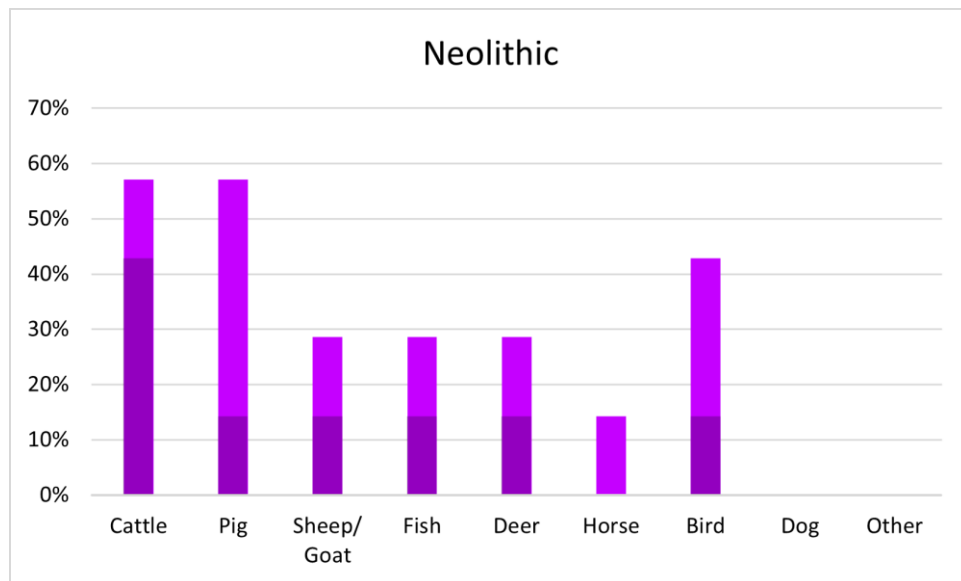


Figure 9.9: Percentage of Neolithic shell midden features with each primary bone species. Grey overlay denotes the frequency of dominance for each. (n=7)

Chalcolithic (2500–2100 BC)

The reduction in shell deposition during the Late Neolithic and Neolithic/Chalcolithic transition is continued through the Chalcolithic with only four shell midden features dating to this time. Two of these are part of a multiperiod site. These four deposits are found at Dalkey Island, Co. Dublin (DU009C), Finner, Co. Donegal (DL050), Castle Espie, Co. Down (DW003), and Settlement 15, Co. Sligo (SO041B). The site of Portstewart, Co. Derry (DY006) discussed above also contained evidence of Chalcolithic activity along with deposition dating to the Neolithic, Bronze Age, and Iron Age.

Due to the small number of these sites, it is difficult to identify trends in shell midden activity in this period. The ‘Beaker shells’ at Dalkey Island, Co. Dublin (DU009C) were not reported to species nor were the shells from Finner, Co. Donegal (DL050). Oyster was reported as the dominant species at both Castle Espie, Co. Down (DW005) and Settlement 15, Co. Sligo (SO041B). The lack of fish bones in any Chalcolithic deposits was unique for early prehistory. Bones were only recorded at Settlement 15, Co. Sligo (SO041B) and were that of pig, bird, and hare. The pig dominance along with the lack of fish fits with trends seen in the Neolithic.

9.2.2 Later Prehistory

Bronze Age (2100–500 BC)

Shell deposition increases again during the Bronze Age with a total of 26 shell midden features dating to the period. This may relate to the steady increase in population in Ireland during that period. Many of these deposits are part of large sites, including Potters Cave, Co. Antrim (AN002) with five Bronze Age deposits; Chimney Cave, Co. Antrim (AN014), with another five; and Dún Aonghasa, Co. Galway which contains nine deposits. Even if only counting the sites with purely Bronze Age evidence, nine such sites show an increase in shell deposition compared to the six total deposits (seven if including Portstewart, Co. Derry (DY006)) dating from the Late Neolithic to the Chalcolithic. Reasons for this hiatus are discussed in section 9.4 but may include an increase in dependence upon domesticates.

The largest Bronze Age deposit is recorded at Settlement 15, Co. Sligo (SO041D) with a volume of 900m³, the largest prehistoric shell midden feature in Ireland. Most of the other Bronze Age deposits, however, are much smaller, with an average thickness of 0.31m and one very small deposit at Dún Aonghasa, Co. Galway (GA069B) with a recorded volume of 1.06m³.

Three types of settlements are evident in these Bronze Age shell midden sites. This is the first period in which shell deposits are identified in known permanent settlement areas such as the deposits in the cliff-edge fort of Dún Aonghasa, Co. Galway (GA069A–H, J). The deposits here also show the importance of marine resources to those living at the fort as they would have brought the in-shell molluscs up to the cliff from c.1km away. There are also cave deposits during this period at Potter's Cave (AN002) and Chimney Cave (AN014), Co. Antrim. This has been interpreted as evidence of short-term occupation (Dowd 2015, 125). Finally, temporary occupation is still evident in the Bronze Age at sites such as Settlement 15, Co. Sligo (SO041D). Here, hearths were identified throughout the shell deposits. This was interpreted as frequent small visits to the site in order to collect and process shellfish. Overnight stays may not have occurred, but the site was repeatedly use for shellfish collection.

Dún Aonghasa, Co. Galway (GA069) provides a great deal of evidence concerning food supply and craftworking. Burnt bones, burnt shells, charred cereal grains, and fire cracked rocks were found in shell deposits that indicate cooking on site. Metalworking was evidenced by the inclusion of mould fragments, crucibles, completed metal

objects, and some later iron ore and slag. Shell beads were noted in deposits along with shell-tempered pottery sherds.



Figure 9.10: Map of midden features with oyster as a dominant species dated to the Early Mesolithic–Bronze Age/Iron Age. All other sites are indicated by black dots.

The shell midden site at White Park, Co. Antrim (AN012) was much smaller than Dún Aonghasa and was probably not a permanent settlement, with significant Bronze

Age activity none the less. Bones at the site showed evidence of butchery, while a quern stone indicates some on-site food processing. This is the earliest quern found in a shell deposit. The midden also contained human and dog bones, an association already noted for the Neolithic, and which continues through the Iron Age.

Limpet and winkle are the most common species during the Bronze Age (Figure 9.11). This is more similar to the Mesolithic and Mesolithic/Neolithic transition than the Neolithic or Chalcolithic. Oyster is also still a frequent species. In fact, the Bronze Age is the first period in which oyster is a dominant species south of Sligo on the west and Louth on the east (Figure 9.10). This may indicate an increase in appropriate environmental conditions further south or changes of cultural choice.

The Bronze Age saw a wide variety of animal species in shell middens, with cattle, fish, pig, sheep/goat, and horse all found in high numbers (Figure 9.12). Charred grain was reported in an undated deposit at Dún Aonghasa, Co. Galway (GA069N). These are the earliest plant domesticates identified in Irish shell deposits. These grains, along with the quern found at White Park, Co. Antrim (AN012A), suggests an increase in agricultural activities alongside the use of marine resources. Earlier periods may not show this connection due to the lessening of shellfish deposition through the Late Neolithic and Chalcolithic.

There are six deposits dated to the Bronze Age/Iron Age transition. It is important to note that several of the Dún Aonghasa, Co. Galway (GA069) deposits that produced primarily Bronze Age evidence also contained small traces of Iron Age activity. The deposits dating to this transition period are similar in size to most of the Bronze Age deposits ranging in volume from 0.08m³ to 15.03m³. The settlement evidence seen in these sites is similar to that seen in the Bronze Age, with one deposit recorded in Potter's Cave, Co. Antrim (AN002H), one in the cliff edge fort of Dún Aonghasa, with some smaller deposits as at the Bronze Age site of White Park, Co. Antrim.

The Bronze Age/Iron Age deposit at Dún Aonghasa, Co. Galway (GA069I) again shows the significance of this fort. The deposit contained a neonate burial with a bead, with no definite grave cut. The inclusion of a neonate, infant, or child is repeated in two other shell deposits in the Iron Age (see below). The inclusion of beads with shell deposit burials has already been established since the Neolithic.

Limpet and winkle are again the most common species (Figure 9.13). Oyster is the only other species found to be dominant in a Bronze Age/Iron Age deposit. Animal bones show a slightly different pattern than seen in the Bronze Age, but a broad use of

resources is still evident. Cattle was again the most common, though fish was not recorded in any of the deposits (Figure 9.14). Sheep/goat, pig, and deer follow in frequency. Cereals are again recorded in shell deposits during this transitional period, with barley found at Doolin Pier, Co. Clare (CE011E) and barley, oat, and wheat at Mannin More, Co. Galway (GA032B). Overall, the Bronze Age and Bronze Age/Iron Age shell middens show evidence of similar cultural phenomena.

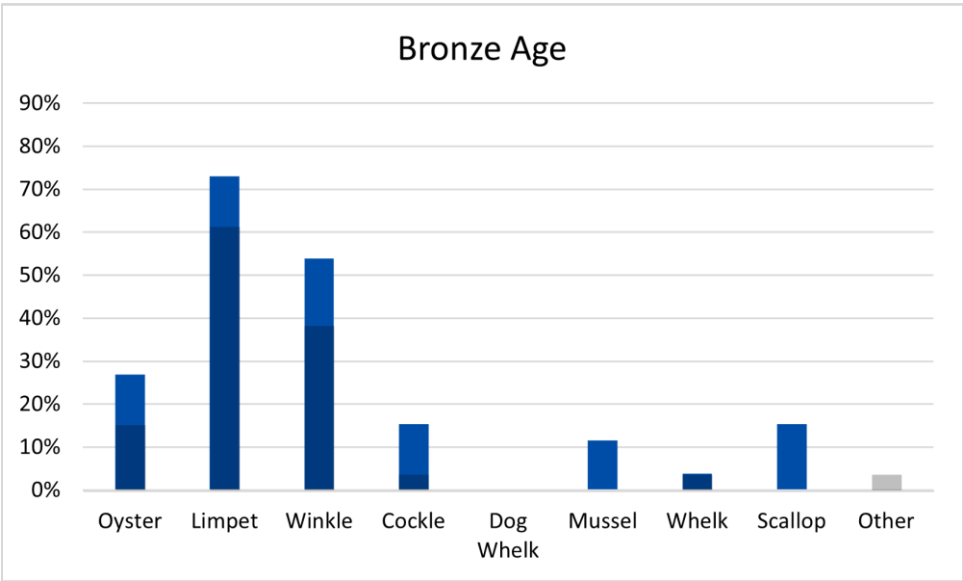


Figure 9.11: Percentage of Bronze Age shell midden features with each primary shell species. Grey overlay denotes the frequency of dominance for each. (n=26)

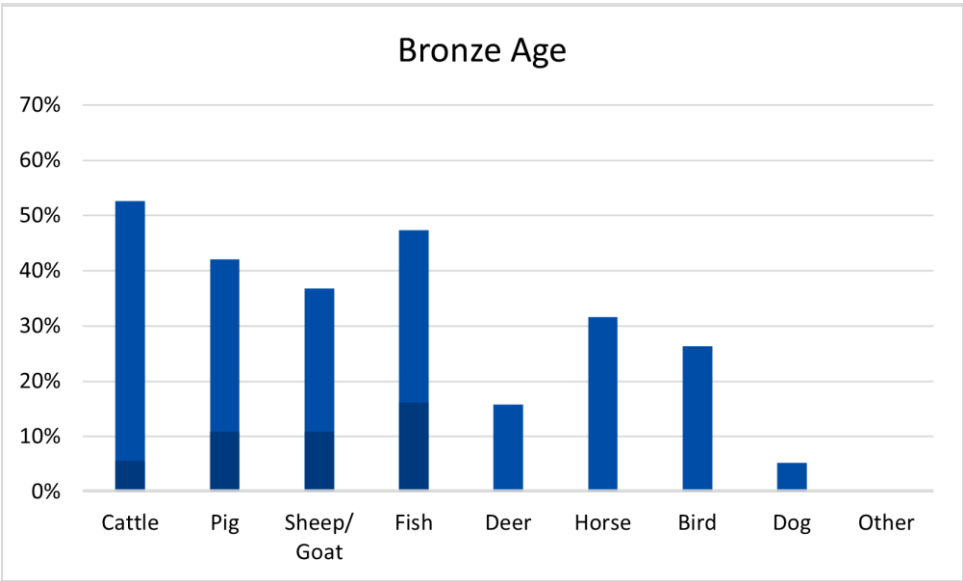


Figure 9.12: Percentage of Bronze Age shell midden features with each primary bone species. Grey overlay denotes the frequency of dominance for each. (n=19)

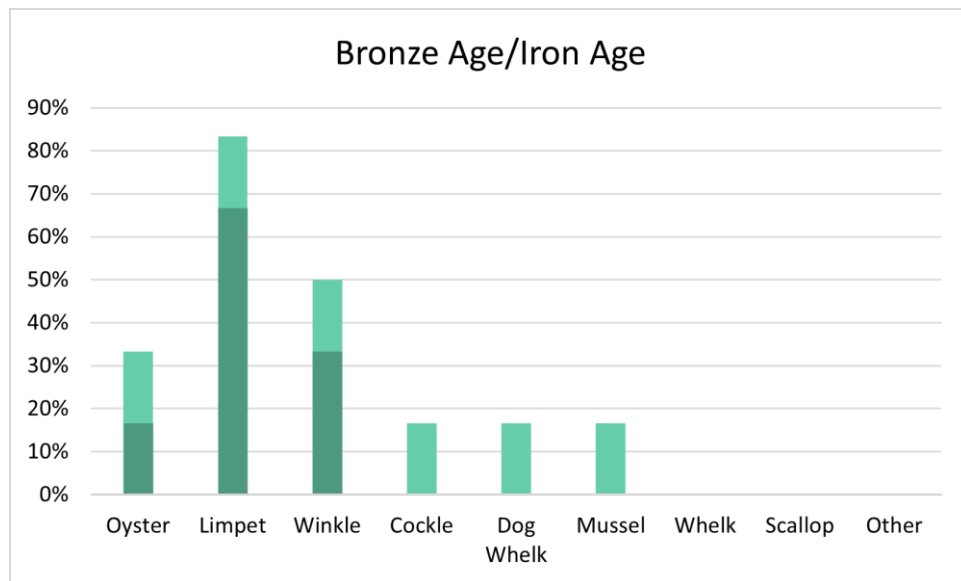


Figure 9.13: Percentage of Bronze Age/Iron Age shell midden features with primary shell species. Grey overlay denotes the frequency of dominance for each. (n=6)

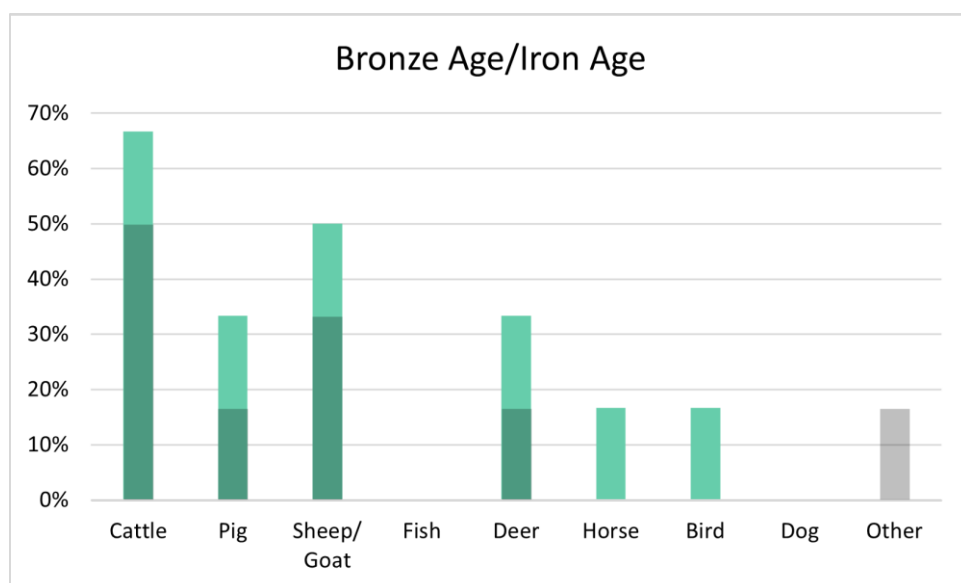


Figure 9.14: Percentage of Bronze Age/Iron Age shell midden features with primary bone species. Grey overlay denotes the frequency of dominance for each. (n=6)

Iron Age (500 BC–400 AD)

Nine shell deposits are dated to the Iron Age in Ireland. The deposit at Settlement 15, Co. Sligo (SO041A) is the largest with an estimated volume of 500m³. The other Iron Age deposits are smaller with volumes ranging from 9m³ to 1.64m³. One deposit is from a cave at Boat Cave, Co. Antrim (AN013B), while temporary habitation refuse is evident at Settlement 15, Co. Sligo (SO041A). Hut sites were reported by Knowles

among the deposits at Mannin Beg, Co. Galway (GA022C), but remain undated and their stratigraphic relationship to the shell middens is unclear. These huts, however, are the only permanent structures associated with Iron Age shell middens. This is unsurprising given the nature of Irish Iron Age archaeology in general which is still working 'to gain a better understanding of how to go about find [Iron Age evidence]' (Becker 2009, 359).

Metalworking is recorded at several Iron Age shell-bearing sites, including Ballymulholland, Co. Derry (DY002) and Boat Cave, Co. Antrim (AN013B). The frequency of iron slag in the shell deposit at Ballymulholland is indicative of iron production (Mallory *et al.* 1988). At Boat Cave, slag and a ceramic sherd 'coated by a slaggy deposit suggesting that the vessel had been used as a crucible for metal-smelting' were identified (Jackson 1936, 38). Boat Cave also has evidence of possible textile production, food processing, and fishing. The textile working is suggested by a bone spindle whorl and bone pins and needles, though the spindle whorl was found in an undated deposit. Food processing is suggested by a quern stone in the same undated deposit. An iron fishhook and harpoon head were also found in this deposit along with fish bones. This may indicate that the deposits of mostly limpet shells in this midden are the remains of bait for line fishing.

The Iron Age deposition at Settlement 15, Co. Sligo (SO041A) contained a neonate burial with a glass bead and a bronze earring. The deposit itself also contained dog bones. Again, this is a continuation of a trend seen in earlier shell deposits. Two other Iron Age deposits contained human remains, though without beads or dog bones: Boat Cave, Co. Antrim (AN013B) and Doolin Pier, Co. Clare (CE011D). The former contained the majority of a neonate or infant skull and the latter contained two mandible fragments, four teeth, and an ulna of an adult. Though these deposits do not have beads or dog bones as found in other late prehistoric shell midden burials, the focus on skull fragments is seen in many shell midden burials, even undated (see section 9.2.5 below) and non-adults are also a common link between many of the identified human remains.

The most common shell in these Iron Age shell midden deposits are limpet, oyster, and cockle. This is a change from the limpet and winkle dominance seen previously. Cattle, pig, sheep/goat, and deer are all found in three deposits each during the Iron Age. Cattle and deer are both dominant in one deposit each, though pig and sheep/goat are not found as dominant species. The inclusion of deer during the Iron Age and the

Bronze Age/Iron Age transition may indicate a slightly higher inclusion of wild foods outside of the marine resources than seen since the Mesolithic. Deer is recorded in Neolithic and Bronze Age deposits, but in smaller numbers. This addition of more wild foods is supported by the hazelnuts found at Culfin, Co. Galway (GA005B) and wild taxa at Doolin Pier, Co. Clare (CE011D). Cereals were also reported at Doolin Pier, and barley was found at Oyster Island, Co. Sligo (SO028) showing that domesticated plants were still being used alongside the wild flora.

Only one shell midden in Ireland dates to the Iron Age/Early Medieval transition. This deposit, Settlement 8, Co. Sligo (SO070) was heavily disturbed as indicated by an Iron Age date from a hearth in the top of the shells and an Early Medieval date from the base of the deposit. This site is included with the late prehistoric deposits rather than the historic period deposits due to similar trends seen in this deposit as recorded earlier. Late prehistoric sites from the Bronze Age through the Iron Age/Early Medieval are thus far only recorded on the western coast (Figure 9.15).

Lithic working is recorded at Settlement 8, Co. Sligo (SO070), with the discovery of chert and flint debitage and a few retouched chert flakes. The deposit also contained glass beads along with 14 limpets and two oysters with perforations assumed to have been used for necklaces. A human tooth was also found in the deposit. Bones in the shell midden included cattle, pig, sheep/goat, horse, deer, and bird bones with cattle, pig, and sheep/goat dominant. Wild plant remains from Settlement 8 included hazelnut and wild taxa along with many cereals, primarily barley and oats but also wheat, flax, and rye. The shells making up Settlement 8 were oyster.

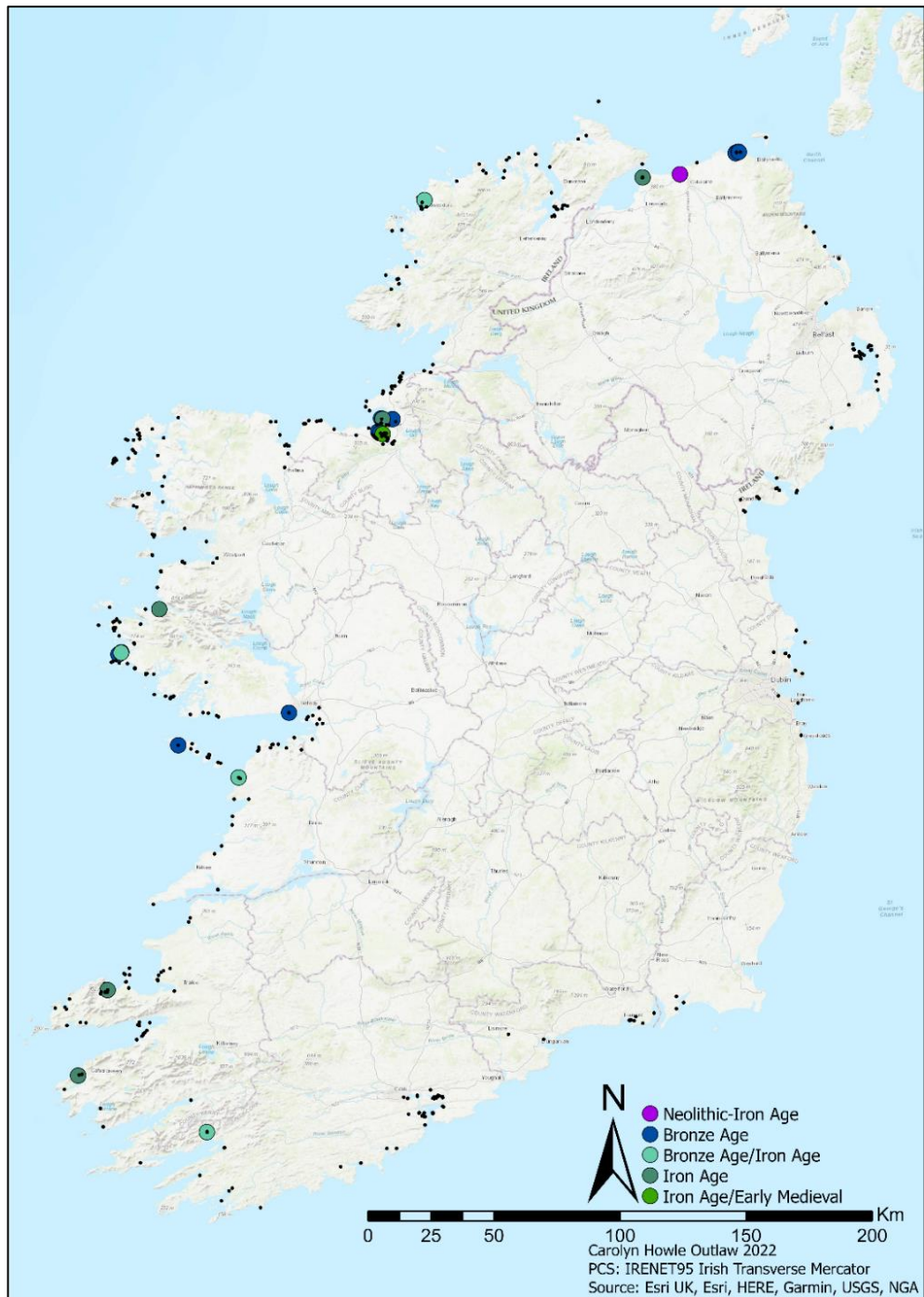


Figure 9.15: Map showing all dated shell midden features between the Bronze Age and the Iron Age/Early Medieval. All other deposits are indicated by black dots.

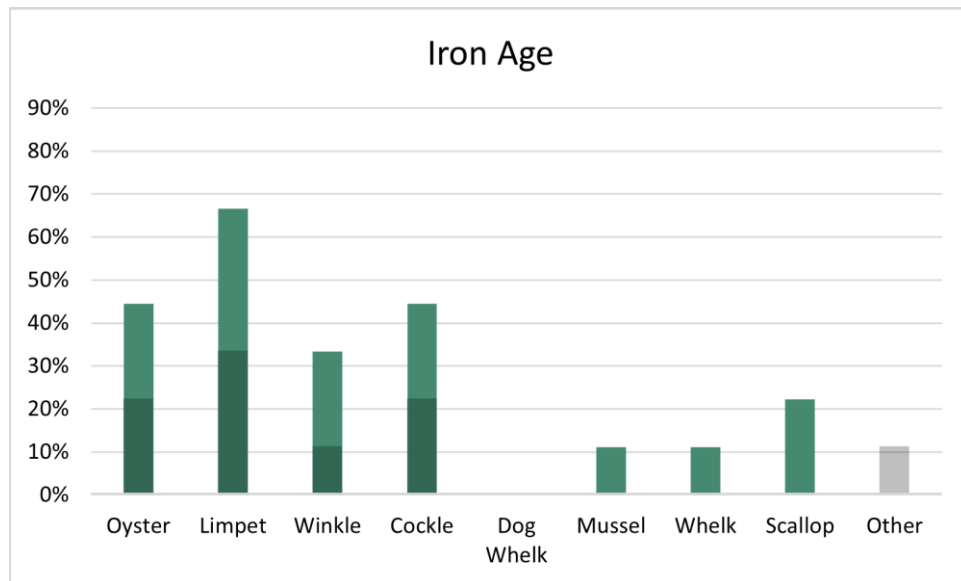


Figure 9.16: Percentage of Iron Age shell midden features with each primary shell species. Grey overlay denotes the frequency of dominance for each. (n=9)

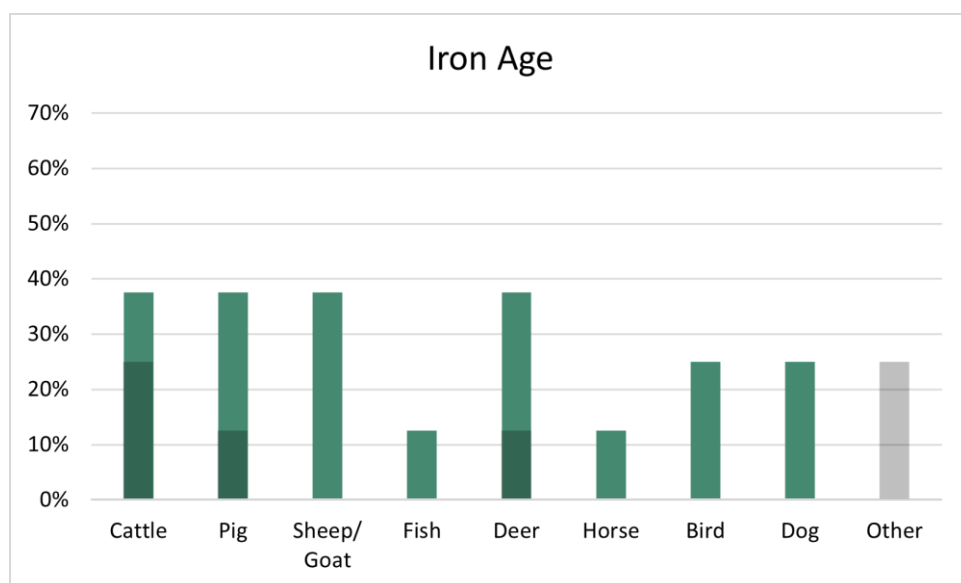


Figure 9.17: Percentage of Iron Age shell midden features with each primary bone species. Grey overlay denotes the frequency of dominance for each. (n=8)

9.2.3 Historical Periods

Early Medieval (400–1100 AD)

Forty-four shell midden features date to the Early Medieval period. The average deposit has a volume of 286.15m^3 , while only one deposit with three recorded dimensions has a volume less than 6m^3 . Some of these middens are associated with permanent settlements. This includes deposits in monastic sites, raths, and a possible

industrial site. There are also deposits found in caves and procurement sites. Monasticism was new to the Early Medieval period with the arrival of Christianity from the continent (see Chapter 6). One shell deposit dating to this period was also identified near a holy well, namely Gooreenatiny, Co. Galway (GA009).

The link between Christianity and seafood was discussed in Chapters 6 and 7. The church encouraged an increase in seafood consumption, which would have included the eating of shellfish and the use of shellfish for fishing purposes. The latter is recorded at Dooley, Co. Donegal (DL040) where iron fishhooks were uncovered. Though this deposit was not located near a Christian monument, it indicates that fishing was indeed taking place in shell midden sites at the time. The Vikings also influenced coastal interactions with an increase in maritime activities. One of the permanent settlements identified with Early Medieval shell deposits was a Viking village at Canroe, Co. Kerry (KY051). This site also showed evidence of fishing and cooking on site. The former is evidenced by a line sinker and two net sinkers.

Some pre-Christian traditions may be present in these Early Medieval deposits. Three bones of an adult female human were identified from one of the shell deposits along with dog bones, perhaps as part of a similar tradition seen in late prehistoric deposits. There are two other Early Medieval shell deposits containing human remains. A single human bone was identified in the deposit at Bewley, Co. Waterford (WA011), while one complete and one partial skeleton along with twelve bones estimated to belong to three or four other individuals were identified at Bailey Mór, Co. Mayo (MO065). The burials at Bailey Mór are likely part of the Christian tradition as they were extended inhumations oriented east–west. The partial skeletons and disarticulated bones may in fact represent disturbed burials.

One trend that seems exclusive to the Early Medieval are large dog whelk middens. This is primarily interpreted as evidence of dyeing, though this has yet to be confirmed (see Chapter 6). Six dog whelk middens are dated to the Early Medieval period, while another five contained this species. The former includes the sites at Dooley, Co. Donegal (DL040); Culfin, Co. Galway (GA005A); Doounloughan (DL9), Co. Galway (GA027F); Rathgurreen, Co. Galway (GA074A); Inis Gé Thuaidh, Co. Mayo (MO028); and Bailey Mór, Co. Mayo (MO065). While dog whelks are still not the most common species seen in all of the deposits, this is the most frequent dog whelks have been recorded since the Mesolithic/Neolithic and the deposits here are much larger than seen during that period with one deposit measuring 188.5m³.

Three of the dog whelk deposits also show evidence of textile working, supporting the idea that the dye was used on textiles, such as was seen in Dorchester, Britain (see Chapter 6). Such evidence at Dooey, Co. Donegal (DL040) included bone spindle-whorls and pins in the dog whelk deposit. The other two sites were both on Inis Gé Thuaidh, Co. Mayo (MO028 and MO065). Both of these deposits contained spindle whorls and the deposit on Bailey Mór (MO065) also contained bone points and pins while the industrial site at Inis Gé Thuaidh (MO028) contained chlorite buttons. The industrial site has been interpreted as such due to the presence of a kiln and a stone lined trough-like pit alongside the large dog whelk deposit. It has been interpreted as a dye production site. Another important aspect seen at Bailey Mór, Co. Mayo (MO065) is the building of permanent beehive huts on top of the shell midden. This is the only known instance of structures built on top of a shell mound in Ireland.

The deposit at Bewley, Co. Waterford (WA011) was made up of another significant shell species: freshwater mussels. This is the only known freshwater shell deposit and it dates to the Early Medieval period. These shells are typically not eaten but have been harvested for both pearls and nacre (see section 9.1.2). The use of pearls in particular is well documented in contemporary literature (see Chapter 6).

Evidence of craftworking seen in Early Medieval deposits primarily consists of metalworking. This is seen at Dooey, Co. Donegal (DL040) and Rinnaraw, Co. Donegal (DL053), with possible further evidence noted at Rathgurreen, Co. Galway (GA074) and Illaunloughan, Co. Kerry (KY053). This includes the discovery of iron slag, crucibles, and clay moulds at Dooey; iron slag and tuyere fragments at Rinnaraw; crucibles at Rathgurreen, while iron slag and tools were identified at Illaunloughan. The Early Medieval deposit at Portbradden Cave, Co. Antrim (AN010A) contained sherds of both shell-tempered and shell decorated pottery.

The most common shell species in the Early Medieval shell middens are limpet, winkle, oyster, cockle, and dog whelk (Figure 9.21). Limpets and winkles by far outnumber the other species. For the first time, limpet is a dominant species in the Highland West during the Early Medieval period as seen in Co. Sligo (Figure 9.18).

The most common bones in Early Medieval shell midden features are cattle, sheep/goat, fish, and pig (Figure 9.22). Fish has not been one of the most common bones since the Bronze Age. This re-emergence may indicate further influence of the Christian tradition and the Vikings on shell midden formation in the Early Medieval period. In the Iron Age/Early Medieval through the Late Medieval period, pig bones

are only dominant in Sligo shell deposits (Figure 9.19). Oughtymore, Co. Derry (DY001) contains wild plant evidence in a deposit which also contains barley and rye. Unidentified cereals were also found at Potter's Cave, Co. Antrim (AN002A) and Horse Island, Co. Sligo (SO020). Quern stones for processing cereals were identified at Dunshammer, Co. Antrim (AN016) and Bailey Mór, Co. Mayo (MO065).

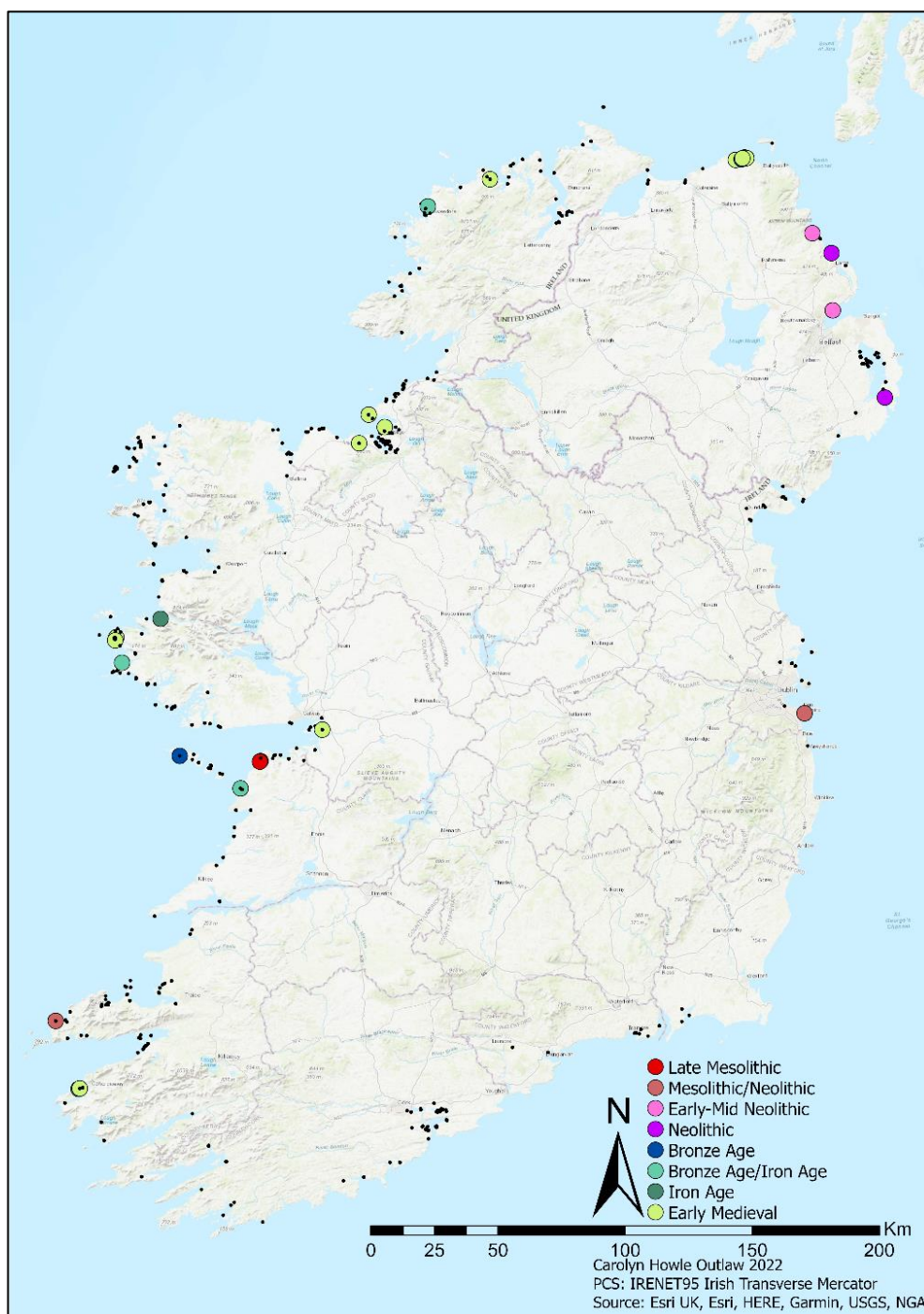


Figure 9.18: Map showing shell midden features with limpet as a dominant species dated from the Early Mesolithic to the Early Medieval period.

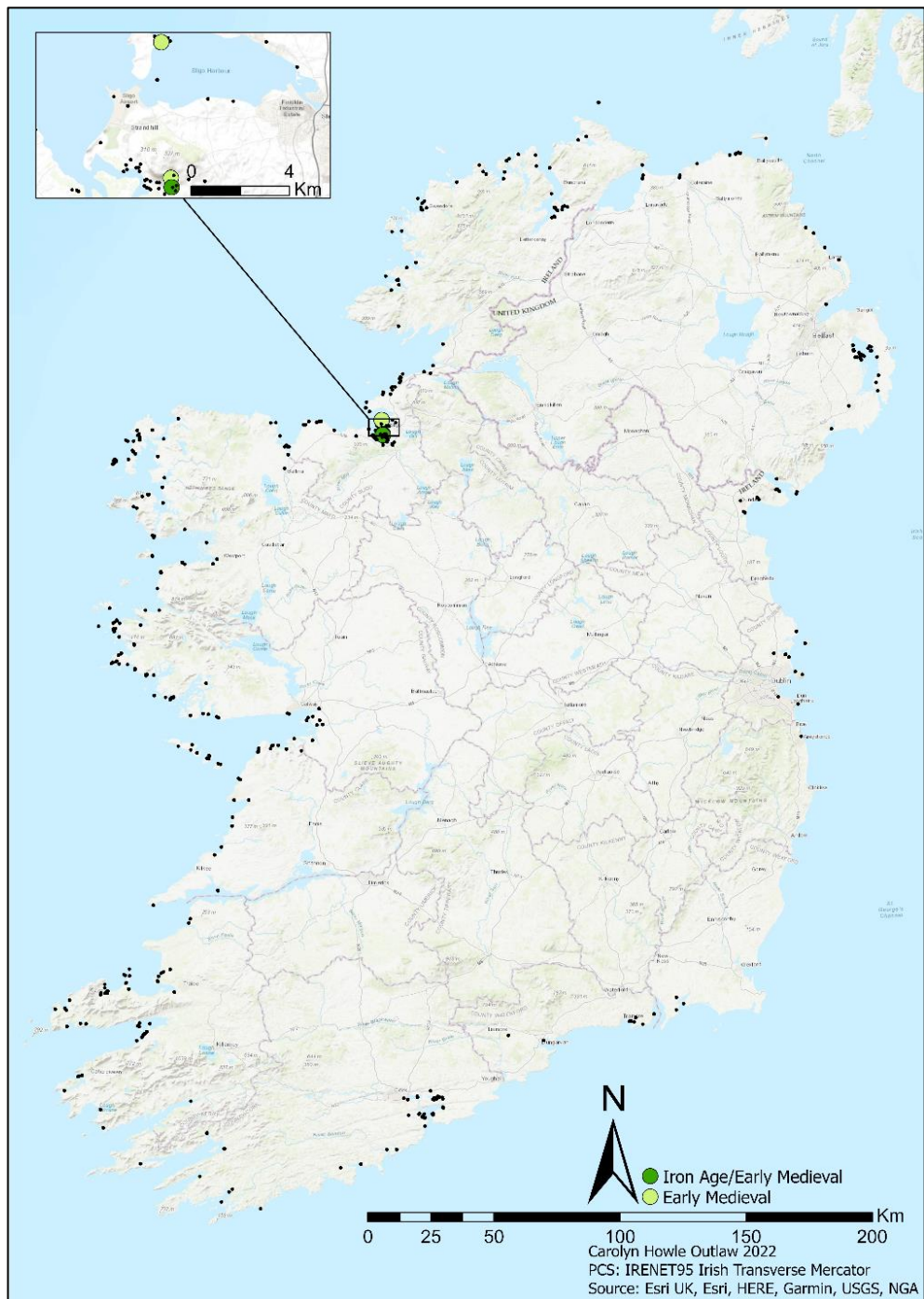


Figure 9.19: Map of Iron Age/Early Medieval and Early Medieval shell midden features with pig as a dominant species.

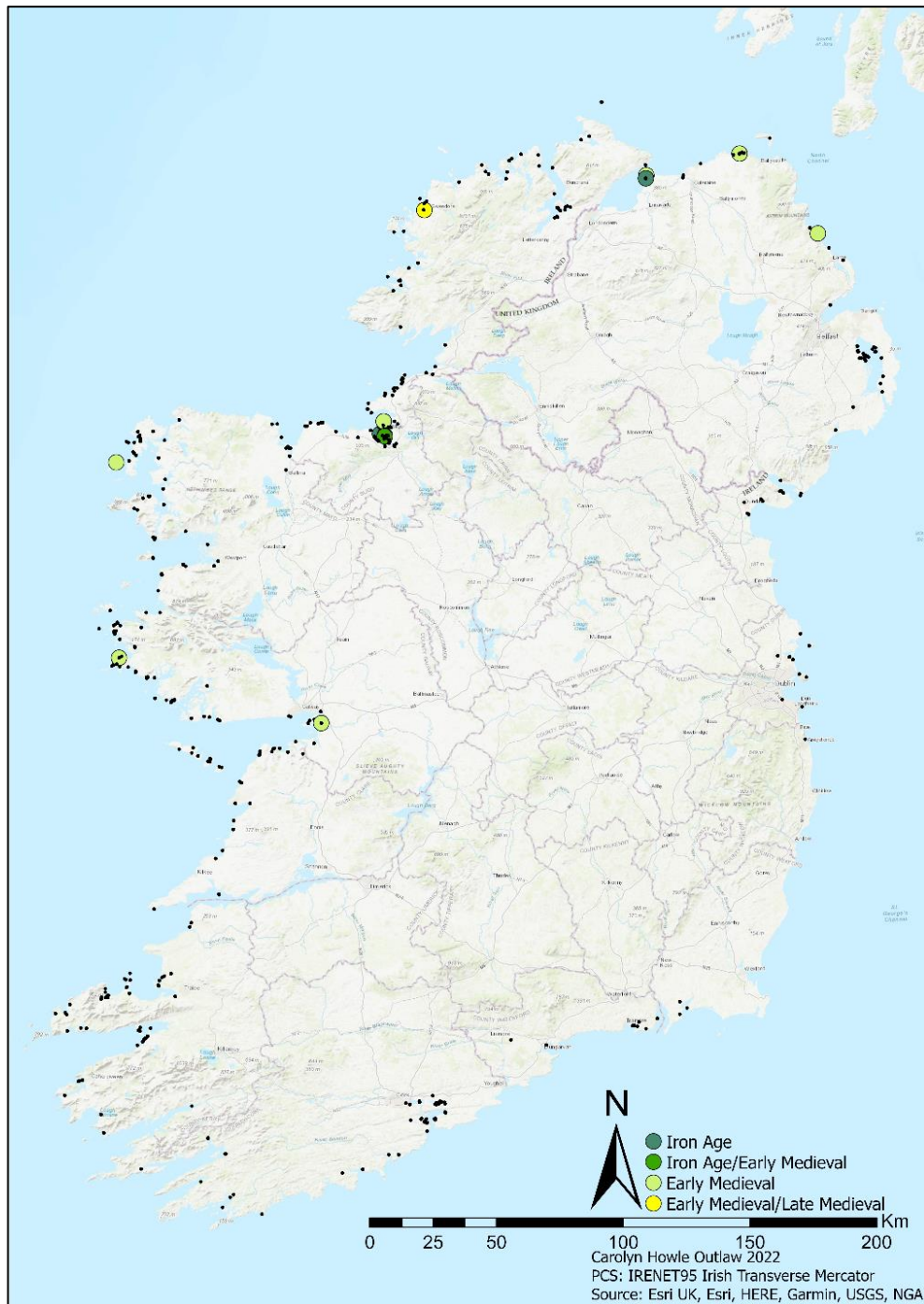


Figure 9.20: Map showing dated shell midden features with cattle as a dominant species from the Iron Age to the Early Medieval/Late Medieval.

Four deposits date to the Early Medieval/Late Medieval transition period. One of these is at the monastic site of Illaunloughan, Co. Kerry (KY053A), which also had an Early Medieval (KY053C) and a Late Medieval (KY053B) deposit as well. Of the four deposits dated to this transitional period, only two have shell or bone species recorded. The dominant species recorded at An Charraig Fhinn, Co. Donegal (DL022) were

oyster, limpet, winkle, and dog whelk. Limpet and winkle were the dominant species at Illaunloughan, Co. Kerry (KY053A). An Charraig Fhinn contained cattle and sheep/goat as dominant species, while fish and bird were dominant at Illaunloughan. From the Iron Age through the Early Medieval/Late Medieval, there is a bias for cattle as a dominant species only in the north and west between Galway and Antrim (Figure 9.20). No plant remains beyond charcoal were recorded. These deposits do not seem to indicate a shift away from trends seen in the Early Medieval shell middens.

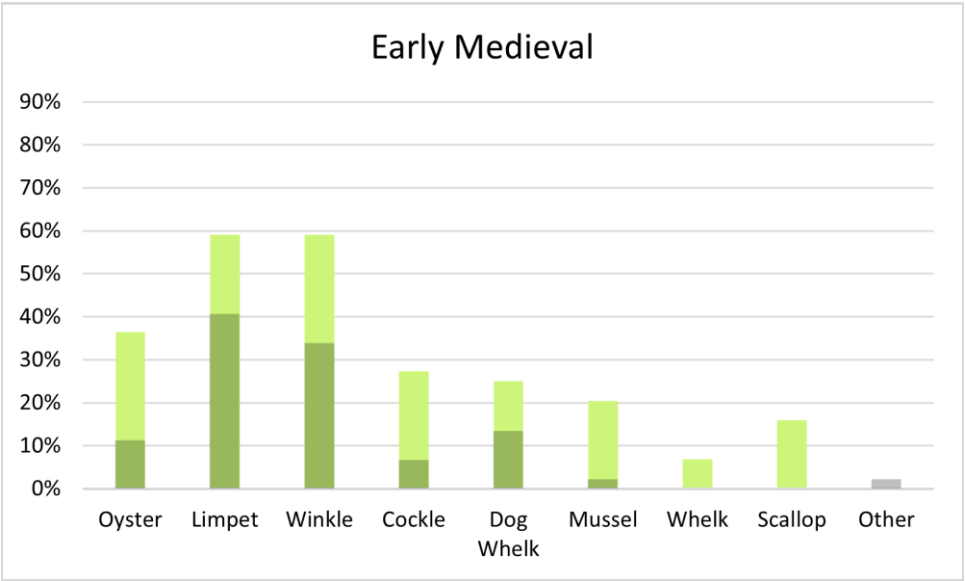


Figure 9.21: Percentage of Early Medieval shell midden features with each primary shell species. Grey overlay denotes the frequency of dominance for each. (n=44)

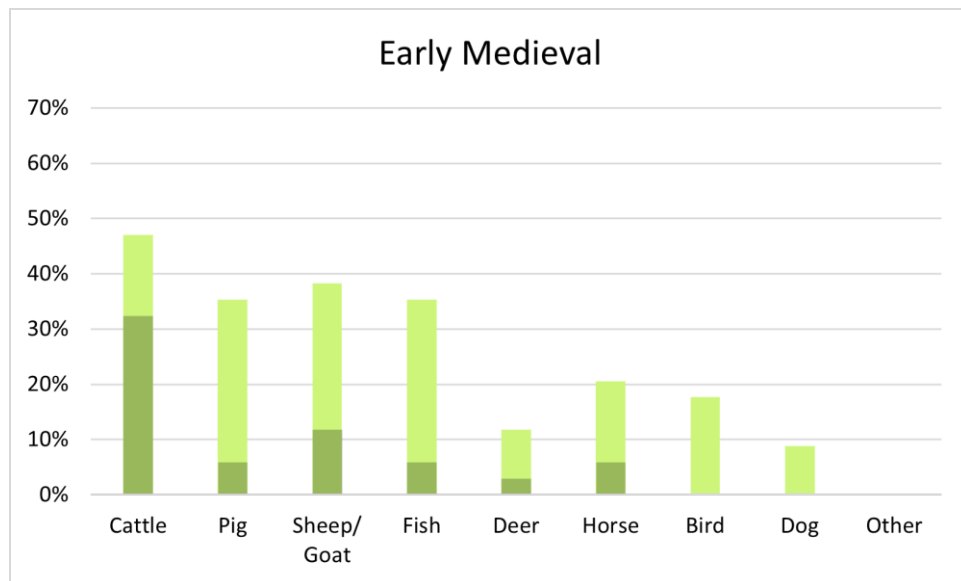


Figure 9.22: Percentage of Early Medieval shell midden features with each primary bone species. Grey overlay denotes the frequency of dominance for each. (n=34)

Late Medieval (1100–1550 AD)

There are 32 shell deposits dating to the Late Medieval period. These deposits are found in 23 sites, five of which contain only later shell deposits along with the Late Medieval evidence. Illaunloughan, Co. Kerry (KY053) was the only site to contain an earlier deposit along with a Late Medieval deposit with one Early Medieval, one Early Medieval/Late Medieval. Most of the Late Medieval deposits are much smaller than those seen in the Early Medieval, though larger deposits are recorded in Cork Harbour.

The Cork Harbour oyster deposits include the two largest deposits at the time, namely Brown Island (CO006) and Rathcoursey East, Co. Cork (CO018) Currabally, Co. Cork (CO010). The former measured 695.4m³ and the latter measured 244.6m³. Two other Cork Harbour oyster deposit dates to the Late Medieval period. The smallest of these was Carrigtohill (CO004), with a volume of approximately 6.8m³. These are likely related to the oyster tithes taken from the areas of what is now Ballybrickan and Ringaskiddy for the priory of St. Catherine in Waterford founded in the twelfth century. This order was dissolved in 1539 and the oyster fishing in Cork Harbour was then leased to a private owner by 1574 (see Chapter 7).

Settlement associations during the Late Medieval include church sites and ringforts, as well as stone castles. The monastic connection is similar to that seen in the Early Medieval, though the religious orders and building construction are different with the introduction of the Benedictine orders and cloistral architecture (see Chapter 7). The

ringforts and castles, one towerhouse and one unidentified, show that the native elite were maintaining a connection to the coast outside of the urban centres that were well established at this time. The absence of Late Medieval and later deposits in the majority of Ulster may be due to shellfish being transported whole into these urban centres (Figure 9.23).

The Late Medieval shell deposits were not simply remains from harvesting molluscs. Butchery on site is evident on two Late Medieval sites: Illaunloughan, Co. Kerry (KY053) and Kilcoe, Co. Cork (CO041). Both of these were interpreted by zooarchaeologists based on the butchery marks and the skeletal elements present. An Rinn Bhuí, Co. Donegal (DL006) contained a quern stone and fire cracked rocks potentially relating to further food-related activities. Burnt bone and shell were identified at High Island, Co. Galway (GA010A, D) suggesting cooking on site.

No convincing evidence of craftworking is seen in the shell deposits of the Late Medieval, perhaps indicating these shell-bearing sites were reserved for food processing. One deposit at An Rinn Bhuí, Co. Donegal (DL006) did have an unidentified human bone. Unlined, supine burials oriented east–west with no grave goods have been found in the vicinity (DG008-026001-) and this bone may be disturbed from a similar grave. No human bone has been identified in Irish shell deposits dating to after the Late Medieval period. Some of the deposits also contained artefacts such as pottery sherds, glass fragments, iron nails, and other small finds, though none indicate specific non-food related activities on the site.

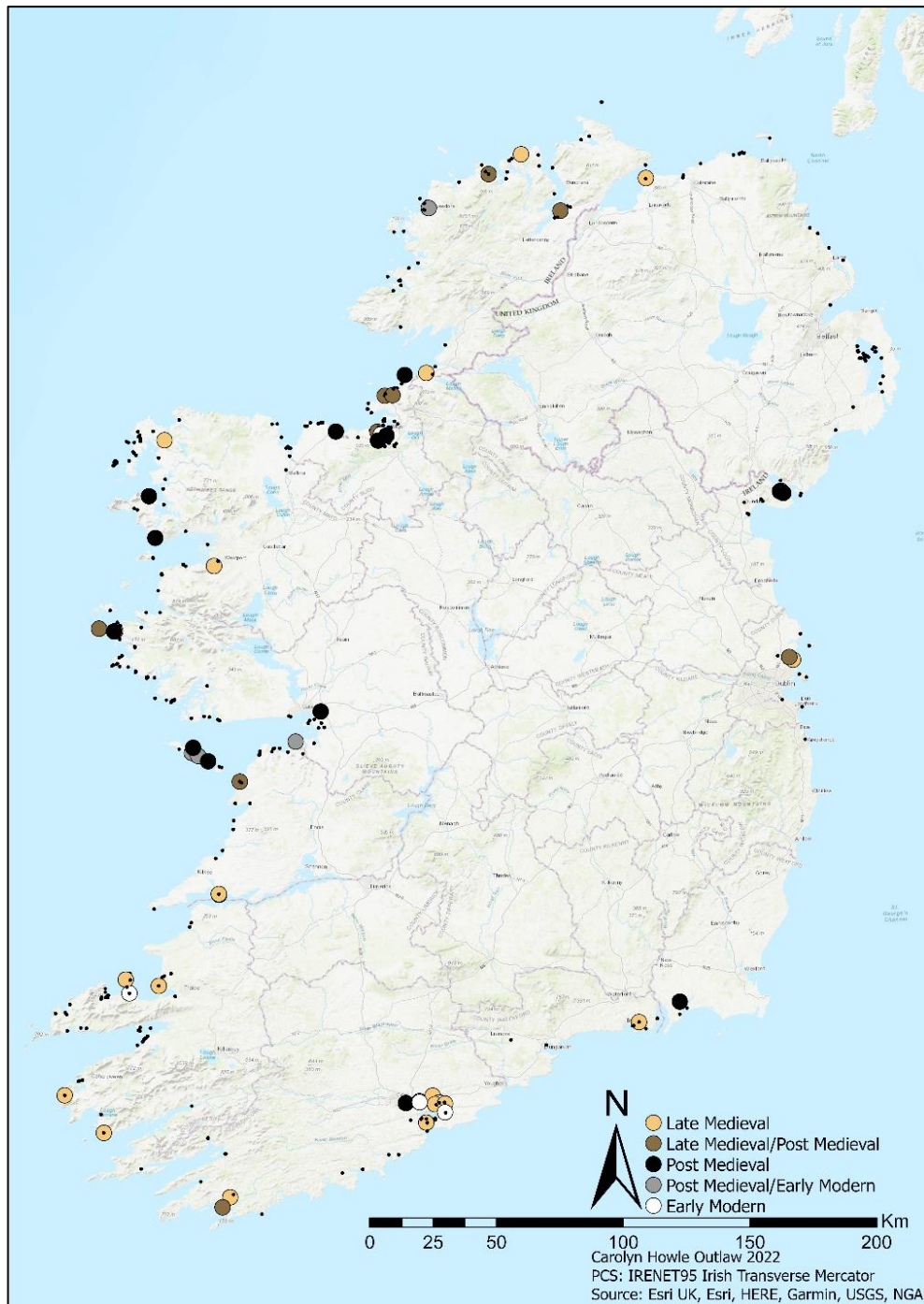


Figure 9.23: Map of all shell midden features dating from the Late Medieval to the Early Modern period.

Oyster, limpet, wrinkle, and cockle are the most common shell species identified in Late Medieval shell deposits (Figure 9.24). An important distinction from the Early Medieval deposits is the general absence of dog whelks. Only one deposit contains dog whelks, and it was not a dominant species. This suggests that this species may no longer have played a significant role in Ireland.

Cattle, sheep/goat, and pig are the most common animal bone species in Late Medieval shell middens (Figure 9.25). Again, the lack of a species is more telling than the presence of a species during this period with the lack of deer potentially indicating Anglo-Norman influence (see Chapter 7). Ballymulholland, Co. Derry (DY003) contained barley, oat, rye, seeds, and wild taxa and Tintern Abbey, Co. Wexford (WX004A) contained cereals, fruit seeds, sloe stones and hazel nuts. The latter shows the continued use of wild foods alongside the domestic plants.

Seventeen shell deposits on eleven sites date to the Late Medieval/Post Medieval transition. Five of these deposits are found at High Island, Co. Galway (GA010B–C, E–G). Another three are found on Scattery Island, Co. Clare (CE025B–C, E). The smallest deposits with recorded dimensions are found in High Island with an average volume of 0.45m³. Outside of this site, the deposits are much larger with a 1350m³ deposit at Shell Valley, Co. Sligo (SO037A).

Settlement associations for Late Medieval/Post Medieval are similar to that in the Late Medieval including castles, a gatehouse, and monastic sites. Two churches are also identified as shell midden sites. The deposits on High Island, Co. Galway (GA010B–C, E–G) also indicate pilgrimage, an activity known both on the continent and in Ireland itself throughout the Late Medieval period (see Chapter 7).

Ceramic sherds, iron nails, and clay pipe fragments are the only artefactual inclusions found in these Late Medieval/Post Medieval deposits. Only one deposit at Scattery Island, Co. Clare (CE025B) contained any potential evidence of cooking on site with the inclusion of burnt shells. Fires in the form of charcoal and hearth-like features are recorded at many of the sites including at High Island, Co. Galway (GA010). Overall, the shell deposits seem even more specialised than in the Late Medieval when the separation of activities was first noted.

Oyster, winkle, limpet, and cockle are the primary shell species identified in the Late Medieval/Post Medieval shell deposits (Figure 9.26). This is similar to the pattern in the Late Medieval deposits. There were also no dog whelks identified in any of these deposits. Fish, cattle, horse, and bird were the most common bone species; no deer bones were recorded (Figure 9.27). Doolin Pier, Co. Clare (CE011A) and Staad Abbey, Co. Sligo (SO015A) both contained cereals. The former contained only barley while the latter contained barley and oat along with seeds and unidentified cereals.

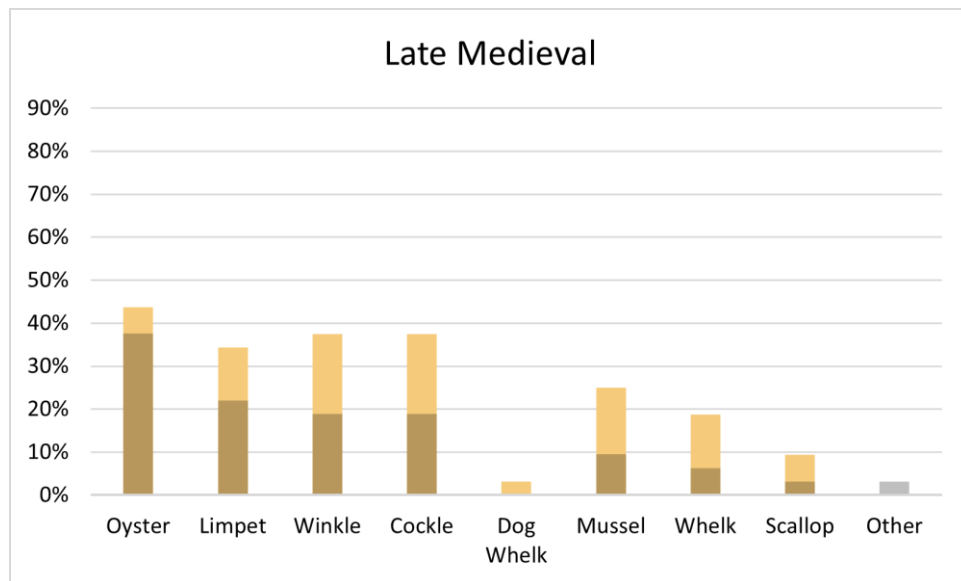


Figure 9.24: Percentage of Late Medieval shell midden features with each primary shell species. Grey overlay denotes the frequency of dominance for each. (n=32)

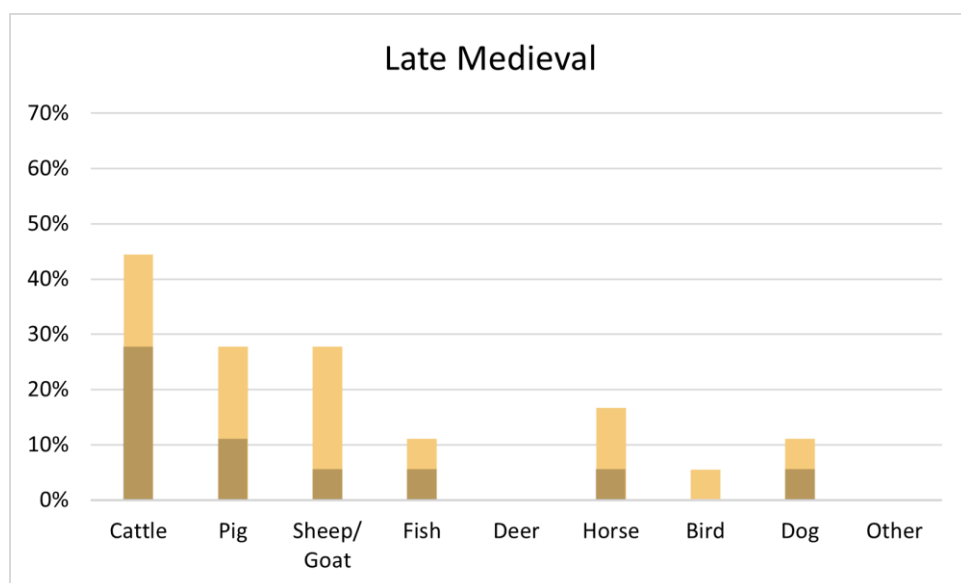


Figure 9.25: Percentage of Late Medieval shell midden features with each primary bone species. Grey overlay denotes the frequency of dominance for each. (n=18)

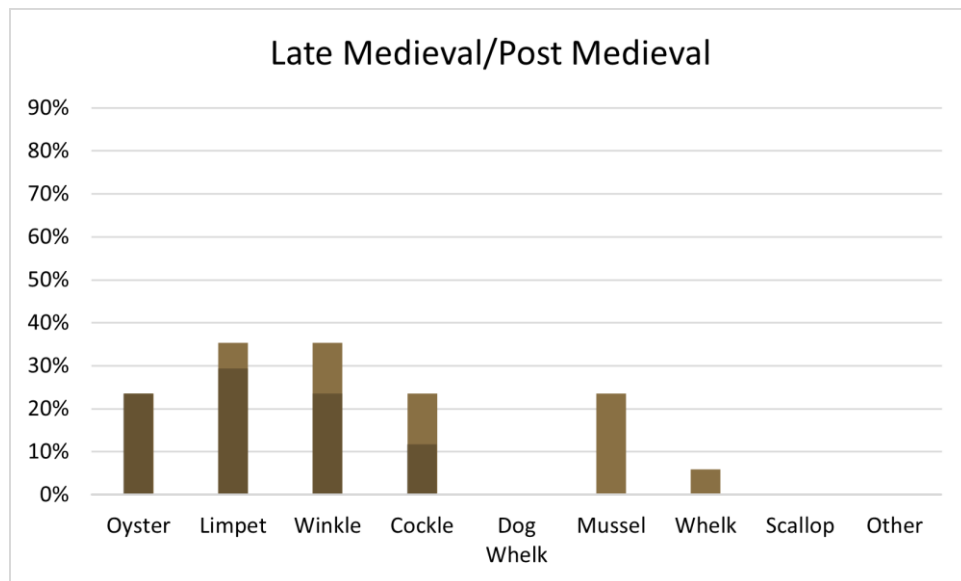


Figure 9.26: Percentage of Late Medieval/Post Medieval shell midden features with each primary shell species. Grey overlay denotes the frequency of dominance for each species. (n=17)

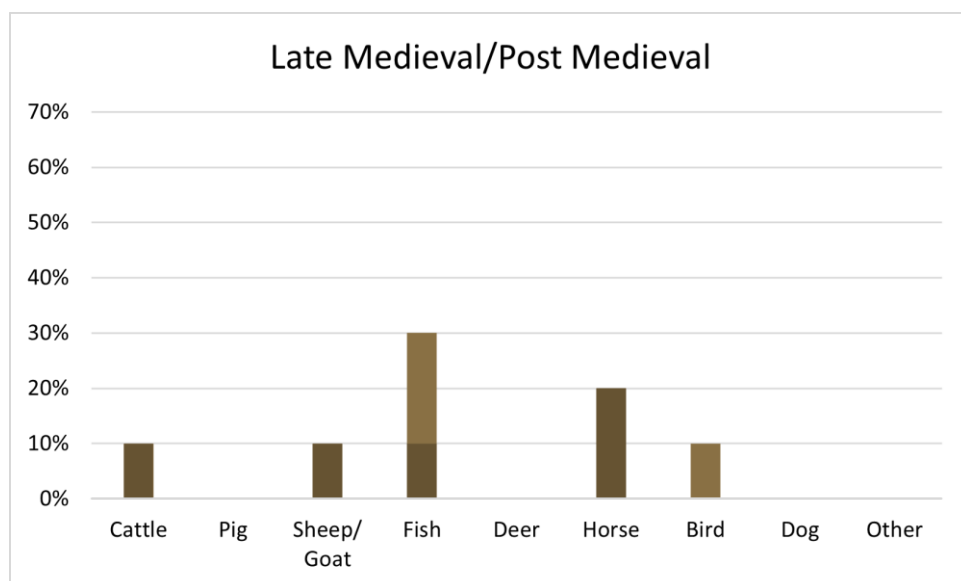


Figure 9.27: Percentage of Late Medieval/Post Medieval shell midden features. Grey overlay denotes the frequency of dominance for each species. (n=10)

9.2.4 Later Developments

Post Medieval (1550–1850 AD)

Nineteen shell deposits from 17 sites date to the Post Medieval period. In these sites, the only other dated shell deposits are that of Late Medieval or Late Medieval/Post Medieval. None of these sites are used after the Post Medieval period. Only three of these deposits have a known volume averaging 46m³, though the average area of all of

the deposits with at least two recorded dimensions is 11.1m². Overall, these are more moderate in size than seen in the Late Medieval/Post Medieval. Another Cork Harbour oyster deposit dated to the Post Medieval is the site at Ballinlough, Co. Cork (CO002). This deposit does not have the same large dimensions as seen previously with an area of only 0.2m².

Settlement associations during the Post Medieval period is now dominated by secular sites such as castles and rural villages. Only one monastic site is recorded with a Post Medieval shell deposit: Tintern Abbey, Co. Wexford (WX004C). This deposit was seen in a context of building debris and other rubbish and was most likely not related to any specific pilgrimage as had been noted in previous periods.

As seen in the Late Medieval and Late Medieval/Post Medieval, very little evidence of non-food related activities are identified in Post Medieval shell deposits. Iron slag was identified at Eochaill, Co. Galway (GA071C), indicating some sort of iron working. There was, however, a wider variety of small finds than seen in the Late Medieval/Post Medieval deposits including iron ornaments and glass beads. The deposits are still dominated by ceramic sherds and clay pipe fragments.

Food-related evidence found in the shell deposits include fishing tools identified at Eochaill, Co. Galway (GA071C), a quern identified at Gob Na hAirde, Co. Mayo (MO050), and fire cracked rocks associated with hearth deposits and burnt shells at Caraun Point, Co. Mayo (MO043). The fishing tools at Eochaill included two copper alloy fishhooks and one iron barbed hook. Fish bones were not specifically recorded, however, perhaps indicating that the fish was not processed at the site, though bones at the site were not identified to genus or species.

The site of Caraun Point, Co. Mayo (MO043) is an important one in the interpretation of shell deposit use at the time. At Caraun Point, the shells were deposited directly outside and between the house structures and were not discarded outside of the 'neighbourhood,' but in it. This may be related to the contemporary use of animal waste as fertiliser. A cross drain was often used to separate the living and byre spaces in vernacular houses in order to remove and collect slurry outside of the houses for this purpose (Figure 9.28) (Hamerow 2002; Mackie 2014; National Museum of Ireland 2022). At Caraun Point, no drainage gulley was located in the excavated house (Figure 9.29) (Campbell and Howle 2018, 51). The shells and other food waste were located outside of the houses in the area traditionally associated with

slurry pits. Shells make a good fertiliser both directly applied to the agricultural sediments and as a raw material for the production of lime (see Chapter 8).

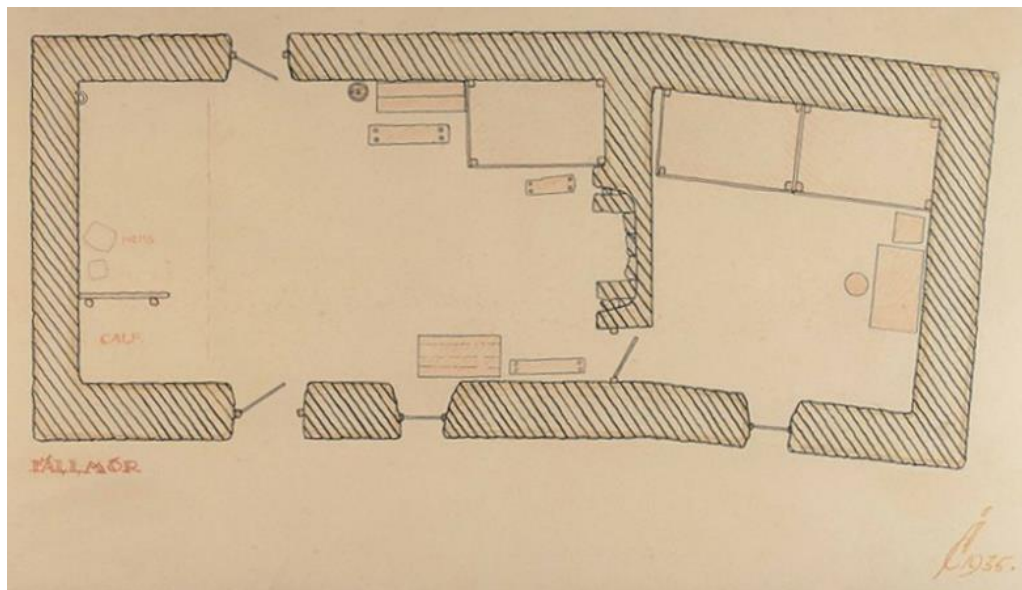


Figure 9.28: Plan of a vernacular house in An Fal Mór, Co. Mayo by Åke Campbell, 1935 (NMI Collection – F:2006.10). Museum description reads: ‘This house was probably originally a one-roomed byre-house. A bedroom was added in a later extension behind the fireplace. A ring for tethering a cow is set into the wall opposite the fireplace. Spaces for a calf and hens are also marked, as is the drain for animal manure.’ (National Museum of Ireland 2022).

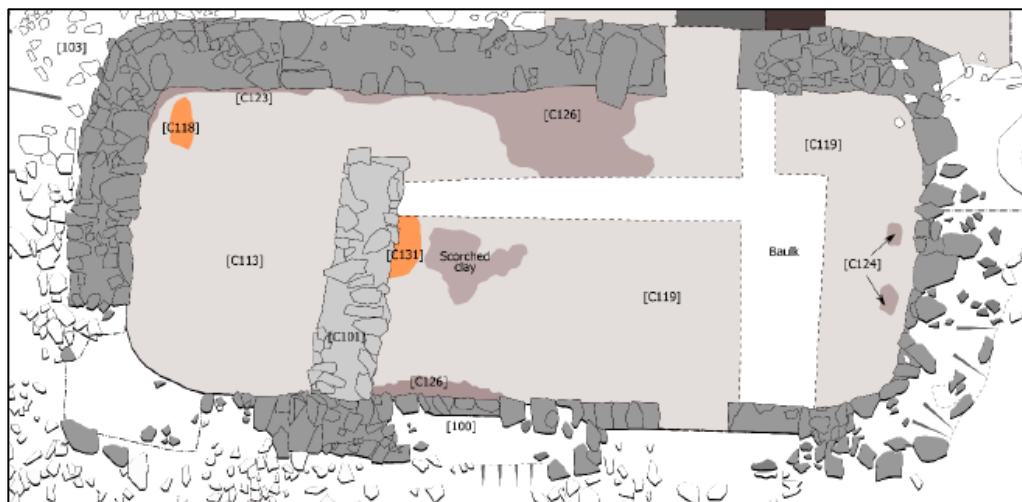


Figure 9.29: Post-excavation plan of Building 3 at Caraun Point, Co. Mayo showing opposing doors similar to Figure 28 with no evidence of a cross drain (Campbell and Howle 2018, 34).

The most common shell species identified in Post Medieval shell deposits are oyster, winkle, and limpet (Figure 9.30). This is again similar to what was seen

throughout the Medieval periods, though dog whelk is not common as it was in the Early Medieval period, only identified in one Post Medieval deposit. Cockle is not as common as it was during the Late Medieval period. Here, oyster was identified in twelve deposits and dominant in eleven, winkle was also identified in twelve deposits and dominant in nine, and limpet was identified in nine deposits and dominant in six. The common animal species is similar to those of the Late Medieval period with cattle, pig, and sheep/goat being found most frequently (Figure 9.31). Again, no deer bones are recorded in the shell deposits. No plant remains other than charcoal were recorded in any Post Medieval shell deposit.

Six deposits date to the Post Medieval/Early Modern transition, all from different sites. One of these is another Cork Harbour oyster deposit, Carrigrenan, Co. Cork (CO003), which measured 64.7m³. The average volume of the Post Medieval/Early Modern deposits is 47.4m³, similar to those in the Post Medieval period.

The settlement associations near these deposits includes a church, a belvedere, and a country house. The church site at Aughinish, Co. Clare (CE009) contained burnt shells and bones, perhaps indicating cooking on site. This may relate to a return to earlier medieval Christian traditions at this site as the shell midden is directly adjacent to the contemporary church. The country home known as Ghan House, Co. Louth (LH010) is an important case study in the consumption of shellfish in aristocratic settings even during a time when most modern interpretations of these fish is that they were a poor man's food (see Chapter 8). The deposit was the largest of the six Post Medieval/Early Modern deposits, with an estimated volume of 117m³.

The artefactual inclusions of these deposits were again primarily that of ceramic sherds and clay pipe fragments. Iron slag is recorded in Cill Éinne, Co. Galway (GA061) perhaps indicating metalworking on the site. Overall, the trend towards only food-related activities taking place on the shell-bearing deposits seems to continue.

The most common shellfish in these deposits are winkle and oyster (Figure 9.32). Limpet declined in overall frequency while cockle was found more frequently. Winkle was identified in five deposits and dominant in three and oyster was found in four deposits and dominant in four. Only one deposit contained identified animal species, though two others contained unidentified bones. Aughinish, Co. Clare (CE009) contained cattle and pig with cattle dominating. No plant remains beyond charcoal were recorded in any of the Post Medieval/Early Modern deposits.

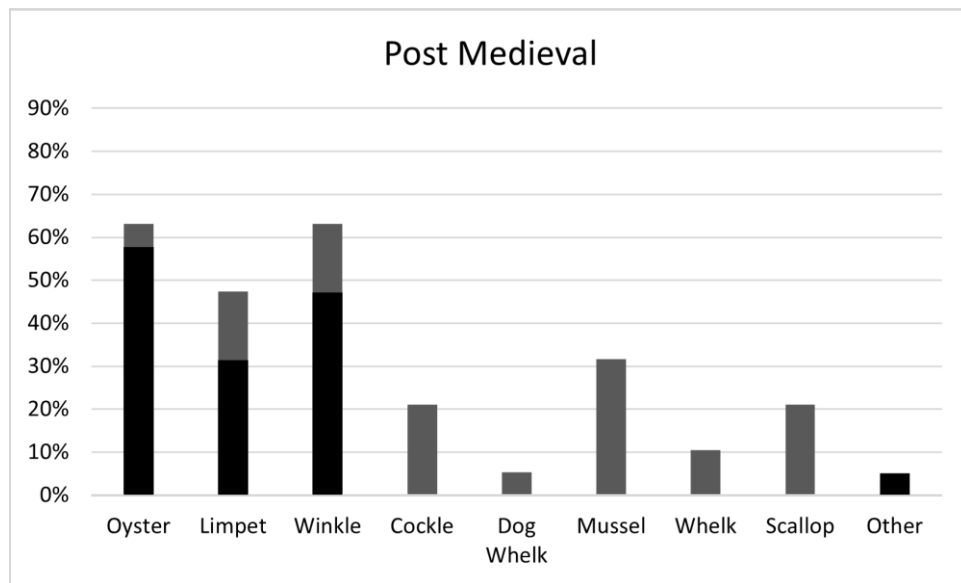


Figure 9.30: Percentage of Post Medieval shell midden features with each primary shell species. Grey overlay denotes the frequency of dominance for each. (n=19)

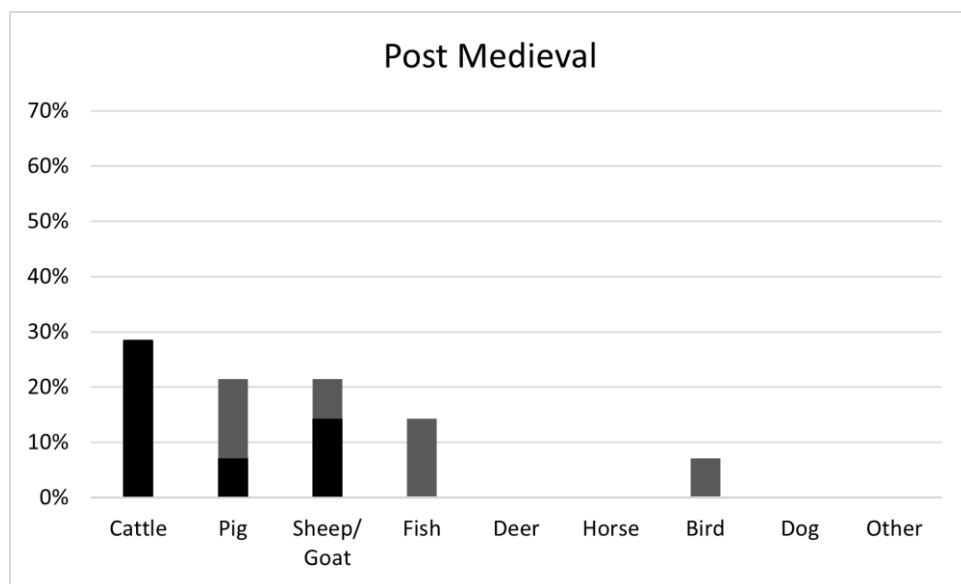


Figure 9.31: Percentage of Post Medieval shell midden features with each primary bone species. Grey overlay denotes the frequency of dominance for each. (n=14)

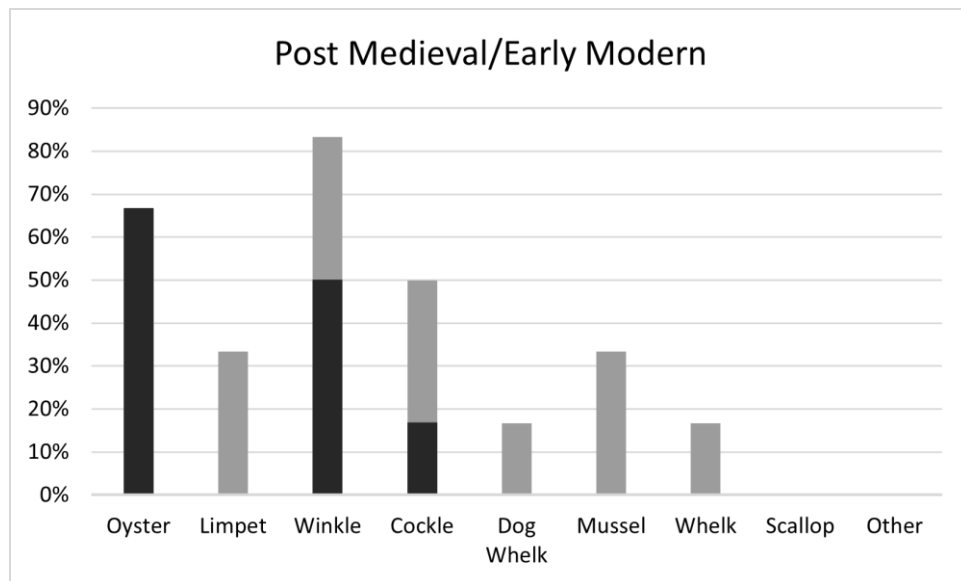


Figure 9.32: Percentage of Post Medieval/Early Modern shell midden features with each primary shell species. Grey overlay denotes the frequency of dominance for each. (n=6)

Early Modern (post-1850 AD)

Nine deposits date to the Early Modern period with five of these are from Culleenamore, Co. Sligo (SO054A–E). The small number of deposits is likely influenced by the lack of early modern archaeological studies but may also reflect the changes in resource procurement and depositional practices seen in modern times. Resources are overwhelmingly gathered by industrial means and brought inland for distribution in and outside of Ireland for individuals or families to buy in single meal amounts and disperse at their own homes. The resulting waste was often deposited using similarly industrialised processes either at landfills or at composting centres.

The largest Early Modern shell midden is another Cork Harbour oyster midden, Brown Island, Co. Cork (CO007) with a volume of 990.9m³. The remaining deposits are moderate in size with volumes less than 10m³ and areas less than 6m². One such deposit was also found in Cork Harbour, namely the oyster deposit of Carrigrenan (CO047). The industrialised oyster harvesting known to have occurred in Cork Harbour starting in the Late Medieval most likely contributed to the production of this large Early Modern deposit as well.

The most common shell species in these deposits were that of oyster followed by winkle (Figure 9.33). Limpet was not recorded in any deposit for the first time during

the Early Modern period. There was one cockle deposit recorded at Culleenamore, Co. Sligo (SO054E). No bones or plant remains were recorded for any of these deposits.

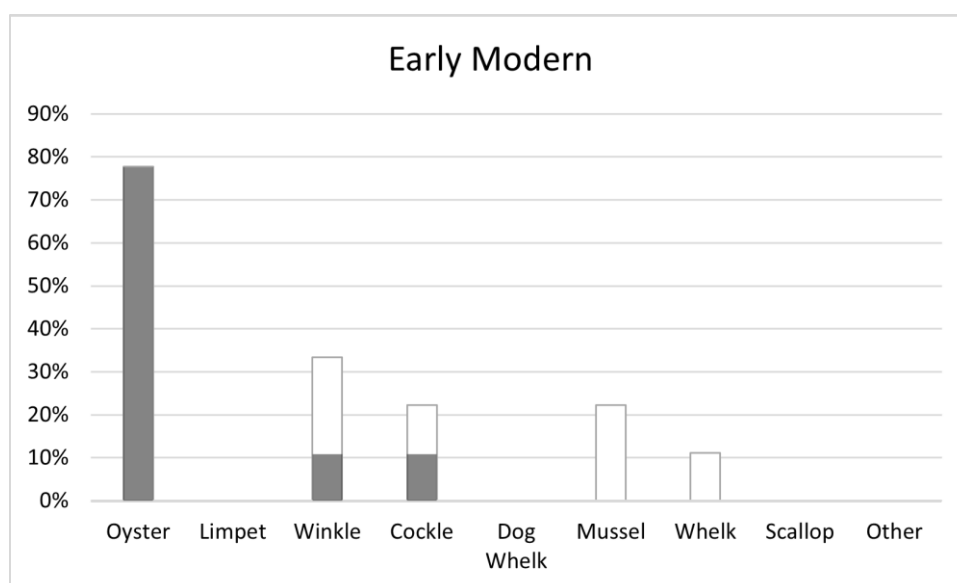


Figure 9.33: Percentage of Early Modern shell midden features with each primary shell species. Grey overlay denotes the frequency of dominance for each. (n=9)

9.2.5 Interpreting Undated Sites

There are a few undated shell midden sites with noteworthy inclusions. For instance, four undated shell deposits contain both human remains and beads: Rosapenna, Co. Donegal (DL010), Grangemore, Co. Derry (DY005), Magherabeg, Co. Kerry (KY012), and Bearanach Thiar, Co. Mayo (MO014). Only the latter provides information about the human remains which were possible skull fragments. The other five deposits with human remains and beads were dated from the Neolithic to the Iron Age/Early Medieval: Dalkey Island, Co. Dublin (DU009B), Portstewart, Co. Derry (DY006), Dún Aonghasa, Co. Galway (GA069M), Settlement 15, Co. Sligo (SO041A), and Settlement 8, Co. Sligo (SO070) in order of age. This may suggest that the four undated sites are also late prehistoric in age. If the deposit at Bearanach Thiar, Co. Mayo (MO014) did contain skull fragments, it further fits into a pattern of deposition of human remains in late prehistoric shell middens. Six late prehistoric burials either contained skull fragments, teeth, or the skull was marked as important through depositional choices (see section 9.2.1–2).

There are also six undated dog whelk deposits across Ireland. Four of these have two dimensions recorded with size ranging from 234m² to 1200m². The two deposits

with at least two recorded dimensions were interpreted as shell heaps by the investigators. Dog whelks were only dominant species in the Late Mesolithic and Mesolithic/Neolithic and the Iron Age/Early Medieval and Early Medieval. The early prehistoric dog whelk deposits were all small with the largest deposit measuring 14m² and the remainder less than 2m². The Early Medieval deposits, however, are much larger with the recorded dimensions showing one deposit with an area of 12.5m² and another with an area of 251.3m². Given these measurements, it is most likely that the undated deposits are Early Medieval based on their size.

One final site is worth noting as it is the only shell midden with potential evidence of medicinal use. A possible pestle and mortar were identified at Mullaghmore, Co. Sligo (SO004). Unfortunately, the shell species in the deposit are unknown so no comparisons with known medicinal shell species can be made. Unidentified bones were also recorded in the deposit. Many other small finds were recorded at the site, though their stratigraphic relationships are unclear.

9.3 Broader Context

Shell middens of varying size and purpose have been identified from around the world from as early as the Lower Palaeolithic. Europe as a whole saw an increase in shellfish use through the Mesolithic. As people, technologies, and religions travelled across Europe through time, the way people interacted with shellfish and their deposition were affected. The Atlantic façade in particular shares similar cultural changes seen paralleled in Ireland. The following sections place the Irish record in a global context (Figure 9.35) and concludes with European parallels (Figure 9.36).

9.3.1 Global Context

The earliest evidence for shell gathering by hominins was found at the 300,000-year-old site of Terra Amata, France. This evidence, however, is limited and isolated (Claassen 1998, 1; Colonese *et al.* 2011, 89). South African shell middens at Ysterfontein 1 and Klasies River Main dated between 120,000 and 104,000 years old show some of the earliest examples of coastal adaptations in the world (Niespolo *et al.* 2021, 1). There is evidence of shellfish exploitation around 45,000 years ago in the Asia-Pacific tropical islands (Balbo *et al.* 2011, 149). Potential Neanderthal molluscan exploitation has been identified in the southern Iberian Peninsula (Colonese *et al.*

2011, 89). Australia's oldest freshwater middens date to around 35,000 years ago (Claassen 1998, 2), while American middens may date to early stages of human colonisation of the continents around 13,000 years ago (Balbo *et al.* 2011, 149). Most shell middens around the world, however, date to the Holocene, from approximately 11,000 years to the present day (Claassen 1998, 2; Gernet *et al.* 2014, 135). This is also the time Ireland was first inhabited, with the oldest shell middens here dating back to at least 6000 years ago (see Chapter 4).

The history of shell midden research varies considerably in different parts of the world. Research on the northern African coast, for example, is limited compared to studies on the European Mediterranean coastline (Balbo *et al.* 2011, 149). Similarly, in Brazil, most shell midden research has focused either on the mouth of the Amazon River or along the southern coast, leaving out large areas of potential research between the two areas (Klokler *et al.* 2021, 93). Sites along the coast in Mexico were also overlooked in favour of the most elaborate inland mounds (Ensor 2022).

Some of the most intensively studied shell deposits around the world include those with human remains. The remains themselves are well preserved in these deposits due to the chemical environment created by the shells. Ireland has 33 shell deposits containing human remains. The Brazilian *sambaqui*, for instance, are famous for their burials (Balbo *et al.* 2011, 149). Prehistoric burials in British Columbia are dominated by shell midden burials (Brown 2003, 153). An estimated 300 burials have been identified in the Yoshigo mound in Tokai, Japan (Kusaka *et al.* 2008, 173; Hellewell 2015, 26). Other areas around the world with a large number of shell midden burials include the San Francisco Bay region with hundreds of examples (Luby and Gruber 1999, 104). The Ohio River valley which has shell middens with both human and dog bones (Claassen 2010), while the Torres Strait Islands have middens with dog and human non-adult teeth (McNiven 2013, 572). The relationship with dog and human remains has been discussed in relation to burials in Australia (Gunn *et al.* 2010) and the Torres Strait Islands (McNiven 2013), in southwestern North America (Hill 2000; Walker 2008), as well as in Siberia (Losey *et al.* 2011). In the Torres Strait Islands, ethnographic records suggest head-hunters would often return from raids with the heads of both humans and dogs, potentially equating the two species in some way (McNiven 2013, 573). Further examples of shell midden burials in Europe are given in section 9.4.2.

As in Ireland, the size of shell deposits around the world is variable. There are many large examples as well as smaller ones, though some areas have many more large shell mounds than recorded in Ireland. In Brazil, shell middens have been recorded with a volume of over 300,000m³ with one example estimated to have reached 46m in height and 470m in diameter (Gernet *et al.* 2014, 135). The average midden in Broken Group Island on the western coast of Canada is over 6,000m³ (Gustas *et al.* 2022, 204). The ‘mega middens’ of South Africa reached over 1000m³ in open area sites (Jerardino 2013, 211). One example of moderate sized Weipa shell mound in Australia had an estimated volume of 2,250m³. There are some large sites recorded in Ireland with one site, Gubbranna Point, Co. Kerry (KY036), recorded as having a volume of over 52,000m³. This is unusual in the area, however, with 95% of known shell deposit volume estimates falling below 1,500m³ and the average volume estimated at around 1,050m³. Smaller shell spreads are also known in each of these locations as in Ireland. Weipa, for example, has more inland middens as small as 5m in diameter and less than half a metre thick (Bailey *et al.* 1994, 69; Holdaway *et al.* 2017).

Large shell mounds have been argued to be the first ritualistic mounds in different parts of the Americas. This includes mounds at Horr’s Island and Tomoka, modern day Florida dating back some 6000 years ago (Russo and Quitmyer 1996). A shell mound in the Matanchén complex at Nayarit, Mexico may be the oldest mound in western Mexico, an area known to have many later ritualised mounds. This shell mound dates to almost 4000 years ago (Mountjoy *et al.* 1972). More recently, burial mounds were built on top of shell mounds in what is now Alabama, comparable to the Scottish evidence from the Isle of Bute (section 9.1.4) and the possible Irish example of Rush, Co. Dublin (DU001) (section 9.2.1) (Claassen 1998, 230–1).

In the Calusa Kingdom of what is now Florida, a defining characteristic of the shell mounds is their use as settlement platforms (Figure 9.34) (Thompson *et al.* 2016). There are a few examples of settlements built on shell deposits in Ireland, such as the mound of Bailey Mór, Co. Mayo (MO065), but Irish deposits are not often associated with substantial structures built on top. There are, however, many examples of shell deposits being integrated in the settlement landscape as at Caraun Point, Co. Mayo (MO043). In modern day Senegal, settlement evidence is not as extensive. As mentioned in Section 9.1.3, the structures used near shell deposits in Senegal are made to be moved as needed as mounding shells affect structural stability, the debris interferes with the living space, or the owner dies (Rowley-Conwy 2013, 144–52).



Figure 9.34: Reconstruction of a Calusa chickee shelter and shell terrace on display at the Florida Museum of Natural History (2008).

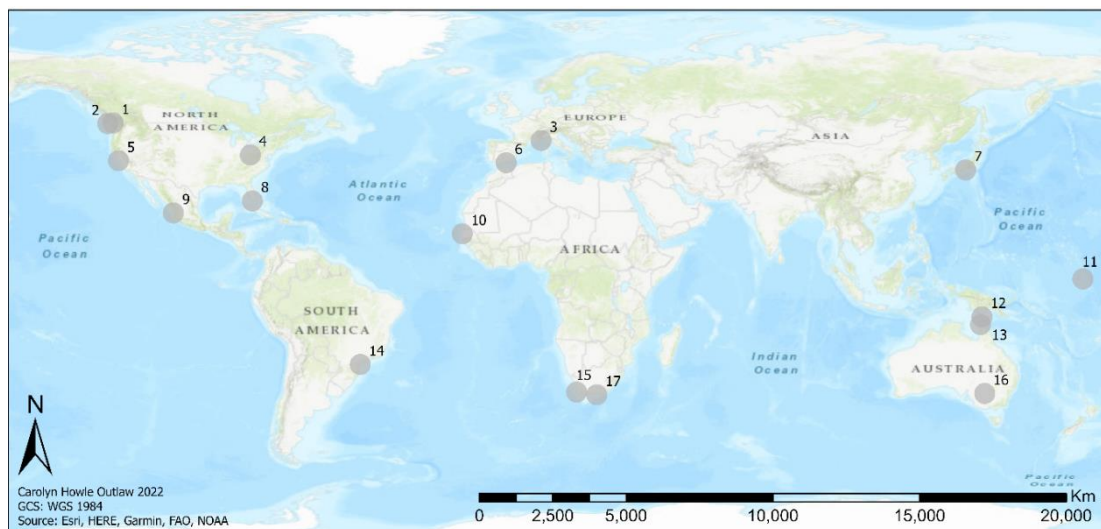


Figure 9.35: Map of regions referred to in section 9.3.1 Global Context. 1)Strait of Georgia, Canada; 2) Broken Group, Canada; 3) Terra Amata, France; 4) Ohio River Valley, United States of America; 5) San Francisco Bay, United States of America; 6) Southern Iberian Peninsula, Spain; 7) Tokai, Japan; 8) Florida (Horr's Island, Tomoka, Calusa Kingdom), United States of America; 9) Nayarit, Mexico; 10) Senegal; 11) Asia-Pacific Islands; 12) Torres Strait Islands, Australia and New Guinea; 13) Weipa, Australis; 14) *Sambaqui*, Southern Brazil; 15) Ysterfontein 1, South Africa; 16) Lake Mungo, Australia; 17) Klasies River Main, South Africa.

9.3.2 European Context

Shell midden research in Atlantic Europe has long been focused on large, Mesolithic shell-bearing sites. This is due to the exceptional shell deposits such as those in western Scotland, the Ertebølle middens, and those of Tévéc and Hoëdic in north-west France. As in Ireland, these extraordinarily large middens are not the norm in size or date. Even the region of Denmark with the famous Ertebølle middens shows shell midden creation through the Neolithic with a break in the Bronze Age and a return to depositional activity in the Iron Age (Milner *et al.* 2007, 1–2). There is a comparable gap in shell midden deposition during the Holocene.

There are also similar parallels to the Mesolithic/Neolithic transition as seen in the shell middens of Atlantic Denmark and those of Ireland. The Ertebølle is often used as an example of ‘Mesolithic hold-outs’ during the spread of a Neolithic way of life through Europe. One of the main pieces of evidence cited for contact between Neolithic agriculturalists and the Mesolithic hunter-gatherers of the Ertebølle is the bones of what has long been interpreted as domesticated pig in the shell middens of these hunter-gatherers. While much debate has gone into whether or not these pig remains are domesticates, recent nuclear and mitochondrial DNA studies of the bones does indicate that the Ertebølle did in fact use domestic pigs from their Neolithic neighbours (Krause-Kyora *et al.* 2013).

Less controversial, due to the absence of wild specimen in Ireland, are the cattle bones found at shell-bearing sites in Ireland dating to the Mesolithic. The remains identified in Ferriter’s Cove, Co. Kerry (KY030), while not in a shell deposit, are often the most cited example of Neolithic interactions with the Mesolithic Irish. Evidence of earlier connections was discussed in Chapter 4, with the cattle bone found in a shell deposit at Sutton, Co. Dublin (DU006A).

The limited evidence of housing structures in the Ertebølle sites may also be the closest parallel to help interpret the limited evidence of structures at Irish shell-bearing sites. Only two possible house structures behind Ertebølle shell deposits have been identified despite targeted excavations. The contemporary houses known from the area consist of three types: Type 1 contains a foundation cut and stake holes; Type 2 contains only a foundation cut; and Type 3 contains only stake holes. It can be assumed that if such structures, especially of Type 3, were to be built on top of shell deposits, the ‘smearing’ and ‘blending’ of such sites would obscure any trace of them. Even if

these structures were built next to the shell deposits instead, as in Senegal, similar processes would take place in a ‘cumulative palimpsest’ (Rowley-Conwy 2013).

The Muge deposits of Portugal contain an estimated 300 skeletons dated to the Late Mesolithic (Figueiredo and Gonçalves 2015, 186; Umbelino *et al.* 2019, 455). This is one of the densest areas of shell deposit burials in Europe, though the middens in Brittany also contain many examples (Schulting 1996; Dupont *et al.* 2009). The famous middens in western Scotland in Oban and Oronsay also contained human remains. Those on Oronsay contained fifty-five total disarticulated human remains, while contemporary disarticulated remains were found in Oban along with later cist burial inserts. Those at Oronsay were primarily of hand and foot bones with some teeth, ribs, and vertebrae while the Oban sites contained a larger variety of disarticulated remains along with later cist burials (Connock *et al.* 1992; Richards and Mellars 1998, 181). The cremations and inhumations from Ertebølle shell middens that have been found are primarily later intrusions. The few burials dated to the Mesolithic include only a small number of scattered disarticulated bones (Andersen 2000, 380; Gutiérrez-Zugasti *et al.* 2011, 73).

Most of the human remains found in Irish shell middens date to late prehistory. Three early prehistoric Irish deposits did contain human remains (Rockmarshall, Co. Louth (LH005), Dalkey Island, Co. Dublin (DU009B), and Ferriter’s Cove, Co. Kerry (KY030C)), but only one (DU009B) contained articulated skeletons. This skeleton was also found to be a later Neolithic inserted skull and not a contemporary deposition. Some parallels may be drawn to the sites in Denmark and Scotland with their disarticulated remains and later inclusions. It is more difficult to draw parallels between other Atlantic European shell midden burials, but perhaps Ireland’s later examples, especially those containing dog remains, were influenced from these Mesolithic examples on the continent. This may be related to other cultural aspects from the area of Portugal and Brittany, such as the influence of the Bell Beaker culture in the Chalcolithic (Fitzpatrick 2013, 55–9).

Further south, some parallels for dog whelk dye use can be identified along the Mediterranean coastlines. *Murex* shellfish, larger cousins of the *Nucella* dog whelks in the same Muricidae family, were used in major dye manufacturing from as early as 1800 BC. Large deposits of the discarded shells are found near large dye workshops and the use of the dye is well attested in both the archaeological record and in contemporary literature (Cooksey 2013). While the making of such dye in Ireland

probably never reached the same scale as in mainland Europe, it is often associated with such shellfish (see Chapter 6). The processes used to make such dyes would also likely have been known to the Irish as other connections with the continent at the time are evident as discussed above. The use of dog whelk dye in Ireland in the Post Medieval and Early Modern periods is attested in the literature (Cole 1685; Lovell 1884, 129–30; Bigger 1895, 730–1).

As previously mentioned, some of the best recorded shell middens in Atlantic Europe are very large. For instance, Muge shell middens can reach up to 8000 m² with thicknesses of up to 5m and the Ertebølle middens can reach up to 5000m³. The thickest site recorded in Ireland measured 15m thick (GA073), though this is a statistical outlier and 99.4% of known thicknesses fall below 5m. The largest area recorded at an Irish site was 360,000m² (GA038), though this is another statistical outlier with 99.7% falling below 20,000m². The largest Irish site by volume measured 52,672m³ (KY036) with 98.3% of sites falling below 9000m³. While Ireland's largest sites do compare to the large sites recorded on the continent, the average Irish shell deposit, including outliers, has a thickness of 0.5m, an area of 1,280m², and a volume of 1053m³. Of Irish sites, 99.4% are less than or equal to the largest Muge thickness, 96.6% fall below the largest Muge area, and 99.1% measure under the largest Ertebølle volume.

The most common species in the shell deposits of Denmark are oyster, cockle, mussel, and winkle with a general absence of limpet shells. In France, the primary species are limpets, oysters, top shells, winkles, cockles, furrow shells, and carpet shells. The coastal areas of Portugal with less estuarine influence were dominated by limpets, mussels, top shells, and rock shells though the estuarine regions are primarily made up of cockle, furrow clam, clams, and razor shells. Spain is the most similar to Irish middens with a predominance of limpets and winkles (Gutiérrez-Zugasti *et al.* 2011).

An interesting differentiation is seen when looking at the frequency of top shells in France and Portugal. These shells are only found in 25 Irish deposits and are only a dominant species in two. We know from modern sources that top shells (colloquially known as cat winkles) were intentionally avoided along with dog whelks when collecting periwinkles for sale (*pers. comm.* residents of Achill Island, Co. Mayo). There is also the assertion found in Irish literature that the French loved eating dog whelks, while the Irish found them inedible (Knowles *et al.* 1899, 437–8). The Spanish

are also cited as eating dog whelks in the spring (Lovell 1884, 207). The top shell is not cited as specifically edible or inedible in the Irish literature and it is unclear why this particular shellfish was not more commonly utilised as it was in other areas of the Atlantic. It is obvious that cultural choices were at play across the Celtic Sea, English Channel, and Bay of Biscay when it comes to shellfish selection, making the evidence of cross sea communication evidenced in shell deposits all the more striking.

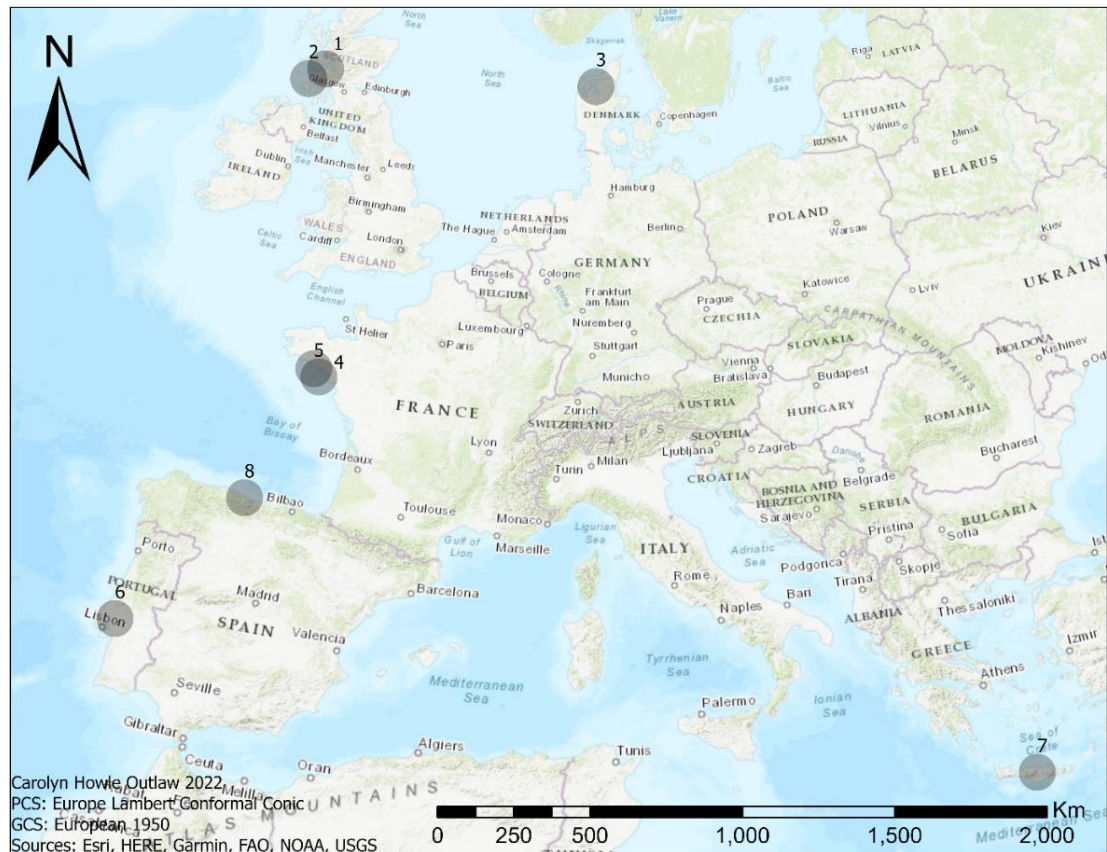


Figure 9.36: Map of regions referred to in section 9.4.2 European Context: 1) Oban, Scotland; 2) Oronsay, Scotland; 3) Ertebølle shell middens, Denmark; 4) Tévéc, France; 5) Hoëdic, France; 6) Muge region, Portugal; 7) Mediterranean (island of Crete, Greece); 8) Northern Spain.

9.4 Discussion

The exploitation of coastal resources leading to the creation of shell middens began in Ireland during the Late Mesolithic period. The use of middens decreased during the Late Neolithic and Chalcolithic, then resumed in the Bronze Age to continue until Early Modern times (Figure 9.37). During this span of time, certain trends can be deciphered.

- 1) Permanent settlements at shell midden sites are not evident until the Bronze Age.
- 2) Some of the earliest evidence of contact with Neolithic farmers is found in coastal shell-bearing sites.
- 3) Craftworking has been identified on shell midden sites dating from the Mesolithic through to the Late Medieval, but more specialised food-processing seems to take place after this.
- 4) Dog whelks are common in the Mesolithic/Neolithic, but large dog whelk deposits almost always date to the Early Medieval. Other frequent species found through time include oyster, limpet, winkle, cockle, mussel, whelk, and scallop.
- 5) Human remains are found in early prehistoric sites but are primarily found in late prehistoric sites and never after the Late Medieval. The late prehistoric human remains often give distinction to the skull and there seems to be a trend to include dog remains and beads in the same deposits.
- 6) After the Early Medieval, deer bone is no longer found in Irish shell middens.

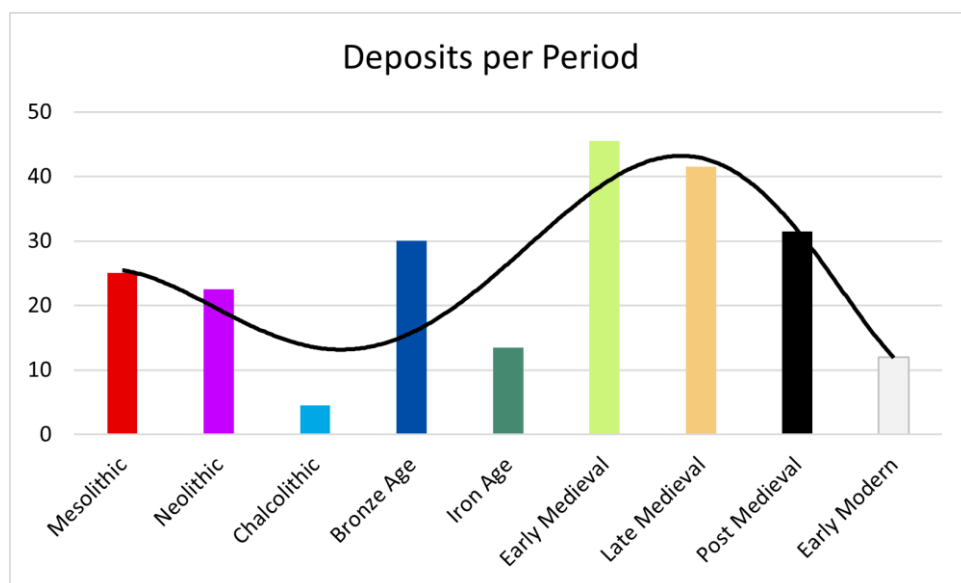


Figure 9.37: Polynomial trend line of deposits per period showing the fall in deposition around the Chalcolithic (the number of transitional sites are split evenly between bordering periods).

Some overall trends are also seen spatially. All deposits with sheep/goat as a dominant species are found in north Co. Clare and northward. Only three deposits in Northern Ireland reported cockle as a dominant species and they are near the border. Articulated burials in shell deposits show a west coast bias. Other spatial trends were

noted above in section 9.2. The northern bias for Mesolithic deposits has also been noted in Chapter 4.

The evidence for settlement in the Irish Mesolithic has yet to be identified in shell middens of this period. When compared to the contemporary housing structures known from the Ertebølle region, however, the stake holes at Ferriter's Cove, Co. Kerry (KY030) could indicate more than a fence-like structure. If the possibility of 'smearing' caused by moveable structures is considered as in Senegal and Denmark, Mesolithic settlements may have already been uncovered at shell bearing sites.

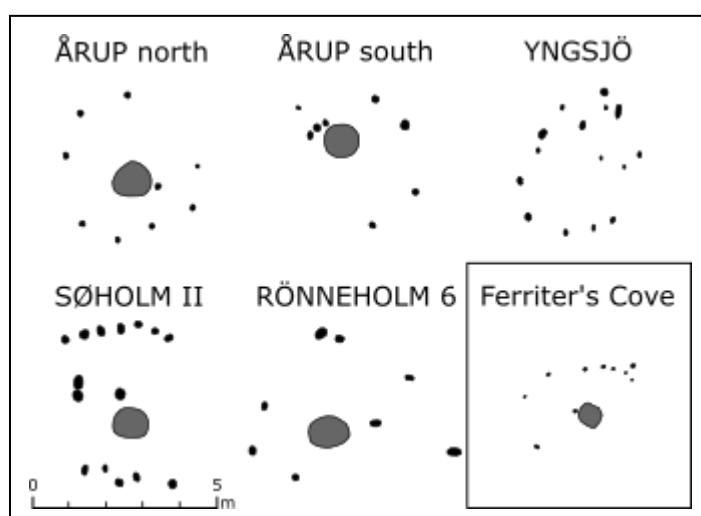


Figure 9.38: Five examples of Type 3 houses from the Kongemose and Ertebølle in southern Scandinavia (after Rowley-Conwy 2013, 148) compared to the Southern Area stake holes around the hearth F308 at Ferriter's Cove, Co. Kerry (KY030) (after Woodman 1999, 24).

The Neolithic saw a reduction in isotopic evidence for marine input into the diet of the Irish population (Milner *et al.* 2007, 2). This may correlate with the reduction in shell deposits recorded between the Late Neolithic and Chalcolithic. The Early Neolithic is also only the beginning of the spread of domestication and farming, but this would not have been an immediate process throughout the island, but by the Late Neolithic, agriculture and livestock may have taken more of a hold. This may have influenced a decision to focus diet choices to terrestrial sources. There was also an influx of new ideas coming from the continent with the Beaker cultural phenomenon. The population increase in the Bronze Age may have led to the broadening of resource use to include marine resources at a larger scale once again (Dowd 2015, 125).

The connection with dog bones and human remains in shell deposits was seen in other areas of the world (see section 9.3). Dogs in other cultures have been intrinsically

linked with humans. If head hunting was occurring in Ireland during late prehistory, which has been suggested (Armit and Ginn 2007, 127–8; Armit 2012), the dog bones may have similar symbolism to that seen in the Torres Strait. Head hunting cultures have been found to target children and the weak in some instances, which would explain the inclusion of non-adults in Irish deposits, especially when skulls or teeth were included. Full inhumations of the non-adults, such as at Settlement 15, Co. Sligo (SO040), may instead have been related to the significance placed on losing children in a society with high infant mortality. Connections with fertility and rebirth may have led to the inclusion of such remains in the shell deposits (see section 9.1.4).

When discussing the temporal trends, the use of shellfish as a resource beyond direct food intake was addressed (see section 9.1.1). These other uses, especially that relating to bait, calls most optimal foraging estimates seen in the literature into question. The protein from a fish would make up for the energy costs of collecting shellfish far more than the smaller amount of nutrients calculated for the shellfish itself (see Claassen 1998, 176). Other problems with optimal foraging estimates were mentioned in Chapter 3, such as cultural taste and symbolic associations driving individuals and groups to collect shellfish regardless of the nutritional value.

It is also important to remember that shell deposits and shells themselves are not static, but instead are an active part of the living landscape. Shell deposits have been harvested for manuring and lime. They have been built on and have had burials added hundreds of years later. They all started as small deposits, and many have become large enough to be monumental markers on the landscape. Shells themselves have been used to decorate pottery or as temper in certain vessels. They can be used as beads or as badges which could be used during life or carried into death. The way people interact with the shell middens is also not static, from the purpose behind Mesolithic shellfish choices (Figure 9.39) to modern day meetings at well-known mounds (Figure 9.40). The only thing that can be certain is that people have used these shellfish, deposited their shells, and lived among their deposits for thousands of years.



Figure 9.39: Reconstruction of Mesolithic oyster consumption after McErlean, McConkey, and Forsythe 2002 (O'Sullivan and Breen 2007, 46).



Figure 9.40: Separate groups of individuals visiting Shelly Valley, Co. Sligo (SO037) in 2022 including children sliding down the dune overlooking the largest shell midden.

Chapter 10: Conclusion

Introduction

This thesis presents the analysis of a comprehensive catalogue of Irish coastal shell middens compiled from recent surveys, published reports, and archived data. These sources date from 1837 to 2022 and were written by antiquarians, scientific archaeologists, and informants after surveys, geophysics, and excavations. This chapter summarises the findings of this study with recommendations for future research and preservation. The broad themes of the study are discussed in Section 10.1 followed by more period specific patterns including any geographical distinctions, artefact inclusions, bone inclusions, macro plant remains, frequent shell species, and average dimensions. Possibilities for future research are then discussed in Section 10.2 in response to current gaps in knowledge.

10.1 Main Findings of Study

There are ten significant findings from this study of coastal shell middens in Ireland. These were explored in depth in Chapter 9 and are as follows:

- 1) A number of Late Mesolithic shell middens in Ireland provide evidence of contact with farming groups in Britain or the Continent.
- 2) The use of coastal resources at shell middens decreased during the Late Neolithic and Chalcolithic and resumed in the Bronze Age.
- 3) Human remains are found in coastal shell middens of later prehistoric date, with emphasis on the skull, accompanied in some instances by dog remains and beads.
- 4) Articulated human burials are only identified within west coast shell midden features.
- 5) Permanent settlements are not evident at shell midden sites until the Bronze Age and begin to decline in the Post Medieval and Early Modern periods.
- 6) Shell middens show more specialisation in the Post Medieval and Early Modern periods.
- 7) Large dog whelk deposits are almost exclusively dated to the Early Medieval period, though smaller deposits of this species are dated to the Mesolithic and Neolithic.

- 8) No deer bones are found within shell midden features following the Early Medieval period.
- 9) Only one shell midden contains sheep/goat as a dominant species south of Doolin Pier, Co. Clare (CE011) on the west and Malahide, Co. Dublin (DU010) on the east.
- 10) Only three shell middens in Northern Ireland contain cockle as a dominant species.

Each time period produced its own patterns of shellfish consumption and midden characteristics, summarised below.

10.1.1 Early Prehistory

Early prehistoric shell midden sites have long been the focus of study for this site type. A great deal of information comes from older sources, potentially influencing the patterns identified. Regardless of when this research was undertaken, the following are the patterns identified for the Mesolithic and Neolithic periods.

- 1) There is a northern bias for oyster as a dominant species within shell middens.
- 2) Lithics and other stone tools are the most common artefact categories in only shell middens followed by fire cracked rocks, and in the case of Neolithic sites, ceramics.
- 3) The most common shell species in order of frequency are winkle, limpet, oyster, dog whelk, mussel, and cockle.
- 4) Fish is the most common non-molluscan animal genus in these shell middens, followed by pig.
- 5) Hazelnuts are the most common plant remain identified in Irish shell middens.
- 6) The average dimensions of early prehistoric shell midden features are: 19.15m long, 5.87m wide, 0.34m thick. The average volume is 86.70m³.

The data suggests that coastal resources were important in Ireland during the late Mesolithic and early Neolithic but were less of a focus in the Late Neolithic. This is probably due to the growing importance of agriculture during the fourth and third millennia BC.

10.1.2 Late Prehistory

There is evidence of a renewed interest in coastal resources and the use of shell middens during the Bronze Age. There are also fewer Iron Age shell-bearing sites than recorded in the preceding Bronze Age or the Early Medieval period that followed. This is, however, partly due to the reduced visibility of Iron Age archaeology in Ireland. There are also issues with radiocarbon dating in this period (Champion *et al.* 2001). The overall patterns identified within the Bronze Age and Iron Age are presented below.

- 1) Three clusters of later prehistoric shell deposition are noted, namely the Ballyconneely peninsula, Co. Galway; Sligo Harbour, Co. Sligo; White Park Bay and Ballintoy, Co. Antrim.
- 2) Stone tools including lithics were the most common artefact category identified followed by ceramics, metal, and objects of bone.
- 3) The most common shell species noted is limpet followed by winkle.
- 4) Cattle is the most common bone identified, followed by pig, sheep/goat, deer, horse, and bird in order of frequency.
- 5) Cereals are the primary plant species identified within late prehistoric shell middens, followed by hazelnut shells.
- 6) The average dimensions of late prehistoric shell midden features are: 23.2m long, 5.8m wide, and 0.5m thick. The average volume was 67.3m³.

A broader use of resources is evident during the Bronze and Iron Ages, with a return to coastal resource deposition noted after a decline in the Late Neolithic and Chalcolithic. This may be due to population increases during the Bronze Age or a desire for more variety in the diet. Some of these middens seem to have taken on a symbolic role as location for human burial and ritual offering (see Chapter 5).

10.1.3 Early Medieval

The Early Medieval period saw a great deal of cultural changes that influenced the role that shellfish played in Ireland for both dietary and industrial purposes. The overall patterns identified in the Early Medieval are presented below.

- 1) There are two clusters of shell midden features, namely Sligo Harbour, Co. Sligo and White Park Bay and Ballintoy, Co. Antrim.

- 2) Stone artefacts including lithics are the most common artefact category identified, followed by ceramics, bone, and metal.
- 3) Limpet is the most common shell species, followed closely by winkle. Other frequent species include oyster and cockle.
- 4) Cattle is the most frequent bone identified within shell middens followed by fish, pig, sheep/goat, horse, bird, deer, and dog.
- 5) Cereals are the primary plant remains identified followed by wild taxa. The use of seaweed has also been identified from this period.
- 6) The average dimensions of Early Medieval shell midden features are 63.1m long, 9.3m wide, and 0.6m thick. The average volume was 740.8m³.

Shell middens of Early Medieval date are often associated with Christianity. This was evidenced by their deposition within the bounds of Christian monuments and by contemporary literature such as that concerning the eating of seafood on days of fast. Shellfish were used not only as a source of food and bait but also for craftworking purposes, such as dying and pearl harvesting.

10.1.4 Late Medieval

Similar trends in shellfish exploitation are evident in the Late Medieval period as seen previously in the Early Medieval, with the addition of Anglo-Norman influence and church reform. The overall patterns identified in the Late Medieval are presented below.

- 1) Ceramics are the most common artefact type found within shell middens. This was followed by stone artefacts including one flaked stone tool, as well as objects made of animal bone.
- 2) The most common bone is that of cattle followed by sheep/goat, pig, fish, and horse.
- 3) Oyster is the most common shell species followed (in order of frequency) by winkle, limpet, cockle, and mussel.
- 4) Three features contained plant remains other than charcoal. All three features had cereals and wild taxa, while one also contained hazelnut shells and fruit remains.
- 5) The average length of Late Medieval shell middens features is 75.4m. The average width is 7.8m. The average thickness is 1.4m. The average volume of these features is 347.7m³.

The Late Medieval period also saw the beginning of industrialisation of shellfish harvesting potentially linked to urbanisation and a growing market economy. Shells were largely associated with pilgrimages at this time, both as a food stuff and a symbol.

10.1.5 Later Developments

As mentioned above, more specialisation occurred in the Post Medieval and Early Modern periods than was previously recorded. Unfortunately, there is less information available for shell middens from these recent centuries. The overall patterns found from the available data for the Post Medieval and Early Modern periods as follows:

- 1) There are two clusters of Post Medieval and Early Modern shell middens in Ireland, namely: Cork Harbour, Co. Cork and Sligo Harbour, Co. Sligo.
- 2) Oyster is the most common shell species in those shell midden features followed in frequency by winkle, limpet, cockle, and mussel.
- 3) Ceramics are the most common artefact, followed by objects of metal and glass.
- 4) The bones identified are primarily of cattle followed by sheep/goat, pig, fish, and bird.
- 5) Post Medieval and Early Modern shell midden features average 16.9m in length, 4.4m in width, and 0.8m in thickness. The average volume is 59.5m³.

The secularisation of much of Irish culture saw fewer religious connections with shell midden features in the Post Medieval and Early Modern periods (see Chapter 8). There is some evidence that farmers collected shell midden material for use as manure (see Chapter 9). Industrialisation of shellfish harvesting was well established at this time, particularly in important harbours such as Cork and Sligo.

10.2 Gaps in Knowledge as a Guide to Future Research

The minimum standards of investigation discussed in Chapter 3 is necessary for future work on shell middens in Ireland. This includes recording of midden location and exposure, dimensions and form, shell species and other environmental material, and cultural material. Other information that could aid in our understanding of shell middens could come from detailed survey, sample and large-scale excavation, dating programmes, and wider environmental analysis.

10.2.1 Gaps in Distribution

There are no known coastal shell middens between Haggardstown, Co. Louth (LH008) and Rush, Co. Dublin (DU001) or further south between Rathdown Upper, Co. Wicklow (WW001) and Townparks, Co. Wexford (WX001). There are also very few sites recorded along coastal lakes, estuaries, and rivers beyond the concentrations recorded around Strangford Lough, Co. Antrim and Lough Swilly, Co. Donegal. This is particularly notable around Lough Foyle, Co. Derry and the River Shannon, Co. Clare and Limerick. Early Medieval written sources suggest that freshwater pearls were collected from the River Dee, Co. Louth and Lough Leane, Co. Kerry, though no freshwater mussel deposits have been recorded near these water bodies (Chapter 6). All of these areas warrant targeted surveys, both terrestrial and underwater, to verify whether or not the absence of sites is a true reflection of the archaeological record.

The south-east coastline of Leinster, covering counties Wicklow and Wexford, the longest stretch of coastline without any known coastal shell midden features, should be particularly targeted with underwater survey. The River Shannon, too, has potential for submerged shell deposition evidence (see section 10.3.1 below). Lough Foyle would benefit more from intensive terrestrial surveys, as would the eastern coastline between Haggardstown and Rush.

10.2.2 Chronology

The dating of shell midden sites is critical for understanding their function. Only 85 sites (with a total of 240 deposits) have been dated in Ireland. Only 20 sites with 33 deposits are dated with multi-proxy evidence from secure, closed contexts within the shell midden features (date ranked A within Catalogue). There are very few shell middens with multiple scientific dates. Only 27 sites have more than one radiocarbon date, while only ten of the 39 with one date have other dating evidence. Due to the nature of shell deposition, intra-site chronology is just as critical to furthering our understanding of these sites. With more dated sites, the potential trends established in Chapter 8 may be further supported or questioned, improving our ability to interpret these sites.

Potential avenues for understanding inter-site chronologies include macro studies of lithographic stratigraphy, close recording of changes in artefact density, surveying magnetic property changes, degrees of weathering, and chemical variation along with

changes in the fauna/flora content (Burenhult 1984, 195; Stein 1992, 71–3; Woodman *et al.* 1999, 101–8). These stratigraphic interpretations should not be limited to vertical layers, but also include horizontal depositional periods. Samples of radiocarbon dates from vertical spits and similarly chosen horizontal sections can allow for inter-site dating where traditional stratigraphic separations are difficult to determine. Micro-stratigraphy can also aid in identifying stratigraphy on sites which are more difficult to discern through standard survey. This analysis can also more securely differentiate between contexts with the capability of better understanding possible disturbance (Matthews *et al.* 1997; Mallol and Mentzer 2017). Such analysis has been used to interpret shell-bearing sites in Tierra del Fuego (Vila *et al.* 2009), Portugal (Duarte *et al.* 2019), and is currently being conducted as part of an analysis of shell middens in Sligo (*pers. comm.* Rory Connolly).

There are several dating techniques that have not been utilised in Irish shell midden research which may aid in checking radiocarbon analysis, especially where the marine reservoir effect may skew results, and dating estimates based on artefactual evidence. These include Uranium-Series dating, Optically Stimulated Luminescence (OSL), and thermoluminescence. Thus far, no appropriate wood samples have been uncovered from shell midden features to allow for the use of dendrochronology. Uranium-Series dating can be used to date marine shells, though it loses applicability for sites younger than 1000 years old. OSL and thermoluminescence dating can date pottery sherds and the most frequent find in shell middens, namely fire cracked rocks.

Seasonality studies are another important area of research that has not been undertaken at many Irish shell middens. This can use the presence or absence of different seasonal indicators, such as foetal pig bones or migratory bird species. Fish bones, namely otoliths, and scales can also be used as seasonal indicators, with the study of growth patterns. Similarly, many shell species, such as mussels, have growth lines which can indicate season of death. Stable isotope analysis is one of the most accurate methods for determining the season of use on a site. Stable oxygen isotope analysis has considerable potential because the ratio of ^{18}O and ^{16}O within a shell directly reflects the water temperature at the time of incremental growth (Monks 1981, 215; Waselkov 1987, 163; Mannino *et al.* 2003, 668).

10.2.3 Environmental Reconstruction

As with seasonality, environmental reconstruction of shell midden sites has only been attempted in a few Irish studies (such as Burenhult 1984; Woodman *et al.* 1999). These reconstructions are typically based on site-specific data, such as the species identified within the shell deposits and local landscape setting. Local pollen records and site data from similarly aged sites nearby are rarely available. Reconstruction of the palaeo-landscape is also usually only done on a generalised level, with lower sea level assumed, whereas climate and the influences of contemporary plants and animals on the landscape are not considered. Pollen diagrams can aid in the latter. Knowledge about how the landscape once looked around these sites may help in developing estimates for site loss in the future (section 10.3).

Flotation and fine sieving of site samples can also assist in the environmental reconstruction as it can increase the amount of plant remains recorded on sites which may otherwise be overlooked. Finally, isotopic analysis and trace elements such as $\delta^{18}\text{O}$, $\delta^{13}\text{C}$, magnesium, and strontium can assist with climatic reconstruction. This can include water temperature, humidity, and plant productivity. These can all be analysed using molluscan samples from securely excavated contexts (Pérez *et al.* 2020).

10.3 Heritage Under Threat

As discussed in Chapter 3, coastal heritage is some of the most vulnerable to natural erosion, especially in shorelines of unconsolidated drift and sand dunes, which often includes the location of shell middens. Factors here include isostatic shift, global sea level rise due to climate change, increases in storm frequency and intensity, human developments such as extraction and construction, ocean acidification, and shifts in currents. Many environmental and heritage agencies around the world have now acknowledged that coastal erosion, in particular that caused by climate change is an area of concern. This has led to many attempts to fight these factors and to address them immediately.

Coastal heritage, however, cannot completely be saved. Some engineering designed to protect inhabited coastal areas, such as seawalls and beach feeding, may protect some areas from flooding while causing erosion elsewhere on the shoreline. The best option for preserving coastal shell-bearing sites is to educate the public about their

importance and so reduce human interference and to record as much as is possible before sites are lost through natural processes.

10.3.1 Surveys and Data Acquisition

To understand the destruction caused to shell middens by natural agencies, the duration and extent of each impact type needs to be fully understood. These are determined through physical observations, measurements, and descriptions of the sites affected. Coastal and intertidal archaeological sites are often only identified after they have been exposed through erosion (Milner 2012, 226). Once exposed, ideally they should be recorded and excavated as soon as possible due to the potential for their rapid destruction.

Conventional surveys, as conducted for this thesis, are an important step in the acquisition of data concerning shell-bearing sites. These baseline surveys need to be undertaken consistently to a high standard so that the minimum amount of data is collected for every site. These should record shell species, inclusions, dimensions, and details of location. Efforts should also be made to monitor the shoreline across Ireland in order to identify new sites, even in areas where shell middens may not be expected, such as the south-east coastline. Some recent initiatives have sought to increase the recording of coastal heritage in Ireland. These include MASC (Monitoring the Archaeology of Sligo's Coastline) which published its findings in 2019 and the CHERISH (Climate, Heritage, and Environments of Reefs, Islands, and Headlands) project which is scheduled to conclude in June 2023. The former was based in Sligo primarily as a community project while the CHERISH study focused on the south and east coasts of Ireland and targeted specific areas of known archaeological significance with no known shell middens chosen or new shell middens recorded. Another project, PRISM (Preservation by Record of Ireland's Shell Middens), is set to launch in 2023 as a community driven project focused on shell midden sites specifically around the Irish coast, not including Northern Ireland.

The CHERISH project has utilised different surveying techniques outside of the standard recording practices such as aerial and marine surveys, geophysical surveys, and underwater surveys along with other archaeological analysis such as coring and rescue excavation. These are all potential survey techniques for shell middens as well (as seen in Stein 1992; Napora *et al.* 2019).

Underwater surveys have increased the available data for shell-bearing sites around the world, including the Gulf of Mexico, Denmark, and Australia. Thus far, no shell-bearing site has been researched using underwater surveys in Ireland, though other sites have been identified around the Irish coast including prehistoric sites such as fish traps, a small occupation site, submerged megaliths, and numerous artefact findspots (SPLASHCOS-Network 2013). Numerous areas of submerged forests and peat deposits have also been identified, potentially indicating preservation potential of archaeological evidence (Westley and Edwards 2017, 268–70; Westley and Woodman 2020, 221). Areas with the most potential for the preservation of submerged archaeology are those with less potential for glacial till deposition and near rivers (Emery and Edwards 1966, 733). In Ireland, this includes the south-east coast and the west/south-west near the River Shannon. The sea level in these areas have risen approximately 25m in the last 10,000 years (Brooks *et al.* 2008; Bradley *et al.* 2011; Kuchar *et al.* 2012). Both of these areas, specifically the south-east, also do not have many recorded sites, possibly due to the presence of such sites lying off of the modern coast.

While there is not as much potential in the north-west, east, and south-west, all of these areas have submerged landscapes. The north-west and east were covered by ice throughout most of the last Ice Age. The south-west, however, was uncovered after approximately 19,000 or 18,000 years ago depending on the model used (Brooks *et al.* 2008, 177; Bradley *et al.* 2011, 546). The north-west and east were approximately 15m below current sea level 10,000 years ago while the south-west was 30m below current sea level. The south-west, therefore, has the most potential of these three regions, though erosion is likely to have destroyed many sites in this dynamic Atlantic environment. The north of Ireland has a sea level almost equal to today 10,000 years ago and is the least likely region to have submerged sites.

Underwater surveys have the potential of increasing the known number of shell midden features around Ireland, especially where there are few sites known in the south-east and near the Shannon River and where there is known submersion of early prehistoric sites in the southwest (see Chapter 3). Beyond discovering new shell middens, the combination of terrestrial archaeology and underwater archaeology allows for a more comprehensive understanding of the paleoenvironment. The importance of combining coastal and submerged data, specifically in relation to middens, was stressed by Bailey and Hardy (2021).

10.3.2 Preservation by Record and by Education

As mentioned above, the best way to address the loss of shell midden site data is by recording as much data as possible prior to the loss of sites, and through educating the public as to the heritage significance of these sites. Public outreach is built into any recent archaeological site investigations in Ireland. Similar programmes are also becoming common as part of research initiatives such as training excavations. As this trend continues, the public may better understand why heritage sites, including coastal shell-bearing sites, are an important part of Irish history and how they can assist with understanding these sites through reporting and continued interest.

Targeted investigations of particularly vulnerable sites by specialists are critical. Methods such as those used on the CHERISH project can be applied to understand site loss in order to establish their state of vulnerability. The more data we can retrieve in terms of dating, intra-site chronology and seasonality, environmental reconstruction, and site content, the better these at-risk sites can be characterised and contextualised before they are permanently lost. While on-site surveys have been stressed here, further excavation, especially where erosion is an imminent threat, is a necessary action, as is the recording of deposits through coring or block sampling. Preservation *in situ*, while a valued goal of modern archaeology, is only a short-term solution for coastal shell middens as continual erosional forces ensure that their survivability is under imminent threat. Where possible, a ‘triage’ approach to excavation should be taken in order to target the most vulnerable sites first. To preserve this important information on past human interaction with the coast, it is necessary for Irish shell midden research to follow the trends seen on the international stage with increased survey and scientific investigation.

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Introduction to Appendices

The following appendices include a table of shell species nomenclature, a table radiocarbon dating information, and a table of locational information for all known shell middens in Ireland. The table of location information includes the following categories: the catalogue number, the associated midden Sites and Monuments Record (SMR or NISMR) number, Irish Transverse Mercator (ITM) coordinates, the accuracy of these coordinates, and the townland, parish, barony, and county of the sites. SMR numbers are only included for midden deposits which have a unique identifier beyond any potentially related site type (for instance, KY020 is related to ringfort – rath KE028-028---, but as the midden itself has no identifier, no SMR number is included; GA069 is related to cliff-edge fort GA110-039—, but two midden SMR numbers are also related to the site and therefore included in the table: GA110-039029- and GA110-039031-). SMR numbers were also included for Northern Irish sites if the number indicated a habitation or occupation settlement related to the midden. Parish and Barony information was retrieved from OpenStreetMap data available on the Irish Townlands website, townlands.ie. Where Global Positioning System (GPS) coordinates or National Grid Reference (NGR) coordinates were recorded for sites, the OSI/OSNI enabled FieldenMaps website was used to convert them to ITM coordinates. Where no coordinates were available for sites, locational descriptions were used to estimate the location as indicated in the Accuracy column of the table.

Entries in the radiocarbon dating table vary in detail depending on the availability of relevant information. Some sites have only published calibrated dates, some are from unknown deposits or are taken from unknown materials, some have no associated lab numbers, and even fewer have associated δC^{13} values. Where the material sampled is known, very few charcoal samples indicate the wood species. Where this information is known, it is included in the table. The deposit ID is given for each sample. Most dates are derived directly from the midden deposits. Lab numbers are followed by uncalibrated radiocarbon ages and uncertainty (BP). All raw dates were recalibrated by the author using the IntCal20 or Marine20 radiocarbon curves using OxCal v. 4.4. The marine reservoir affect was corrected for using the weighted mean ΔR of -148 ± 35 based on six values stored in the CHRONO Marine Reservoir Database from near the Irish coast. (Harkness 1983).

Appendix 1: Shell Species Nomenclature

Shell middens are usually dominated by edible molluscs such as oysters, mussels, cockles, and whelks (McMillan 1973, 9). In Ireland, the six dominant shell types found in middens are oyster (*Ostrea edulis*), mussel (*Mytilus edulis*), cockle (*Cerastoderma edule*), whelk (*Buccinum undatum*), limpet (*Patella vulgate*), and winkle/periwinkle (*Littorina littorea*) (McErlean *et al.* 2003, 186). *Lutraria lutraria*, or Otter Shells, are also associated with Irish middens (McMillan 1973, 9 and 11).

Below, the authoritative scientific names (Hayward and Ryland 1990; Abbott and Dance 1991) are given first followed by other synonymous and outdated scientific names used in publications. Common names in both English and Irish are then given (Irish names are based on the Schools' Collection 2018 volumes 0133, 0308, 1073, and 1075). Of the 104 excavated shell middens identified in Howle 2017, 44 did not publish information on shell species. Many of the reports that have been published use the common names rather than the scientific names of shell species. This can cause confusion when common names are applicable to different species (Colley 2005, 72). For instance, 'dog whelk' could refer to either *Nassarius reticulatus* or *Nucella lapillus* but is most often used to refer to the latter. The common name of 'whelk' can also refer to these dog whelks or to *Buccinum undatum*. Dr Sarah Colley of the University of Leicester called for systematic coding of shell species with reference to scientific nomenclature as well as cultural nomenclature. While genus and species allow accurate differentiation between each shell type, cultural typologies aid in interpretation (*ibid.*). The following chart combines scientific and cultural typologies and is based on Murray 1999 and Howle 2017.

Authoritative Nomenclature	Old Nomenclature/ Synonym	Common Name (English)	Common Name (Irish)
<i>Aequipecten opercularis</i>	<i>Pecten/Chlamys opercularis</i>	Queen Scallop	<i>Cluasóg</i> or <i>Clúaisín</i>
<i>Anomia ephippium</i>	—	Saddle Oyster/ Shingle Shell	—
<i>Arcopagia crassa</i>	<i>Tellina crassa</i>	Blunt Tellin	—
<i>Arctica islandica</i>	<i>Cyprina islandica</i>	Ocean Quahog	—
<i>Bittium reticulatum</i>	—	Small Needle Whelk	—
<i>Buccinum undatum</i>	—	Whelk	<i>Faochóg choirn</i> or <i>Sileóg</i>
<i>Cardium echinatum</i>	—	Prickly Cockle	—
<i>Cerastoderma edule</i>	<i>Cardium edule</i>	Cockle	<i>Rúacan</i> , <i>Sruatan</i> , or <i>Ruarcán</i>
<i>Chamelea gallina</i>	<i>Venus striatula/gallina</i>	Striped Venus	—
<i>Donax vittatus</i>	—	Banded Wedge Shell	—
<i>Dosinia exoleta</i>	—	Rayed Artemis	—
<i>Ensis ensis</i>	<i>Solen ensis</i>	Razor Shell	<i>Sligeán mhara</i> or <i>Scian barrail</i>
<i>Gibbula cineraria</i>	<i>Trochus cinaria</i>	Grey Top Shell	—
<i>Gibbula magus</i>	<i>Trochus magus</i>	Great Top Shell	—
<i>Gibbula umbilicalis</i>	—	Flat Top Shell	—
<i>Glycymeris glycymeris</i>	—	Dog Cockle/ Comb-shell	—
<i>Helcion pellucidum laevis</i>	<i>Patina pellucidum laevis</i>	Blue-rayed Limpet	—
<i>Hinia reticulata</i>	<i>Nassarius/Nassa reticulata</i>	Netted Dog Whelk	—
<i>Janthina janthina</i>	—	Violet Snail	—
<i>Laevicardium crissum</i>	<i>Cardium norvegicum</i>	Norwegian Egg Cockle	—
<i>Littorina littorea</i>	—	Winkle/ Periwinkle	<i>Faochóg</i> or <i>Futhóg</i>
<i>Littorina obtusata</i>	<i>Littorina littoralis</i>	Flat Winkle	—
<i>Littorina saxatilis</i>	—	Rough Winkle	—
<i>Lutraria lutraria</i>	<i>Lutraria elliptica</i>	Otter Shell	—
<i>Macridae</i> sp.	—	Trough Shell	—
<i>Mimachlamys varia</i>	<i>Chlamys varia</i> <i>Pecten varius</i>	Variegated Scallop	—
<i>Monodonta lineata</i>	<i>Trochus lineatus</i>	Thick Top Shell	—
<i>Mya arenaria</i>	—	Sand Gaper	—
<i>Mytilus edulis</i>	—	Mussel	<i>Dúilicín</i> , <i>Sliagan dubh</i> , or <i>Sligeán dubh</i>
<i>Neptunea antiqua</i>	<i>Fusus antiquus</i>	Red Whelk	—
<i>Nucella lapillus</i>	<i>Purpura/Bracinum/Thais lapillus/capillus</i>	Dog Whelk	<i>Faochóg mhadairdh</i>
<i>Ocenebra erinacea</i>	<i>Murex erinaceus</i>	Native Sting Winkle	—
<i>Ostrea edulis</i>	—	Oyster	<i>Oisreach</i>
<i>Paphia pullastra</i>	<i>Venerupis pullastra</i>	Golden Venus	—
<i>Patella vulgata</i>	<i>Patella vulgaris</i>	Limpet	<i>Báirneach</i>
<i>Pecten maximus</i>	—	Great Scallop	—
<i>Phalium</i> sp.	—	Bonnet Snail	—
<i>Polititapes aureus</i>	<i>Paphia/Tapes/Venerupis aurea</i>	Golden Venus	—
<i>Polititapes rhomboides</i>	<i>Paphia/Venerupis rhomboides</i>	Banded Venus	—
<i>Semibalanus balanoides</i>	<i>Balanus balanoides</i>	Rock Barnacles	<i>Giúrainn</i>
<i>Spisula subtruncata</i>	<i>Mactra subtruncata</i>	Cut Through Shell	—
<i>Steromphala pennanti</i>	<i>Gibbula pennanti</i>	Pennant's Top Shell	—
<i>Tapes decussatus</i>	<i>Venerupis/ Paphia/ Pullastra decussata</i>	Grooved Carpet Shell	—
<i>Travia monachia</i>	—	Cowrie/ Nun/ Groat/ Grottie-buckie	—
<i>Turritella communis</i>	—	Auger Shell/ Tower Shell	—
<i>Varicorbula gibba</i>	<i>Aloidis/Corbula gibba</i>	European Clam	—

Appendix 2: Radiocarbon Dates of Irish Shell Middens

Deposit ID	Site Name, Townland	County	Lab #	Raw Date	±	C13 %	Sample Material	Date (1σ)	Date (2σ)	Curve	LOC
AN002H	Potter's Cave, Ballintoy Demesne	Antrim	UBA-6709	1747	33	-27	charcoal	248–354 AD	241–402 AD	IntCal20	B
AN002H	Potter's Cave, Ballintoy Demesne	Antrim	UBA-6708	2454	34	-22.6	pig bone	749–423 BC	756–413 BC	IntCal20	B
AN002H	Potter's Cave, Ballintoy Demesne	Antrim	UBA-6707	2502	35	-27.4	charcoal	768–550 BC	786–490 BC	IntCal20	B
AN005	The Moat, Minnis North	Antrim	UB-3537	1244	55	—	human bone	682–875 AD	660–941 AD	IntCal20	C
AN013B	Boat Cave, Ballintoy Demesne	Antrim	UBA-6710	1854	32	-18.3	human bone	130–234 AD	86–306 AD	IntCal20	B
CE002	Fanore More	Clare	UBA-24385	4966	30	—	hazelnut	3775–3658 BC	3890–3650 BC	IntCal20	A
CE002	Fanore More	Clare	UBA-24389	5043	34	—	hazelnut	3944–3785 BC	3954–3714 BC	IntCal20	A
CE002	Fanore More	Clare	UBA-24380	5061	36	—	hazelnut	3945–3800 BC	3961–3769 BC	IntCal20	A
CE002	Fanore More	Clare	UBA-24388	5105	32	—	hazelnut	3962–3810 BC	3976–3798 BC	IntCal20	A
CE002	Fanore More	Clare	UBA-24379	5106	32	—	hazelnut	3963–3810 BC	3976–3799 BC	IntCal20	A
CE002	Fanore More	Clare	—	5108	42	-30.6	hazelnut	3968–3806 BC	3986–3791 BC	IntCal20	A
CE002	Fanore More	Clare	UBA-24383	5115	37	—	hazelnut	3971–3809 BC	3986–3797 BC	IntCal20	A
CE002	Fanore More	Clare	UBA-24381	5139	32	—	hazelnut	3985–3817 BC	4041–3804 BC	IntCal20	A
CE002	Fanore More	Clare	UBA-24384	5151	30	—	hazelnut	4036–3948 BC	4044–3809 BC	IntCal20	A
CE002	Fanore More	Clare	UBA-24378	5187	33	—	hazelnut	4041–3936 BC	4157–3949 BC	IntCal20	A
CE002	Fanore More	Clare	UBA-24387	5217	36	—	hazelnut	4048–3978 BC	4224–3957 BC	IntCal20	A
CE002	Fanore More	Clare	UBA-24382	5242	37	—	hazelnut	4215–3983 BC	4229–3971 BC	IntCal20	A
CE002	Fanore More	Clare	UBA-24386	5386	37	—	hazelnut	4329–4172 BC	4338–4058 BC	IntCal20	A
CE002	Fanore More	Clare	—	5449	53	0.4	limpet	3942–3745 BC	4025–3641 BC	Marine20	A
CE002	Fanore More	Clare	—	5511	44	4.3	winkle	3991–3796 BC	4107–3699 BC	Marine20	A
CE003	Fanore More	Clare	UBA-23429	6294	33	—	winkle	4850–4661 BC	4945–4560 BC	Marine20	A
CE003	Fanore More	Clare	UBA-23430	6305	35	—	winkle	4866–4676 BC	4850–4661 BC	Marine20	A
CE003	Fanore More	Clare	UBA-23428	6314	37	—	limpet	4877–4686 BC	4976–4586 BC	Marine20	A
CE011E	Doolin Pier, Ballaghaline	Clare	SUERC-61188 (GU37956)	2451	29	-25.0	charred barley	747–423 BC	754–413 BC	IntCal20	C

Appendix 2: Radiocarbon Dates of Irish Shell Middens

Deposit ID	Site Name, Townland	County	Lab #	Raw Date	±	C13 %	Sample Material	Date (1σ)	Date (2σ)	Curve	LOC
CO006	Brown Island, Ballintubbrid West	Cork	BETA-155384	1050	50	—	oyster	1282–1419 AD	1198–1483 AD	Marine20	C
CO006	Brown Island, Ballintubbrid West	Cork	BETA-155385	2000	50	—	oyster	280–480 AD	207–590 AD	Marine20	C
CO007	Brown Island, Ballintubbrid West	Cork	BETA-161650	300	50	—	oyster	1881–'1953' AD	1800–'1953' AD	Marine20	C
CO010	Currabally	Cork	BETA-155383	1150	50	—	oyster	1174–1335 AD	1082–1412 AD	Marine20	C
CO012	Ashgrove/Ballyellane	Cork	BETA-175809	730	60	—	oyster	1509–1689 AD	1448–1810 AD	Marine20	D
CO013	Rathcoursey East	Cork	BETA-161649	1050	50	—	oyster	1282–1419 AD	1198–1483 AD	Marine20	C
CO018	Curraghbinny	Cork	BETA-155382	990	50	—	oyster	1318–1453 AD	1250–1533 AD	Marine20	C
CO023	Rostellan	Cork	BETA-155381	290	50	—	oyster	1883–'1953' AD	1806–'1953' AD	Marine20	C
CO030	Poul Gorm, Monteensudder	Cork	Q	2120	50	—	charcoal	334–53 BC	356 BC–7 AD	IntCal20	A
CO030	Poul Gorm, Monteensudder	Cork	Q	2510	80	—	charcoal	786–542 BC	798–416 BC	IntCal20	A
CO030	Poul Gorm, Monteensudder	Cork	Q	2610	10	—	shell	433–253 BC	531–177 BC	Marine20	A
CO030	Poul Gorm, Monteensudder	Cork	Q	3040	60	—	shell	977–782 BC	1116–693 BC	Marine20	A
DL022	An Charraig Fhinn	Donegal	UB-3616	832	35	—	—	1180–1262 AD	1161–1273 AD	IntCal20	B
DL022	An Charraig Fhinn	Donegal	UB-3615	879	35	—	—	1054–1220 AD	1043–1257 AD	IntCal20	B
DL022	An Charraig Fhinn	Donegal	UB-3617	1018	36	—	—	991–1117 AD	901–1155 AD	IntCal20	B
DL026	Tievebane	Donegal	BETA-155376	3930	50	—	oyster	2101–1881 BC	2201–1754 BC	Marine20	D
DL027A	Baylet	Donegal	BETA-151927	4940	70	—	shells	3404–3136 BC	3518–3016 BC	Marine20	B
DL027A	Baylet	Donegal	UB-4716	5655	40	—	hazelnut	4539–4449 BC	4597–4363 BC	IntCal20	B
DL027A	Baylet	Donegal	BETA-151926	6060	80	—	shells	4606–4368 BC	4732–4267 BC	Marine20	B
DL027A	Baylet	Donegal	UB-4714	6065	40	—	hazelnut	5032–4906 BC	5204–4842 BC	IntCal20	B
DL027A	Baylet	Donegal	GrA-21490	6450	50	—	pig bone	5474–5376 BC	5510–5313 BC	IntCal20	B
DL028	An Machaire Beag	Donegal	BETA-161645	3450	70	—	oyster	1495–1266 BC	1613–1138 BC	Marine20	C
DL028	An Machaire Beag	Donegal	BETA-161644	5000	80	—	oyster	3506–3242 BC	3607–3087 BC	Marine20	C
DL031	Ballymoney	Donegal	BETA-151925	5510	80	—	oyster	4026–3779 BC	4156–3656 BC	Marine20	B

Appendix 2: Radiocarbon Dates of Irish Shell Middens

Deposit ID	Site Name, Townland	County	Lab #	Raw Date	±	C13 %	Sample Material	Date (1σ)	Date (2σ)	Curve	LOC
DL031	Ballymoney	Donegal	BETA-161646	5970	80	—	winkle	4522–4295 BC	4652–4177 BC	Marine20	B
DL031	Ballymoney	Donegal	BETA-161647	6190	60	—	oyster	4744–4526 BC	4856–4420 BC	Marine20	B
DL032	Castlequarter	Donegal	BETA-155379	5360	60	—	oyster	3843–3636 BC	3949–3548 BC	Marine20	C
DL037	Drumboy	Donegal	BETA-155378	5160	60	—	oyster	3632–3433 BC	3727–3334 BC	Marine20	C
DL040	Dooley, An Dumhaigh	Donegal	UB-4215	1803	36	—	dog whelk	530–683 AD	436–756 AD	Marine20	B
DL053A	Rinnaraw	Donegal	GrN-19756	1160	35	—	charcoal	776–956 AD	773–979 AD	IntCal20	C
DL053B	Rinnaraw	Donegal	GrN-18079	790	50	—	shell	1480–1639 AD	1408–1719 AD	Marine20	C
DL053B	Rinnaraw	Donegal	GrN-18078	910	50	—	shell	1378–1533 AD	1311–1625 AD	Marine20	C
DU006A	Sutton, Burrow	Dublin	I-5067	5250	100	—	charcoal	4233–3972 BC	4332–3806 BC	IntCal20	B
DU006A	Sutton, Burrow	Dublin	OxA-3960	6560	75	-23.5	cattle bone	5617–5473 BC	5628–5373 BC	IntCal20	B
DU006A	Sutton, Burrow	Dublin	OxA-3691	6660	80	-20.5	cattle bone	5636–5484 BC	5716–5477 BC	IntCal20	B
DU006A	Sutton, Burrow	Dublin	OxA-4449	7140	100	-19.5	pig bone	6087–5887 BC	6227–5803 BC	IntCal20	B
DU009B	Dalkey Island	Dublin	OxA-4567	3050	70	-22.9	cattle bone	1405–1222 BC	1493–1060 BC	IntCal20	A
DU009B	Dalkey Island	Dublin	OxA-4566	5050	90	-19.6	sheep bone	3956–3715 BC	4039–3647 BC	IntCal20	A
DU009B	Dalkey Island	Dublin	OxA-4568	6870	90	-19.2	pig bone	5841–5666 BC	5977–5624 BC	IntCal20	A
DU009D	Dalkey Island	Dublin	OxA-4571	4820	75	-21.4	cattle bone	3700–3519 BC	3768–3376 BC	IntCal20	A
DU009D	Dalkey Island	Dublin	D-38	5290	170	—	charcoal	4329–3963 BC	4452–3711 BC	IntCal20	A
DU009D	Dalkey Island	Dublin	OxA-4570	5600	80	-20.2	pig bone	4500–4351 BC	4658–4266 BC	IntCal20	A
DU009D	Dalkey Island	Dublin	OxA-4572	6410	110	-11.4	seal bone	5038–4730 BC	5203–4596 BC	Marine20	A
DU009D	Dalkey Island	Dublin	OxA-4569	7250	100	-13.9	seal bone	5854–5614 BC	5976–5504 BC	Marine20	A
DW002	Ringneill	Down	Q-635	2660	110	—	shell	597–249 BC	755–114 BC	Marine20	A
DW002	Ringneill	Down	Q-770	5380	120	—	charcoal	4338–4055 BC	4448–3969 BC	IntCal20	A
DW036	Kilnatierny	Down	UBA-15059	995	22	—	<i>Avena</i>	997–1121 AD	993–1152 AD	IntCal20	B
DW036	Kilnatierny	Down	UBA-15058	1118	12	—	<i>Hordeum</i>	894–977 AD	891–987 AD	IntCal20	B

Appendix 2: Radiocarbon Dates of Irish Shell Middens

Deposit ID	Site Name, Townland	County	Lab #	Raw Date	±	C13 %	Sample Material	Date (1σ)	Date (2σ)	Curve	LOC
DW036	Kilnatierny	Down	UB-6835	5365	36	—	bone	4323–4069 BC	4330–4054 BC	IntCal20	B
DW036	Kilnatierny	Down	UBA-10232	5810	22	—	oyster	4324–4160 BC	4384–4046 BC	Marine20	B
DW036	Kilnatierny	Down	UBA-10233	5911	38	—	oyster	4426–4256 BC	4519–4162 BC	Marine20	B
DW036	Kilnatierny	Down	UBA-10231	6045	22	—	oyster	4554–4380 BC	4655–4323 BC	Marine20	B
DY001	Oughtymore	Derry	UB-2442	1295	40	—	charcoal	668–772 AD	654–822 AD	IntCal20	A
DY002	Ballymulholland	Derry	UB-3076	2202	35	—	bone	359–198 BC	379–171 BC	IntCal20	B
GA004	Tully Beg	Galway	UBA-8883	5783	47	—	winkle	4312–4117 BC	4370–3994 BC	Marine20	C
GA004	Tully Beg	Galway	UBA-10230	6021	39	—	winkle	4532–4355 BC	4648–4287 BC	Marine20	C
GA005B	Culfin	Galway	UB-7203	2086	34	—	hazeulnut	151–49 BC	197 BC–8 AD	IntCal20	C
GA022C	MN1, Mannin Beg	Galway	—	2303	21	—	charcoal	400–377 BC	405–234 BC	IntCal20	C
GA022D	MN4, Mannin Beg	Galway	UB-3664	757	18	—	shell	1513–1654 AD	1446–1723 AD	Marine20	D
GA027A	DL1, Doonloughan,	Galway	—	3587	36	—	charcoal	2013–1892 BC	2035–1778 BC	IntCal20	B
GA027C	DL3, Doonloughan	Galway	UB-3640	1205	26	—	charcoal	784–877 AD	707–890 AD	IntCal20	A
GA027C	DL3, Doonloughan	Galway	SUERC-1085	1220	35	—	charred grain	784–878 AD	680–890 AD	IntCal20	A
GA027C	DL3, Doonloughan	Galway	SUERC-1086	1225	35	—	charred grain	708–877 AD	680–888 AD	IntCal20	A
GA027C	DL3, Doonloughan	Galway	SUERC-1087	1280	35	—	charred grain	676–771 AD	660–826 AD	IntCal20	A
GA027C	DL3, Doonloughan	Galway	SUERC-1080	1335	35	—	charred grain	653–772 AD	645–775 AD	IntCal20	A
GA027C	DL3, Doonloughan	Galway	SUERC-1089/3545	1515	40	—	shell	811–986 AD	714–1049 AD	Marine20	A
GA027C	DL3, Doonloughan	Galway	SUERC-1090/3190	1531	34	—	shell	791–964 AD	711–1031 AD	Marine20	A
GA027C	DL3, Doonloughan	Galway	SUERC-3188	1605	35	—	shell	713–878 AD	659–970 AD	Marine20	A
GA027E	DL11, Doonloughan	Galway	SUERC-1847	1215	35	—	charred grain	783–880 AD	681–939 AD	IntCal20	B
GA027E	DL11, Doonloughan	Galway	UB-7053	1244	33	—	sheep bone	685–828 AD	676–880 AD	IntCal20	B

Appendix 2: Radiocarbon Dates of Irish Shell Middens

Deposit ID	Site Name, Townland	County	Lab #	Raw Date	±	C13 %	Sample Material	Date (1σ)	Date (2σ)	Curve	LOC
GA027E	DL11, Doonloughan	Galway	SUERC-1842	1245	50	—	charred grain	682–873 AD	666–888 AD	IntCal20	B
GA027E	DL11, Doonloughan	Galway	SUERC-1848	1260	35	—	charred grain	678–819 AD	667–877 AD	IntCal20	B
GA027E	DL11, Doonloughan	Galway	UB-4317	1276	30	—	charcoal	680–770 AD	664–822 AD	IntCal20	B
GA027E	DL11, Doonloughan	Galway	SUERC-1849	1325	35	—	charred grain	657–772 AD	650–775 AD	IntCal20	B
GA027E	DL11, Doonloughan	Galway	UB-4324	1524	23	—	winkle	806–970 AD	723–1032 AD	Marine20	B
GA027E	DL11, Doonloughan	Galway	SUERC-1854	1535	35	—	shell	787–960 AD	706–1030 AD	Marine20	B
GA027E	DL11, Doonloughan	Galway	SUERC-1853	1545	40	—	shell	778–955 AD	695–1025 AD	Marine20	B
GA027E	DL11, Doonloughan	Galway	SUERC-1850	1590	35	—	shell	724–892 AD	670–981 AD	Marine20	B
GA027E	DL11, Doonloughan	Galway	SUERC-1852	1595	40	—	shell	718–889 AD	664–983 AD	Marine20	B
GA027E	DL11, Doonloughan	Galway	UB-4327	1600	30	—	limpet	720–880 AD	665–969 AD	Marine20	B
GA027E	DL11, Doonloughan	Galway	UB-4325	1819	30	—	shell	518–667 AD	425–726 AD	Marine20	B
GA027F	DL9, Doonloughan	Galway	UB-4002	1780	35	—	dog whelk	551–701 AD	457–778 AD	Marine20	B
GA032B	MN2, Mannin More	Galway	—	2503	30	—	shell	334–149 BC	386–43 BC	Marine20	C
GA032B	MN2, Mannin More	Galway	—	2799	28	—	charcoal	991–911 BC	1043–842 BC	IntCal20	C
GA050	Seaweed Point, Knocknacarragh	Galway	—	2560	110	—	—	816–521 BC	907–403 BC	IntCal20	C
GA069C	Dún Aonghasa, Cill Mhuirbhígh	Galway	GrN-22166	2770	60	-25.9	charred twigs	983–834 BC	1105–806 BC	IntCal20	B
GA069E	Dún Aonghasa, Cill Mhuirbhígh	Galway	GrN-22731	2810	30	-21.2	bone	1002–926 BC	1050–849 BC	IntCal20	A
GA069F	Dún Aonghasa, Cill Mhuirbhígh	Galway	GrN-20229	2955	25	-21.3	bone	1214–1125 BC	1260–1055 BC	IntCal20	B
GA069G	Dún Aonghasa, Cill Mhuirbhígh	Galway	GrN-20227	2870	35	-21.2	bone	1116–997 BC	1193–927 BC	IntCal20	B

Appendix 2: Radiocarbon Dates of Irish Shell Middens

Deposit ID	Site Name, Townland	County	Lab #	Raw Date	±	C13 %	Sample Material	Date (1σ)	Date (2σ)	Curve	LOC
GA069H	Dún Aonghasa, Cill Mhuirbhígh	Galway	GrN-20226	2840	25	-21.3	bone	1045–932 BC	1108–917 BC	IntCal20	B
GA069I	Dún Aonghasa, Cill Mhuirbhígh	Galway	GrA-902	2475	35	-22.3	human bone	755–541 BC	770–421 BC	IntCal20	B
GA069J	Dún Aonghasa, Cill Mhuirbhígh	Galway	GrN-20231	3165	30	-21.1	bone	1495–1414 BC	1503–1326 BC	IntCal20	B
GA074A	Rathgurreen, Cottage	Galway	UB-4331	1925	30	0.9	dog whelk	404–569 AD	316–645 AD	Marine20	A
GA074C	Rathgurreen, Cottage	Galway	UB-4323	1275	36	-22.5	bone	679–771 AD	661–872 AD	IntCal20	B
KY030A	Ferriter's Cove, An Baile Uachtarach Theas	Kerry	BM-2227R	5400	220	—	charcoal	4451–3981 BC	4717–3712 BC	IntCal20	A
KY030A	Ferriter's Cove, An Baile Uachtarach Theas	Kerry	BM-2227AR	5420	150	—	charcoal	4440–4050 BC	4602–3951 BC	IntCal20	A
KY030B	Ferriter's Cove, An Baile Uachtarach Theas	Kerry	Q-2641	5245	55	—	charcoal	4223–3980 BC	4239–3961 BC	IntCal20	A
KY030B	Ferriter's Cove, An Baile Uachtarach Theas	Kerry	Q-2634	5680	70	—	shell	4610–4406 BC	4685–4361 BC	IntCal20	A
KY030C	Ferriter's Cove, An Baile Uachtarach Theas	Kerry	OxA-4918	5545	65	-14	human bone	4447–4343 BC	4536–4257 BC	IntCal20	A
KY030C	Ferriter's Cove, An Baile Uachtarach Theas	Kerry	OxA-5770	5590	60	-14.1	human tooth	4456–4356 BC	4544–4337 BC	IntCal20	A
KY030C	Ferriter's Cove, An Baile Uachtarach Theas	Kerry	BM-2228R	5750	140	—	charcoal	4780–4449 BC	4936–4341 BC	IntCal20	A
KY030C	Ferriter's Cove, An Baile Uachtarach Theas	Kerry	BM-2228AR	5850	140	—	charcoal	4896–4541 BC	5197–4368 BC	IntCal20	A
KY030C	Ferriter's Cove, An Baile Uachtarach Theas	Kerry	GrN-18769	5900	110	—	charcoal	4934–4616 BC	5197–4496 BC	IntCal20	A
KY030E	Ferriter's Cove, An Baile Uachtarach Theas	Kerry	GrN-18770	5620	130	—	hazelnut	4607–4342 BC	4789–4173 BC	IntCal20	A
KY030G	Ferriter's Cove, An Baile Uachtarach Theas	Kerry	GrN-18772	6300	140	—	charcoal	5469–5064 BC	5531–4905 BC	IntCal20	A
KY030I	Ferriter's Cove, An Baile Uachtarach Theas	Kerry	UB-3597	5479	56	—	charcoal	4438–4254 BC	4450–4173 BC	IntCal20	A
KY030I	Ferriter's Cove, An Baile Uachtarach Theas	Kerry	UB-3599	5503	45	—	charcoal	4442–4268 BC	4449–4256 BC	IntCal20	A
KY030I	Ferriter's Cove, An Baile Uachtarach Theas	Kerry	UB-3598	5727	81	—	hazelnut	4680–4461 BC	4778–4366 BC	IntCal20	A

Appendix 2: Radiocarbon Dates of Irish Shell Middens

Deposit ID	Site Name, Townland	County	Lab #	Raw Date	±	C13 %	Sample Material	Date (1σ)	Date (2σ)	Curve	LOC
KY0300	Ferriter's Cove, An Baile Uachtarach Theas	Kerry	BM-2229R	5490	160	—	charcoal	4498–4061 BC	4685–3982 BC	IntCal20	A
KY030P	Ferriter's Cove, An Baile Uachtarach Theas	Kerry	UB-3760	4820	67	—	charcoal	3651–3524 BC	3761–3377 BC	IntCal20	A
KY030P	Ferriter's Cove, An Baile Uachtarach Theas	Kerry	UB-3761	5402	24	—	shell	3886–3702 BC	3950–3631 BC	Marine20	A
KY050	Beginish Island, Beginish	Kerry	Su-1788	2380	50	—	limpet	176 BC–39 AD	306 BC– 136 AD	Marine20	B
KY053A	Illaunloughan, Portmagee	Kerry	UCLA-2811	960	120	—	charcoal	991–1219 AD	775–1279 AD	IntCal20	A
LH005	Rockmarshall	Louth	I-5323	5470	110	—	charcoal	4450–4169 BC	4540–4046 BC	IntCal20	A
LH005	Rockmarshall	Louth	OxA-4604	5705	75	-18.1	human bone	4658–4453 BC	4715–4365 BC	IntCal20	A
MO059	Killadangan	Mayo	Hel-2065	1120	90	—	Winkle	1189–1395 AD	1056–1462 AD	Marine20	B
MO059	Killadangan	Mayo	Hel-2064	1140	90	—	Oyster	1169–1381 AD	1045–1449 AD	Marine20	B
MO065	Bailey Mór, Inis Gé Thuidh	Mayo	UB-7023	1793	30	—	dog whelk	544–687 AD	450–762 AD	Marine20	A
MO065	Bailey Mór, Inis Gé Thuidh	Mayo	UB-4217	1827	29	—	dog whelk	509–660 AD	421–716 AD	Marine20	A
SO015A	Staad Abbey, Agharrow	Sligo	UB-3771	368	54	—	horse bone	1457–1629 AD	1445–1640 AD	IntCal20	B
SO018	Conor's Island	Sligo	UBA-21147	3370	43	—	—	1739–1565 BC	1862–1532 BC	IntCal20	B
SO018	Conor's Island	Sligo	UBA-21145	3596	30	—	—	2014–1901 BC	2034–1831 BC	IntCal20	B
SO018	Conor's Island	Sligo	UBA-21144	3598	31	—	—	2016–1901 BC	2035–1830 BC	IntCal20	B
SO018	Conor's Island	Sligo	UBA-21146	3924	31	—	—	2469–2348 BC	2557–2296 BC	IntCal20	B
SO018	Conor's Island	Sligo	UBA-21143	4765	38	—	—	3631–3525 BC	3639–3381 BC	IntCal20	B
SO018	Conor's Island	Sligo	UBA-14434	5403	25	—	charcoal	4328–4248 BC	4338–4172 BC	IntCal20	B
SO018	Conor's Island	Sligo	UBA-14433	5446	27	—	charcoal	4340–4261 BC	4349–4250 BC	IntCal20	B
SO025	Ballincar	Sligo	UB-4681	3148	45	1.448	shell	1107–901 BC	1206–811 BC	Marine20	C
SO037A	Shelly Valley, Carrowdough	Sligo	UGAMS-24423	250	25	-22.9	pony bone	1640–1794 AD	1524–1800 AD	IntCal20	C
SO037A	Shelly Valley, Carrowdough	Sligo	UGAMS-27125	370	20	-22.4	charcoal	1467–1618 AD	1455–1630 AD	IntCal20	C

Appendix 2: Radiocarbon Dates of Irish Shell Middens

Deposit ID	Site Name, Townland	County	Lab #	Raw Date	±	C13 %	Sample Material	Date (1σ)	Date (2σ)	Curve	LOC
SO041B	Settlement 15, Culleenamore	Sligo	Lu-1759	3780	60	—	charcoal	2296–2053 BC	2454–2031 BC	IntCal20	B
SO041C	Settlement 15, Culleenamore	Sligo	St-7624	4710	100	—	charcoal	3627–3373 BC	3705–3106 BC	IntCal20	B
SO041D	Settlement 15, Culleenamore	Sligo	Fra-63	2475	100	—	charcoal	767–486 BC	806–393 BC	IntCal20	B
SO041D	Settlement 15, Culleenamore	Sligo	Lu-2225	2980	60	—	charcoal	1370–1115 BC	1394–1016 BC	IntCal20	B
SO041D	Settlement 15, Culleenamore	Sligo	Fra-65	3045	100	—	charcoal	1421–1129 BC	1501–1016 BC	IntCal20	B
SO041D	Settlement 15, Culleenamore	Sligo	Fra-60	3060	100	—	charcoal	1433–1132 BC	1509–1016 BC	IntCal20	B
SO041D	Settlement 15, Culleenamore	Sligo	Lu-1948	3970	75	—	charcoal	2577–2344 BC	2847–2206 BC	IntCal20	B
SO041E	Settlement 15, Culleenamore	Sligo	Fra-53	1210	100	—	charcoal	682–949 AD	653–1018 AD	IntCal20	B
SO058	Culleenduff	Sligo	BETA-155380	3400	50	—	oyster	1421–1225 B	1510–1110 BC	Marine20	C
SO066	Settlement 1, Grange West	Sligo	Lu-1754	1010	50	—	charcoal	992–1150 AD	898–1161 AD	IntCal20	D
SO067	Settlement 2, Grange West	Sligo	Lu-1838	1320	70	—	charcoal	650–773 AD	604–878 AD	IntCal20	A
SO067	Settlement 2, Grange West	Sligo	Lu-1699	1830	50	—	charcoal	130–311 AD	79–350 AD	IntCal20	A
SO070	Settlement 8, Luffertan	Sligo	Lu-1756	1260	50	—	charcoal	676–822 AD	663–881 AD	IntCal20	C
SO070	Settlement 8, Luffertan	Sligo	Lu-1862	2020	55	—	charcoal	96 BC–75 AD	170 BC–124 AD	IntCal20	C
SO075	Settlement 6, Grange East	Sligo	Lu-1758	1230	50	—	charcoal	703–879 AD	667–944 AD	IntCal20	D
SO080	Tanrego West	Sligo	BETA-155386	4710	60	—	oyster	3107–2873 BC	3276–2776 BC	Marine20	C
SO087	Settlement 11, Seafield	Sligo	Lu-1757	1310	50	—	charcoal	659–772 AD	643–872 AD	IntCal20	D
SO099	Luffertan	Sligo	Lu-1809	9440	100	—	charcoal	9116–8561 BC	9191–8461 BC	IntCal20	D

Appendix 3: Locations of Irish Shell Middens

Site ID	Site Name, Townland	Parish	Barony	County	SMR	Location Category	ITM Easting	ITM Northing	Accuracy
AN001A-D	Church Bay, Demesne	Rathlin Island	Cary	Antrim	ANT001:092	North	714867	950960	exact
AN002A-L	Potter's Cave, Ballintoy Demesne	Ballintoy	Cary	Antrim	—	North	702934	944919	exact
AN003A-B	masked rock shelter, Ballintoy Demesne	Ballintoy	Cary	Antrim	—	North	702906	944899	exact
AN004A-B	Glenarm 1 & 2, Cloney	Tickmacrevan	Glenarm Lower	Antrim	—	North	730674	915547	exact
AN005	The Moat, Minnis North	Carncastle	Glenarm Upper	Antrim	ANT030:013	North	733793	913388	exact
AN006	Ballygalley	Carncastle	Glenarm Upper	Antrim	—	North	738192	907739	exact
AN007	Ballyprior Beg	Islandmaggee	Belfast Lower	Antrim	ANT041:033	North	743781	902800	exact
AN008	Greenisland, West Division	Carrickfergus	Carrickfergus, St Nicholas	Antrim	ANT052:065	North	738692	885194	exact
AN009A-C	Park Cave, White Park	Ballintoy	Cary	Antrim	—	North	702835	944820	exact
AN010A-F	Portbradden Cave, Templestragh	Ballintoy	Cary	Antrim	—	North	700483	944382	exact
AN011	Portrush, Ballymacrea Lower	Ballywillin, Dunluce	Dunluce Lower	Antrim	—	North	687533	940982	estimate
AN012A-B	White Park	Ballintoy	Cary	Antrim	—	North	702850	944661	exact
AN013A-C	Boat Cave, Ballintoy Demesne	Ballintoy	Cary	Antrim	—	North	703947	945317	exact
AN014A-E	Chimney Cave, Ballintoy Demesne	Ballintoy	Cary	Antrim	—	North	704077	945229	exact
AN015A-C	Larrybane Head, Knocksoghey	Ballintoy	Cary	Antrim	—	North	704749	945101	exact
AN016	Dunshammer, Ballintoy Demesne	Ballintoy	Cary	Antrim	—	North	703130	945061	exact
CE001A-C	Fanore Beg, Fanore More	Killonaghan	Burren	Clare	CL001-014	Lowland West	513700	708200	estimate
CE002	Fanore More	Killonaghan	Burren	Clare	CL001-019	Lowland West	513525	707715	exact
CE003	Fanore More	Killonaghan	Burren	Clare	CL001-021	Lowland West	513332	707512	exact
CE004	Gleninagh North	Gleninagh	Burren	Clare	CL002-008005	Lowland West	519292	710103	exact
CE005	Gleninagh North	Gleninagh	Burren	Clare	CL002-008006	Lowland West	519000	710000	estimate

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Site ID	Site Name, Townland	Parish	Barony	County	SMR	Location Category	ITM Easting	ITM Northing	Accuracy
CE006	Bishopsquarter	Drumcreehy	Burren	Clare	CL002-014004	Lowland West	524687	708645	exact
CE007	Gleninagh South	Gleninagh	Burren	Clare	CL002-030003	Lowland West	518348	708789	exact
CE008	Gleninagh North	Gleninagh	Burren	Clare	CL002-079	Lowland West	521404	710138	exact
CE009	Aughinish	Oughtmama	Burren	Clare	CL003-010003	Lowland West	527767	712758	exact
CE010	Oughtmama	Oughtmama	Burren	Clare	CL003-032010	Lowland West	530600	707900	estimate
CE011A-G	Doolin Pier, Ballaghaline	Killilagh	Corcomroe	Clare	—	Lowland West	505685	696944	exact
CE012	Kineilty	Kilmacrehy	Corcomroe	Clare	CL014-035	Lowland West	503941	688367	exact
CE013	Lahinch, Dough	Kilmacrehy	Corcomroe	Clare	CL015-118	Lowland West	509700	688400	estimate
CE014A-C	Freaghcastle	Kilfarboy	Ibrickane	Clare	CL030-002004	Lowland West	503286	681566	exact
CE015	Freaghcastle	Kilfarboy	Ibrickane	Clare	CL030-002005	Lowland West	503293	681564	exact
CE016A-B	Leagard South	Kilfarboy	Ibrickane	Clare	CL030-031	Lowland West	503100	678100	estimate
CE017	Doonmore	Killard	Ibrickane	Clare	CL046-038	Lowland West	496152	666610	exact
CE018A-B	Doonmore	Killard	Ibrickane	Clare	CL046-040	Lowland West	496146	666613	exact
CE019A-B	Doonmore	Killard	Ibrickane	Clare	CL046-041	Lowland West	496140	666613	exact
CE020A-B	Scattery Island	Kilrush	Moyarta	Clare	CL067-024020	Lowland West	497522	652313	exact
CE021	Dunmore Head, Horse Island, Kilbaha South	Kilballyowen	Moyarta	Clare	CL071-014001	Lowland West	471906	646645	exact
CE022	Carrowmore Point, Carrowmore North	Killard	Ibrickane	Clare	—	Lowland West	498900	669800	estimate
CE023	Doolin Stone Axe Factory, Ballaghaline	Killilagh	Corcomroe	Clare	—	Lowland West	506342	696532	exact
CE024	Murrooghtoohey South	Gleninagh	Burren	Clare	CL001-023	Lowland West	513699	708914	exact
CE025A-S	Scattery Island	Kilrush	Moyarta	Clare	—	Lowland West	497442	652562	exact
CO001	Rochestown, Monfieldstown	Carrigaline	Cork	Cork	CO075-045	South East	572856	569585	exact
CO002	Ballinlough	St Finbar's	Cork	Cork	CO074-063	South East	571218	570058	exact
CO003	Carrigrenan	Little Island	Barrymore	Cork	CO075-024001	South East	576533	570832	exact
CO004	Carrigtohill	Carrigtohill	Barrymore	Cork	CO075-068	South East	581854	573006	exact

Appendix 3: Locations of Irish Shell Middens

Site ID	Site Name, Townland	Parish	Barony	County	SMR	Location Category	ITM Easting	ITM Northing	Accuracy
CO005A-C	Brick Island, Rossmore	Mogeesha	Barrymore	Cork	CO076-011	South East	583124	570164	exact
CO006	Brown Island, Ballintubbrid West	Mogeesha	Barrymore	Cork	CO076-012	South East	584155	570221	exact
CO007	Brown Island, Ballintubbrid West	Mogeesha	Barrymore	Cork	CO076-013	South East	584711	570227	exact
CO008	Ballyvodock West	Mogeesha	Barrymore	Cork	CO076-014	South East	584796	570774	exact
CO009	Ballyvodock West	Mogeesha	Barrymore	Cork	CO076-015001	South East	585386	570593	exact
CO010	Currabally	Templerobin	Barrymore	Cork	CO076-032	South East	582712	569596	exact
CO011	Ashgrove/Currabally	Templerobin	Barrymore	Cork	CO076-033	South East	583275	569451	exact
CO012	Ashgrove/Ballyellane	Templerobin	Barrymore	Cork	CO076-037001	South East	583969	569642	exact
CO013	Rathcoursey East	Garranekinnefeake	Imokilly	Cork	CO076-040	South East	586636	569813	exact
CO014	Brown Island, Ballintubbrid West	Mogeesha	Barrymore	Cork	CO076-065	South East	584467	570227	exact
CO015	Ballyvodock East	Mogeesha	Barrymore	Cork	CO076-068	South East	586539	570346	exact
CO016	Ringaskiddy	Barnahely	Kerrycurrihy	Cork	CO087-054	South East	579018	563511	exact
CO017	Curraghbinny	Carrigaline	Kerrycurrihy	Cork	CO087-055	South East	578452	562691	exact
CO018	Curraghbinny	Carrigaline	Kerrycurrihy	Cork	CO087-056	South East	579303	562366	exact
CO019	Curraghbinny	Carrigaline	Kerrycurrihy	Cork	CO087-057	South East	579729	562275	exact
CO020	Carrigaline Middle	Carrigaline	Kerrycurrihy	Cork	CO087-071	South East	573100	563300	estimate
CO021	Barnahely	Barnahely	Kerrycurrihy	Cork	CO087-120	South East	577251	563778	exact
CO022	Ringaskiddy	Barnahely	Kerrycurrihy	Cork	CO087-161	South East	579325	563812	exact
CO023	Rostellan	Rostellan	Imokilly	Cork	CO088-022002	South East	586663	566475	exact
CO024	Rostellan	Rostellan	Imokilly	Cork	CO088-025	South East	586972	566231	exact
CO025	Corkbeg	Corkbeg	Imokilly	Cork	CO088-079	South East	582800	564000	estimate
CO026	Corkbeg	Corkbeg	Imokilly	Cork	CO088-105	South East	582637	563842	exact
CO027	Corkbeg	Corkbeg	Imokilly	Cork	CO088-106	South East	582581	563839	exact
CO028	Corkbeg	Corkbeg	Imokilly	Cork	CO088-126	South East	582807	563501	exact
CO029	Ballinluska	Templebreedy	Kerrycurrihy	Cork	CO099-035	South East	579667	559048	exact

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Site ID	Site Name, Townland	Parish	Barony	County	SMR	Location Category	ITM Easting	ITM Northing	Accuracy
CO030	Poul Gorm, Monteensudder	Kilcaskan	Bear	Cork	CO104-002	South West	493093	556232	exact
CO031	Poul Gorm, Monteensudder	Kilcaskan	Bear	Cork	CO104-038001	South West	493187	556175	exact
CO032	Poul Gorm, Monteensudder	Kilcaskan	Bear	Cork	CO104-038002	South West	493189	556176	exact
CO033	Poul Gorm, Monteensudder	Kilcaskan	Bear	Cork	CO104-039	South West	493145	556346	exact
CO034	Old Fort	Ringrone	Kinsale	Cork	CO112-079	South West	564500	549700	estimate
CO035	Ringville	Kilmonoge	Kinalea	Cork	CO112-080	South West	568391	549725	exact
CO036	Dunnamark	Kilmocomoge	Bantry	Cork	CO118-004003	South West	500165	550018	exact
CO037	Coolmain	Ringrone	East Carbery	Cork	CO124-073	South West	554200	543900	estimate
CO038	Dunboy	Kilaconenagh	Bear	Cork	CO128-024001	South West	466725	544051	exact
CO039	Dunbeacon	Skull	West Carbery	Cork	CO130-025001	South West	490303	539038	exact
CO040	Barryshall	Timoleague	Barryroe	Cork	CO136-019	South West	546197	542499	exact
CO041A-C	Kilcoe	Kilcoe	West Carbery	Cork	—	South West	501884	532904	exact
CO042	Holly Island, Kilcoe	Kilcoe	West Carbery	Cork	CO140-070	South West	503241	533941	exact
CO043	Skeam Island, Skeam West	Aghadown	West Carbery	Cork	CO149-011003	South West	498919	528920	exact
CO044	Dooneendermotmore, Toehead	Castlehaven	West Carbery	Cork	—	South West	514395	526202	exact
CO045	Dunnamark	Kilmocomoge	Bantry	Cork	—	South West	499960	550003	exact
CO046	M28 Ringaskiddy-Barnahely , Ringaskiddy	Barnahely	Kerrycurrihy	Cork	—	South East	577400	564000	estimate
CO047	Carrigrenan	Little Island	Barrymore	Cork	CO075-095	South East	576641	570434	exact
DL001	Inishtrahull	Clonca	Inishowen East	Donegal	DG002A005	North	648358	965251	exact
DL002	Inishtrahull	Clonca	Inishowen East	Donegal	DG002A006	North	648499	965292	exact
DL003	Ballyliffen, Ballymacmoriarty	Clonmany	Inishowen East	Donegal	DG003-003	North	640404	950308	exact
DL004A-B	Drung	Clonca	Inishowen East	Donegal	DG004-019	North	643602	951741	exact
DL005	Dún Dubháin íochtarach	Mevagh	Kilmacrenan	Donegal	DG007-002001	North	612005	942041	exact

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Site ID	Site Name, Townland	Parish	Barony	County	SMR	Location Category	ITM Easting	ITM Northing	Accuracy
DL006	An Rinn Bhuí	Clondavaddog	Kilmacrenan	Donegal	DG008-006	North	616674	944585	exact
DL007	Gort na Luchóg	Mevagh	Kilmacrenan	Donegal	DG008-021	North	613000	942900	estimate
DL008	Dumhaigh Bhig	Clondavaddog	Kilmacrenan	Donegal	DG009-004	North	623500	944300	estimate
DL009A-B	Horn Head, Cloghernagh, Largatreany, Pollaguill, Lurgabrak	Clondavaddog	Kilmacrenan	Donegal	DG015-003001	North	601200	940400	estimate
DL010	Rosapenna, Machaire Loiscthe	Mevagh	Kilmacrenan	Donegal	DG016-013	North	611184	937657	exact
DL011	Portsalon, Coaghross	Clondavaddog	Kilmacrenan	Donegal	DG018-002	North	623800	940000	estimate
DL012	Dunree	Desertegny	Inishowen West	Donegal	DG018-007	North	629081	939253	exact
DL013	Eleven Ballyboes	Moville Lower	Inishowen East	Donegal	DG022-012	North	665844	940442	exact
DL014	Eleven Ballyboes	Moville Lower	Inishowen East	Donegal	DG022-013	North	665831	940411	exact
DL015	Baile an Easa	Tullaghobegly	Kilmacrenan	Donegal	DG024-001	North	592239	933614	exact
DL016	Glenree	Mevagh	Kilmacrenan	Donegal	DG026-009	North	610729	934923	exact
DL017	Kinnegar	Killygarvan	Kilmacrenan	Donegal	DG028-031	North	629800	929000	estimate
DL018	Gola Island, Gabhla	Tullaghobegly	Kilmacrenan	Donegal	DG032-002	North	576800	927100	estimate
DL019	Ard na gCeapairí	Tullaghobegly	Kilmacrenan	Donegal	DG032-005	North	579419	926083	exact
DL020A-C	An Carn Buí	Templecrone	Boylagh	Donegal	DG032-006	North	578000	923500	estimate
DL021	An Bun Beag	Tullaghobegly	Kilmacrenan	Donegal	DG032-007	North	580200	923400	estimate
DL022	An Charraig Fhinn	Templecrone	Boylagh	Donegal	DG032-009	North	578545	922550	exact
DL023	An Bhráid	Templecrone	Boylagh	Donegal	DG032-010	North	578242	922626	exact
DL024A-B	Ballynakilly	Inch	Inishowen West	Donegal	DG037-025	North	630924	923510	exact
DL025	Bohullion	Inch	Inishowen West	Donegal	DG037-026	North	631430	923348	exact
DL026	Tievebane	Fahan Upper	Inishowen West	Donegal	DG038-055	North	636152	923780	exact
DL027A-B	Baylet	Inch	Inishowen West	Donegal	DG038-052	North	634015	922708	exact
DL028	An Machaire Beag	Mevagh	Kilmacrenan	Donegal	DG038-053	North	635017	924139	exact
DL029	Carrickanee	Inch	Inishowen	Donegal	DG038-054	North	634342	923875	exact
DL030	Inis Sionnaigh	Tullaghobegly	Kilmacrenan	Donegal	DG040-004	North	578500	925200	estimate

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Site ID	Site Name, Townland	Parish	Barony	County	SMR	Location Category	ITM Easting	ITM Northing	Accuracy
DL031	Ballymoney	Burt	Inishowen West	Donegal	DG046-035	North	630852	920096	exact
DL032	Castlequarter	Inch	Inishowen West	Donegal	DG046-036001	North	631895	922569	exact
DL033	Castlequarter	Inch	Inishowen West	Donegal	DG046-036002	North	631829	922591	exact
DL034	Castlequarter	Inch	Inishowen West	Donegal	DG046-037	North	632185	922375	exact
DL035	Castlequarter	Inch	Inishowen West	Donegal	DG046-038	North	632211	922345	exact
DL036	Grange	Burt	Inishowen West	Donegal	DG046-039	North	631074	919691	exact
DL037	Drumboy	Allsaints	Raphoe North	Donegal	DG046-040	North	629993	919575	exact
DL038	Athphort	Templecrone	Boylagh	Donegal	DG048-001	North	566547	913943	exact
DL039	Rutland Island, Inis Mhic An Doirn	Templecrone	Boylagh	Donegal	DG048-004	North	570400	914200	estimate
DL040	Dooley, An Dumhaigh	Lettermacaward	Boylagh	Donegal	DG065-003003	North	575950	901702	exact
DL041	Narin Sandhills, Clooney	Inishkeel	Boylagh	Donegal	DG064-004	North	572378	899682	exact
DL042	Magheramore	Inishkeel	Boylagh	Donegal	DG073-007	North	569055	895013	exact
DL043	Kilcashel	Inishkeel	Boylagh	Donegal	DG073-013003	North	569306	892847	exact
DL044	An Machaire	Inishkeel	Boylagh	Donegal	DG073-034	North	566250	890746	exact
DL045	Inishbarnog	Inishkeel	Boylagh	Donegal	DG073-047	North	564076	896308	exact
DL046	Magheramore	Inishkeel	Boylagh	Donegal	DG073-049	North	568486	894703	exact
DL047	Magheramore	Inishkeel	Boylagh	Donegal	DG073-050	North	568995	894740	exact
DL048	Fintragh	Upper Killybegs	Banagh	Donegal	DG097-008	North	569102	876464	exact
DL049	Rossnowlagh Lower	Drumhome	Tirhugh	Donegal	DG103-009	North	586774	869348	exact
DL050	Finner	Rossinver	Tirhugh	Donegal	DG106-005	North	582789	860797	exact
DL051	Magheracar	Rossinver	Tirhugh	Donegal	DG109-001001	North	579251	858290	exact
DL052	Magheracar	Rossinver	Tirhugh	Donegal	DG109-003	North	581825	857761	exact
DL053A-D	Rinnaraw	Clondahorky	Kilmacrenan	Donegal	DG016-016002 DG016-016003	North	603860	936795	exact
DL054	Sandhill	Clondahorky	Kilmacrenan	Donegal	—	North	602700	937700	estimate

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Site ID	Site Name, Townland	Parish	Barony	County	SMR	Location Category	ITM Easting	ITM Northing	Accuracy
DU001	Rush	Lusk	Balrothery East	Dublin	DU008-013003	East	726909	755356	exact
DU002	Lambay Island	Portraine	Nethercross	Dublin	DU009-001004	East	730416	750613	exact
DU003A-B	Windmill Lands	Swords	Nethercross	Dublin	DU011-034020	East	717976	746679	exact
DU004A-C	Robswalls	Portmarnock	Coolock	Dublin	DU012-062 DU012-012	East	724024	745144	exact
DU005	Malahide	Malahide	Coolock	Dublin	DU012-050	East	722800	746200	estimate
DU006A-B	Sutton, Burrow	Howth	Coolock	Dublin	DU015-024	East	726474	739406	exact
DU007	Howth	Howth	Coolock	Dublin	DU016-003003	East	729300	738200	estimate
DU008	Boosterstown	Boosterstown	Rathdown	Dublin	—	East	719772	729404	exact
DU009A-D	Dalkey Island	Dalkey	Rathdown	Dublin	DU023-029002	East	727614	726512	exact
DU010A-C	Malahide	Malahide	Coolock	Dublin	—	East	722529	746124	exact
DW001	Rough Island, Ringcreevy	Comber	Castlereagh Lower	Down	DOW011:014	North	749410	868857	exact
DW002	Ringneill	Tullynakill	Castlereagh Lower	Down	DOW011:017	North	752169	865348	exact
DW003	Castle Espie	Tullynakill	Castlereagh Lower	Down	DOW011:055	North	749631	867079	exact
DW004A-B	Nundrum, Mahee Island	Tullynakill	Castlereagh Lower	Down	—	North	752359	863628	exact
DW005	Ardkeen	Ardkeen	Ards Upper	Down	DOW025:035	North	759498	856970	exact
DW006	Portaferry, Ballyphilip	Ballyphilip	Ards Upper	Down	—	North	759212	850853	exact
DW007	Dundrum, Murlough Lower	Kilmegan	Lecale Upper	Down	DOW044:033	North	740851	835754	exact
DW008	Ballinran	Kilbroney	Iveagh Upper	Down	DOW054:024	North	719116	815829	exact
DW009	Cranfield	Kilkeel	Mourne	Down	DOW057:011	North	726924	809950	exact
DW010	Cranfield	Kilkeel	Mourne	Down	DOW057:014	North	727144	810780	exact
DW011	Rough Island, Ringcreevy	Comber	Castlereagh Lower	Down	MRD148:031	North	749343	868960	exact
DW012	Chapel Island, Audleystown	Ballyculter	Lecale Lower	Down	MRD149:015	North	755418	867698	exact
DW013	Castle Espie	Tullynakill	Castlereagh Lower	Down	MRD167:016	North	749520	866998	exact
DW014	Castle Espie	Tullynakill	Castlereagh Lower	Down	MRD167:017	North	749720	866698	exact

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Site ID	Site Name, Townland	Parish	Barony	County	SMR	Location Category	ITM Easting	ITM Northing	Accuracy
DW015	Castle Espie	Tullynakill	Castlereagh Lower	Down	MRD167:018	North	749820	866698	exact
DW016	Tullynakill	Tullynakill	Castlereagh Lower	Down	MRD167:019	North	750319	864098	exact
DW017	Mahee Island	Tullynakill	Castlereagh Lower	Down	MRD168:096	North	753819	864498	exact
DW018	Rainey Island, Ballydorn	Killinchy	Dufferin	Down	MRD168:097	North	752619	863139	exact
DW019	Ringneill	Tullynakill	Castlereagh Lower	Down	MRD168:098	North	752119	865298	exact
DW020	Ringneill	Tullynakill	Castlereagh Lower	Down	MRD168:099	North	751829	865878	exact
DW021	Reagh Island	Tullynakill	Castlereagh Lower	Down	MRD168:100	North	752519	865198	exact
DW022	Reagh Island	Tullynakill	Castlereagh Lower	Down	MRD168:171	North	752419	864598	exact
DW023	Reagh Island	Tullynakill	Castlereagh Lower	Down	MRD168:172	North	752419	864998	exact
DW024	Reagh Island	Tullynakill	Castlereagh Lower	Down	MRD168:174	North	752719	865198	exact
DW025	Ringneill	Tullynakill	Castlereagh Lower	Down	MRD168:176	North	753119	864998	exact
DW026	Ballyurnanellan	Grey Abbey	Ards Lower	Down	MRD168:177	North	756418	866598	exact
DW027	Ballyurnanellan	Grey Abbey	Ards Lower	Down	MRD168:178	North	756718	866698	exact
DW028	Tullynakill	Tullynakill	Castlereagh Lower	Down	MRD168:179	North	751049	864168	exact
DW029	Ballygarvan	Inishargy	Ards Upper	Down	MRD168:181	North	758600	854100	estimate
DW030	Demesne of Down	Down	Lecale Upper	Down	MRD224:006	North	747720	844802	exact
DW031	Mount Stewart	Grey Abbey	Ards Lower	Down	DOW011:023	North	755918	868497	exact
DW032	Mount Stewart	Grey Abbey	Ards Lower	Down	—	North	755900	868400	estimate
DW033	Nun's Quarter	Inishargy	Ards Upper	Down	DOW018:029	North	758958	864198	exact
DW034	Reagh Island	Tullynakill	Castlereagh Lower	Down	DOW017:043	North	752579	865013	exact
DW035A-B	Reagh Island	Tullynakill	Castlereagh Lower	Down	DOW017:045	North	752530	865280	exact
DW036	Kilnatierny	Grey Abbey	Ards Lower	Down	—	North	756598	868277	exact
DY001	Oughtymore	Magilligan, Tamlaghtard	Keenaght	Derry	LDY001:002	North	666098	936363	exact
DY002	Ballymulholland	Magilligan, Tamlaghtard	Keenaght	Derry	LDY001:003	North	665928	935113	exact

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Site ID	Site Name, Townland	Parish	Barony	County	SMR	Location Category	ITM Easting	ITM Northing	Accuracy
DY003	Ballymulholland	Magilligan, Tamlaghtard	Keenaght	Derry	LDY001:004	North	665938	935223	exact
DY004	Ballymulholland	Magilligan, Tamlaghtard	Keenaght	Derry	LDY001:005	North	665898	934943	exact
DY005	Grangemore	Dunboe	Coleraine	Derry	MRL012:003 MRL012:017	North	680535	935383	exact
DY006	Portstewart, Crossreagh East	Ballyaghan	N.E. Liberties of Coleraine	Derry	LDY003:001	North	680755	936373	exact
GA001	Knock	Inishbofin	Ballynahinch	Galway	GA009D015	Lowland West	454500	764500	estimate
GA002	Gooreen Island	Omey	Ballynahinch	Galway	GA009D041	Lowland West	457289	759813	exact
GA003	Rossadillisk	Omey	Ballynahinch	Galway	GA009D042	Lowland West	457436	759502	exact
GA004	Tully Beg	Ballynakill	Ballynahinch	Galway	GA010-040	Lowland West	468699	763711	exact
GA005A-B	Culfin	Ballynakill	Ballynahinch	Galway	GA010-048	Lowland West	474246	763736	exact
GA006	Aughrus Beg	Omey	Ballynahinch	Galway	GA021-002	Lowland West	455900	758600	estimate
GA007A-B	Cartoorbeg	Omey	Ballynahinch	Galway	GA021-007	Lowland West	456558	756393	exact
GA008	Cartoorbeg	Omey	Ballynahinch	Galway	GA021-008	Lowland West	456756	756461	exact
GA009	Gooreenatinny	Omey	Ballynahinch	Galway	GA021-021	Lowland West	456355	755226	exact
GA010A-G	High Island	Omey	Ballynahinch	Galway	—	Lowland West	450146	757357	exact
GA011	Gooreen	Omey	Ballynahinch	Galway	GA021-045	Lowland West	456165	756263	exact
GA012	Gooreen	Omey	Ballynahinch	Galway	GA021-039002	Lowland West	456140	756287	exact
GA013	N/A	Omey	Ballynahinch	Galway	GA021-041	Lowland West	456500	755800	estimate
GA014	Gooreen	Omey	Ballynahinch	Galway	GA021-044	Lowland West	456089	756265	exact
GA015	Gooreen	Omey	Ballynahinch	Galway	GA021-046	Lowland West	456242	756247	exact
GA016	Cartoorbeg, Sturakeen	Omey	Ballynahinch	Galway	GA021-047	Lowland West	456331	756252	exact
GA017	Aughrus Beg	Omey	Ballynahinch	Galway	GA021-050	Lowland West	456504	759015	exact
GA018A-D	Eyrehport	Omey	Ballynahinch	Galway	GA022-038001	Lowland West	458359	753193	exact
GA019	Knocknahaw	Ballynakill	Ballynahinch	Galway	GA022-114	Lowland West	466800	757776	exact
GA020	Rossadillisk	Omey	Ballynahinch	Galway	GA022-121	Lowland West	458463	758589	exact

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Site ID	Site Name, Townland	Parish	Barony	County	SMR	Location Category	ITM Easting	ITM Northing	Accuracy
GA021	Faul	Moyrus	Ballynahinch	Galway	GA035-044	Lowland West	464298	749925	exact
GA022A-D	MN1, 4; Mannin Beg	Ballindoon	Ballynahinch	Galway	GA035-058	Lowland West	459151	746665	exact
GA023	Fakeeragh	Omey	Ballynahinch	Galway	GA035-070	Lowland West	464221	750338	exact
GA024	Aillebrack	Ballindoon	Ballynahinch	Galway	GA048-001	Lowland West	458300	742400	estimate
GA025A-D	Ballinaleama	Ballindoon	Ballynahinch	Galway	GA048-002	Lowland West	455288	742647	exact
GA026	Creggoduff	Ballindoon	Ballynahinch	Galway	GA048-004	Lowland West	457400	743600	estimate
GA027A-O	DL1-4, 9, 11, 13; Truska, Doonloughan, Truska, Keerhaun South	Ballindoon	Ballynahinch	Galway	GA048-008001	Lowland West	458041	745865	exact
GA028	Keerhaunmore	Ballindoon	Ballynahinch	Galway	GA048-013	Lowland West	455800	743000	estimate
GA029	Silverhill	Ballindoon	Ballynahinch	Galway	GA048-018	Lowland West	457121	743265	exact
GA030A-C	Ballyconneely	Ballindoon	Ballynahinch	Galway	GA049-006	Lowland West	461650	742186	exact
GA031A-B	Dolan	Ballindoon	Ballynahinch	Galway	GA049-023002	Lowland West	464571	740040	exact
GA032A-B	MN2; Mannin More	Ballindoon	Ballynahinch	Galway	GA049-024003	Lowland West	459073	746409	exact
GA033	Callow	Ballindoon	Ballynahinch	Galway	GA049-030001	Lowland West	464571	740486	exact
GA034A-K	Iorras Beag Thiar	Moyrus	Ballynahinch	Galway	GA063-002	Lowland West	469400	738200	estimate
GA035	Inishlackan	Moyrus	Ballynahinch	Galway	GA063-004001	Lowland West	472018	737909	exact
GA036	Iorras Beag Thiar	Moyrus	Ballynahinch	Galway	GA063-023	Lowland West	468886	738181	exact
GA037	Iorras Beag Thiar	Moyrus	Ballynahinch	Galway	GA063-024	Lowland West	468969	737767	exact
GA038	Maínis	Moyrus	Ballynahinch	Galway	GA076-016	Lowland West	476707	729119	exact
GA039	St Macdara's Island, Cruach na Cara	Moyrus	Ballynahinch	Galway	GA076-023	Lowland West	472243	729892	exact
GA040	Fínis	Moyrus	Ballynahinch	Galway	GA077-012	Lowland West	479923	729269	exact
GA041	Fínis	Moyrus	Ballynahinch	Galway	GA077-037	Lowland West	478612	728204	exact
GA042	Fínis	Moyrus	Ballynahinch	Galway	GA077-038	Lowland West	478718	728536	exact
GA043	Fínis	Moyrus	Ballynahinch	Galway	GA077-040	Lowland West	478994	728911	exact
GA044	Fínis	Moyrus	Ballynahinch	Galway	GA077-041	Lowland West	479702	728903	exact
GA045	Fínis	Moyrus	Ballynahinch	Galway	GA077-043	Lowland West	479775	729114	exact

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Site ID	Site Name, Townland	Parish	Barony	County	SMR	Location Category	ITM Easting	ITM Northing	Accuracy
GA046	An Caorán Beag	Killanin	Moycullen	Galway	GA090-009	Lowland West	493660	722396	exact
GA047	An Bhánrain BhAn Caorán Beagan Theas	Killanin	Moycullen	Galway	GA091-003	Lowland West	497700	721000	estimate
GA048	Keeraunnagark South	Killanin	Moycullen	Galway	GA091-012	Lowland West	496965	721440	exact
GA049A-B	Derryloney	Rahoon	Galway	Galway	GA093-007	Lowland West	525089	722814	exact
GA050	Seaweed Point, Knocknacarragh	Rahoon	Galway	Galway	GA093-012	Lowland West	525706	722671	exact
GA051	Seaweed Point, Knocknacarragh	Rahoon	Galway	Galway	GA093-012001	Lowland West	525706	722671	exact
GA052	Ardfry	Ballynacourty	Dunkellin	Galway	GA094-006	Lowland West	535108	721535	exact
GA053	Mweeloon	Ballynacourty	Dunkellin	Galway	GA094-037	Lowland West	532720	719994	exact
GA054	Ardfry	Ballynacourty	Dunkellin	Galway	GA094-114	Lowland West	533182	720957	exact
GA055	Ardfry	Ballynacourty	Dunkellin	Galway	GA094-135	Lowland West	533200	721000	estimate
GA056	Oranmore	Oranmore	Dunkellin	Galway	—	Lowland West	537622	724624	exact
GA057	Ballynacourty	Ballynacourty	Dunkellin	Galway	GA103-038	Lowland West	536773	718174	exact
GA058	Corraun Point, Rahaneena	Stradbally	Dunkellin	Galway	GA103-214	Lowland West	539027	718380	exact
GA059	Cill Éinne	Árainn	Aran	Galway	GA110-168	Lowland West	486710	708320	exact
GA060A-D	Doorús Demesne	Kinvarradóorus	Kiltartan	Galway	GA112-057	Lowland West	535017	712098	exact
GA061	Cill Éinne	Árainn	Aran	Galway	GA119-017	Lowland West	489216	707145	exact
GA062	Ceathrú An Teampaill	Inis Meáin	Aran	Galway	GA119-045	Lowland West	493877	706061	exact
GA063	Ceathrú An Teampaill	Inis Meáin	Aran	Galway	GA119-085	Lowland West	493884	704790	exact
GA064	Ceathrú An Teampaill	Inis Meáin	Aran	Galway	GA119-095002	Lowland West	494196	705844	exact
GA065	Ceathrú An Teampaill	Inis Meáin	Aran	Galway	GA119-118	Lowland West	493470	704877	exact
GA066	Ceathrú An Teampaill	Inis Meáin	Aran	Galway	GA119-121	Lowland West	493147	705016	exact
GA067	Inis Oírr	Inis Oírr	Aran	Galway	GA120-003	Lowland West	497543	702853	exact
GA068	Inis Oírr	Inis Oírr	Aran	Galway	GA120-007002	Lowland West	498548	702572	exact
GA069A-N	Dún Aonghasa, Cill Mhuirbhigh	Árainn	Aran	Galway	GA110-039029 GA110-039031	Lowland West	481734	709778	exact

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Site ID	Site Name, Townland	Parish	Barony	County	SMR	Location Category	ITM Easting	ITM Northing	Accuracy
GA070	Gorumna Island, An Máimin	Killannin	Moycullen	Galway	—	Lowland West	486558	721989	exact
GA071A-C	Eochaill	Árainn	Aran	Galway	—	Lowland West	487239	710369	exact
GA072	Rabbit Island, Oileán na gCoiníní	Kilcummin	Moycullen	Galway	—	Lowland West	492800	734700	estimate
GA073	Greatman's Bay, An Cheathrú Rua Theas	Kilcummin	Moycullen	Galway	—	Lowland West	491600	722700	estimate
GA074A-D	Rathgurreen, Cottage	Ballynacourty	Dunkellin	Galway	—	Lowland West	537837	720046	exact
GA075	Gooreen	Omey	Ballynahinch	Galway	—	Lowland West	456381	755556	exact
GA076	Gooreen	Omey	Ballynahinch	Galway	—	Lowland West	455994	755942	exact
GA077	Gooreen	Omey	Ballynahinch	Galway	—	Lowland West	456002	755951	exact
GA078	Gooreen	Omey	Ballynahinch	Galway	—	Lowland West	456059	755956	exact
GA079	Knocknahaw	Ballynakill	Ballynahinch	Galway	—	Lowland West	466825	757864	exact
KY001A-C	Ballybunion	Killehenry	Iraghticonnor	Kerry	KE004-059	South West	485900	639600	estimate
KY002A-B	Ballybunion, Ballyeagh	Killehenry	Iraghticonnor	Kerry	KE004-060	South West	485900	639600	estimate
KY003A-C	Shell Valley, Ballybunion	Killehenry	Iraghticonnor	Kerry	KE004-065	South West	486500	641200	estimate
KY004	Illeaghtannig	Killiney	Corkaguiny	Kerry	KE019-002008	South West	462325	621301	exact
KY005A-E	Ardfert	Ardfert	Clanmaurice	Kerry	—	South West	478559	621173	exact
KY006	Rahoneen	Ardfert	Clanmaurice	Kerry	KE020-079	South West	475922	620225	exact
KY007	Barrow	Ardfert	Trughanacmy	Kerry	KE020-081	South West	474977	619626	exact
KY008	Lios Na Caolbhuí	Cloghane	Corkaguiny	Kerry	KE026-011	South West	452633	615227	exact
KY009	Gort na Bhráthar, Baile Uí Dhuinn	Cloghane	Corkaguiny	Kerry	KE026-022002	South West	452642	613817	exact
KY010	Garrywilliam	Stradbally	Corkaguiny	Kerry	KE026-027	South West	460200	619100	estimate
KY011	Fahamore	Stradbally	Corkaguiny	Kerry	KE027-003	South West	460701	618862	exact
KY012	Magherabeg	Killiney	Corkaguiny	Kerry	KE027-006	South West	460969	615778	exact
KY013	Magherabeg	Killiney	Corkaguiny	Kerry	KE027-006001	South West	460965	615761	exact

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Site ID	Site Name, Townland	Parish	Barony	County	SMR	Location Category	ITM Easting	ITM Northing	Accuracy
KY014	Magherabeg	Killiney	Corkaguiny	Kerry	KE027-006002	South West	460989	615759	exact
KY015A-B	Castlegregory	Killiney	Corkaguiny	Kerry	—	South West	462141	613415	exact
KY016A-D	Magherees Peninsula, Magherabeg	Killiney	Corkaguiny	Kerry	KE027-009	South West	461200	615900	estimate
KY017	Kilshannig	Killiney	Corkaguiny	Kerry	KE027-014	South West	462400	618624	exact
KY018	Barrow	Ardfert	Trughanacmy	Kerry	KE028-00400(5-11)	South West	473938	618453	exact
KY019	Tawlaght	Ballynahaglish	Trughanacmy	Kerry	KE028-027001	South West	473498	616703	exact
KY020A-B	Tawlaght	Ballynahaglish	Trughanacmy	Kerry	—	South West	473685	616372	exact
KY021	An Ghlaise Bheag	Kilmalkedar	Corkaguiny	Kerry	KE033-010	South West	438626	609015	exact
KY022	Fermoyle Island, Formaoil	Cloghane	Corkaguiny	Kerry	KE035-008	South West	453592	612404	exact
KY023	Fermoyle Island, Formaoil	Cloghane	Corkaguiny	Kerry	KE035-009	South West	453732	612584	exact
KY024	Fermoyle Island, Formaoil	Cloghane	Corkaguiny	Kerry	KE035-010	South West	453802	612594	exact
KY025	Baile Na Leacan	Cloghane	Corkaguiny	Kerry	KE035-026	South West	451183	611774	exact
KY026	Drom Hill, An Droim Thoir	Cloghane	Corkaguiny	Kerry	KE035-030	South West	452782	611704	exact
KY027	An Clochán	Cloghane	Corkaguiny	Kerry	KE035-032	South West	450923	611104	exact
KY028	An Droim Thoir	Cloghane	Corkaguiny	Kerry	KE035-036	South West	453582	611704	exact
KY029	Annagh	Kiltallagh	Trughanacmy	Kerry	KE038-003010	South West	480187	612198	exact
KY030A-V	Ferriter's Cove, An Baile Uachtarach Theas	Kilcolman	Trughanacmy	Kerry	KE042-035	South West	432899	605444	exact
KY031	Baile An Reannaigh	Marhin	Corkaguiny	Kerry	KE042-054	South West	436786	605805	exact
KY032	Baile An Reannaigh	Marhin	Corkaguiny	Kerry	KE042-061	South West	437356	605025	exact
KY033	Cill Fearnóg	Ventry	Corkaguiny	Kerry	KE052-114	South West	437611	598550	exact
KY034	Baile Mhic An Daill	Dingle	Corkaguiny	Kerry	KE053-015	South West	442943	599730	exact
KY035	An Loch	Garfinny	Corkaguiny	Kerry	KE053-019	South West	445155	599545	exact
KY036	Gubbranna Point, Inch	Ballinvoher	Corkaguiny	Kerry	KE055-001	South West	466399	599836	exact

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Site ID	Site Name, Townland	Parish	Barony	County	SMR	Location Category	ITM Easting	ITM Northing	Accuracy
KY037	Cromane Spit, Cromane Lower	Killorglin	Trughanacmy	Kerry	KE055-002	South West	469306	596493	exact
KY038	Dooaghs	Killorglin	Iveragh	Kerry	KE055-004	South West	468498	595660	exact
KY039	Dooaghs	Killorglin	Iveragh	Kerry	KE055-005	South West	467709	594698	exact
KY040	Dooaghs	Killorglin	Iveragh	Kerry	KE055-006	South West	467699	594678	exact
KY041A-B	Dooaghs	Killorglin	Iveragh	Kerry	KE055-007	South West	467669	594658	exact
KY042	Dooaghs	Killorglin	Iveragh	Kerry	KE055-008	South West	467350	594293	exact
KY043	Dooaghs	Killorglin	Iveragh	Kerry	KE055-009	South West	467899	595287	exact
KY044	Inch	Ballinvoher	Corkaguiny	Kerry	KE055-010	South West	466347	599842	exact
KY045A-B	Inch	Ballinvoher	Corkaguiny	Kerry	KE055-010001	South West	466300	598500	estimate
KY046	Inch	Ballinvoher	Corkaguiny	Kerry	KE055-012	South West	465700	598800	estimate
KY047	Crow's Point, Cromane Lower	Killorglin	Trughanacmy	Kerry	KE056-059	South West	470513	599629	exact
KY048	Rossbehy	Glanbehy	Iveragh	Kerry	KE063-001	South West	465240	592898	exact
KY049	Rossbehy	Glanbehy	Iveragh	Kerry	KE063-002	South West	465299	592878	exact
KY050	Beginish Island, Beginish	Caher	Iveragh	Kerry	KE079-028	South West	442025	578661	exact
KY051A-D	Canroe, Beginish	Caher	Iveragh	Kerry	KE079-031003	South West	442415	578841	exact
KY052	Ballycarbery South	Caher	Iveragh	Kerry	KE079-033	South West	443634	579181	exact
KY053A-C	Illaunloughan, Portmagee	Killemlagh	Iveragh	Kerry	KE087-036007	South West	436609	573130	exact
KY054	Dunkerron Island West	Templenoe	Dunkerron South	Kerry	KE092-052	South West	486735	568893	exact
KY055	Abbey Island	Kilcrohane	Dunkerron South	Kerry	KE106-077005	South West	452028	558307	exact
KY056	Abbey Island	Kilcrohane	Dunkerron South	Kerry	KE106-129	South West	451972	558385	exact
KY057	Waterville	Dromond	Iveragh	Kerry	—	South West	450900	565600	estimate
KY058	Formaoil	Cloghane	Corkaguiny	Kerry	—	South West	453721	612575	exact
KY059A-B	An Droim Thoir	Cloghane	Corkaguiny	Kerry	—	South West	452915	611921	exact
LH001A-B	Liberties of Carlingford	Carlingford	Lower Dundalk	Louth	LH005-029001	East	719346	811845	exact

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Site ID	Site Name, Townland	Parish	Barony	County	SMR	Location Category	ITM Easting	ITM Northing	Accuracy
LH002	Liberties of Carlingford	Carlingford	Lower Dundalk	Louth	LH005-038	East	720215	810900	exact
LH003	Rockmarshall	Ballymascanlan	Lower Dundalk	Louth	LH008-026001	East	711367	808440	exact
LH004	Rockmarshall	Ballymascanlan	Lower Dundalk	Louth	LH008-026002	East	711417	808440	exact
LH005	Rockmarshall	Ballymascanlan	Lower Dundalk	Louth	LH008-026003	East	711447	808440	exact
LH006	Rockmarshall	Ballymascanlan	Lower Dundalk	Louth	LH008-034	East	712047	807660	exact
LH007	Haggardstown	Haggardstown	Upper Dundalk	Louth	LH012-056	East	706017	802844	exact
LH008A-B	Haggardstown	Haggardstown	Upper Dundalk	Louth	LH012-070	East	706598	802443	exact
LH009	Townparks	Dundalk	Upper Dundalk	Louth	—	East	704786	807201	exact
LH010	Ghan House, Liberties of Carlingford	Carlingford	Lower Dundalk	Louth	—	East	718930	811564	exact
LH011A-C	Liberties of Carlingford	Carlingford	Lower Dundalk	Louth	—	East	718844	811601	exact
MO001	An Corrán Buí	Burrishoole	Burrishoole	Mayo	MA004-007002	Highland West	481770	839812	exact
MO002	Kilcummin	Kilcummin	Tirawley	Mayo	MA008-011001	Highland West	520489	838186	exact
MO003	Beltra	Lackan	Tirawley	Mayo	MA008-016	Highland West	518444	838116	exact
MO004	An tEanach	Manulla	Carra	Mayo	MA009-014	Highland West	465733	833123	exact
MO005	An Más, Tóin An Mhása	Kilmore	Erris	Mayo	MA009-015005	Highland West	466243	833617	exact
MO006	Imleach Beag Thuaidh	Kilmore	Erris	Mayo	MA009-018002	Highland West	466470	832396	exact
MO007	An Geata Mór	Kilmore	Erris	Mayo	MA016-008008	Highland West	466420	831307	exact
MO008	Tearmann Caitheach	Kilmore	Erris	Mayo	MA009-022	Highland West	465492	835059	exact
MO009	Barr Thráú	Kilmore	Erris	Mayo	MA010-028	Highland West	471435	835208	exact
MO010	Inis Doire	Kilcommon	Erris	Mayo	MA010-029001	Highland West	475944	831749	exact
MO011	Ross	Killala	Tirawley	Mayo	MA015-059001	Highland West	522100	832900	estimate
MO012	An Chrois	Kilmore	Erris	Mayo	MA016-004007	Highland West	464069	830878	exact
MO013	Inis Gluaire	Kilmore	Erris	Mayo	MA016-012	Highland West	461000	831200	estimate
MO014	Bearnach Thiar	Kilmore	Erris	Mayo	MA016-013	Highland West	463600	827100	estimate
MO015	Poulbeg, An Léim	Kilmore	Erris	Mayo	MA016-014001	Highland West	464000	826600	estimate

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Site ID	Site Name, Townland	Parish	Barony	County	SMR	Location Category	ITM Easting	ITM Northing	Accuracy
MO016	An Bheairic Theas	Kilmore	Erris	Mayo	MA016-019	Highland West	464746	825784	exact
MO017	Inis Gluaire	Kilmore	Erris	Mayo	MA016-020	Highland West	461710	830875	exact
MO018	Oileán na gCapall	Doonfeeny	Tirawley	Mayo	MA022-112	Highland West	524940	828695	exact
MO019	Bartragh Island	Killala	Tirawley	Mayo	MA022-114	Highland West	524682	829138	exact
MO020	Bartragh Island	Killala	Tirawley	Mayo	MA022-117	Highland West	525649	828539	exact
MO021	Rusheens	Ballysakeery	Tirawley	Mayo	MA022-119	Highland West	524024	828673	exact
MO022	Bartragh Island	Killala	Tirawley	Mayo	MA022-120	Highland West	525532	828551	exact
MO023	Rosserk	Ballysakeery	Tirawley	Mayo	MA022-124001	Highland West	525311	825446	exact
MO024	Rosserk	Ballysakeery	Tirawley	Mayo	MA022-124002	Highland West	525286	825478	exact
MO025	Inis Gé Thuaidh	Kilmore	Erris	Mayo	MA023-004	Highland West	456332	823498	exact
MO026	Inis Gé Thuaidh	Kilmore	Erris	Mayo	MA023-005	Highland West	456722	823598	exact
MO027	Inis Gé Thuaidh	Kilmore	Erris	Mayo	MA023-010	Highland West	457072	823228	exact
MO028	Inis Gé Thuaidh	Kilmore	Erris	Mayo	MA023-012	Highland West	457193	822828	exact
MO029	Inis Gé Thuaidh	Kilmore	Erris	Mayo	MA023-016	Highland West	456372	822139	exact
MO030	Inis Gé Theas	Kilmore	Erris	Mayo	MA023-017	Highland West	455742	821659	exact
MO031	Inis Gé Theas	Kilmore	Erris	Mayo	MA023-018002	Highland West	455771	821607	exact
MO032	Inis Gé Thuaidh	Kilmore	Erris	Mayo	MA023-031	Highland West	456100	823000	estimate
MO033	Torán	Kilmore	Erris	Mayo	MA024-025	Highland West	462000	823600	estimate
MO034	Bun An Mhuilinn	Kilcommon	Erris	Mayo	MA025-001002	Highland West	473608	824778	exact
MO035	Kilmoremoy	Kilmoremoy	Tirawley	Mayo	—	Highland West	523956	819996	exact
MO036	Tulachán Dubh	Kilcommon	Erris	Mayo	MA034-007004	Highland West	476257	816302	exact
MO037	Fahy	Kilcommon	Erris	Mayo	MA034-009	Highland West	475425	812561	exact
MO038	Caraun Point, Tóin an tSeanbhaile	Achill	Burrishoole	Mayo	MA043-004002	Highland West	469706	809678	exact
MO039	Caraun Point, Tóin an tSeanbhaile	Achill	Burrishoole	Mayo	MA043-004007	Highland West	469721	809636	exact
MO040	Caraun Point, Tóin an tSeanbhaile	Achill	Burrishoole	Mayo	MA043-004008	Highland West	469751	809617	exact

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Site ID	Site Name, Townland	Parish	Barony	County	SMR	Location Category	ITM Easting	ITM Northing	Accuracy
MO041	Caraun Point, Tóin an tSeabhail	Achill	Burrishoole	Mayo	MA043-004009	Highland West	469771	809623	exact
MO042	Caraun Point, Tóin an tSeabhail	Achill	Burrishoole	Mayo	MA043-004010	Highland West	469766	809563	exact
MO043	Caraun Point, Tóin an tSeabhail	Achill	Burrishoole	Mayo	MA043-004013	Highland West	469814	809645	exact
MO044	Caraun Point, Tóin an tSeabhail	Achill	Burrishoole	Mayo	MA043-004018	Highland West	469865	809386	exact
MO045	Caraun Point, Tóin an tSeabhail	Achill	Burrishoole	Mayo	MA043-004019	Highland West	470211	809665	exact
MO046	Inis Bigil	Kilcommon	Erris	Mayo	MA043-018	Highland West	475713	806309	exact
MO047	Keel Strand, Keel East	Achill	Burrishoole	Mayo	MA054-014001	Highland West	464038	804800	exact
MO048	Doonkinelly (Calvy)	Achill	Burrishoole	Mayo	MA054-016	Highland West	465294	804257	exact
MO049	An Cloich Mhóir	Achill	Burrishoole	Mayo	MA065-029001	Highland West	471489	793465	exact
MO050	Gob Na hAirde	Achill	Burrishoole	Mayo	MA065-035001	Highland West	472295	793151	exact
MO051	Murrevagh/Mulranny	Burrishoole	Burrishoole	Mayo	MA066-002	Highland West	484356	795794	exact
MO052	Acaill Bheag	Achill	Burrishoole	Mayo	MA075-015	Highland West	472003	792465	exact
MO053	Inishcottle Island	Kilmeena	Burrishoole	Mayo	MA076-046	Highland West	492927	790574	exact
MO054	Capnagower	Kilgeever	Murrisk	Mayo	MA085-031	Highland West	471392	785405	exact
MO055	Glen	Kilgeever	Murrisk	Mayo	MA085-078	Highland West	471479	785097	exact
MO056	Oldhead	Kilgeever	Murrisk	Mayo	MA086-012	Lowland West	483340	782756	exact
MO057	Fallduff	Kilgeever	Murrisk	Mayo	MA086-013	Lowland West	484346	781977	exact
MO058	Oldhead	Kilgeever	Murrisk	Mayo	MA086-018	Lowland West	483338	782525	exact
MO059	Killadangan	Oughaval	Murrisk	Mayo	MA087-037003	Lowland West	495517	782076	exact
MO060	Rossbeg	Oughaval	Murrisk	Mayo	MA087-075	Lowland West	497120	783979	exact
MO061	Dooghmakeon	Kilgeever	Murrisk	Mayo	MA095-001	Lowland West	474794	778772	exact
MO062	Dooghmakeon	Kilgeever	Murrisk	Mayo	MA095-032002	Lowland West	474949	778588	exact
MO063	Dooghmakeon	Kilgeever	Murrisk	Mayo	MA095-033	Lowland West	474852	778960	exact
MO064	Kinnadoohy	Kilgeever	Murrisk	Mayo	MA105-003003	Lowland West	473490	772370	exact

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Site ID	Site Name, Townland	Parish	Barony	County	SMR	Location Category	ITM Easting	ITM Northing	Accuracy
MO065	Bailey Mór, Inis Gé Thuaidh	Kilmore	Erris	Mayo	—	Highland West	456919	823043	exact
MO066	Dugort	Achill	Burrishoole	Mayo	—	Highland West	467500	808900	estimate
MO067	Caraun Point, Tóin an tSeabhail	Achill	Burrishoole	Mayo	—	Highland West	469703	809584	exact
MO068	Caraun Point, Tóin an tSeabhail	Achill	Burrishoole	Mayo	—	Highland West	469747	809596	exact
SO001	Mullaghmore	Ahamlish	Carbury	Sligo	SL002-025	Highland West	570800	857500	estimate
SO002	Mullaghmore West	Ahamlish	Carbury	Sligo	SL002-038	Highland West	569522	854076	exact
SO003	Mullaghmore	Ahamlish	Carbury	Sligo	SL002-039	Highland West	569877	854939	exact
SO004	Mullaghmore	Ahamlish	Carbury	Sligo	SL002-040	Highland West	570120	856024	exact
SO005	Mullaghmore	Ahamlish	Carbury	Sligo	SL002-041	Highland West	569795	856259	exact
SO006	Mullaghmore	Ahamlish	Carbury	Sligo	SL002-042	Highland West	569705	855781	exact
SO007	Mullaghmore	Ahamlish	Carbury	Sligo	SL002-043	Highland West	569710	855838	exact
SO008	Mullaghmore	Ahamlish	Carbury	Sligo	SL002-044	Highland West	569637	855549	exact
SO009	Mullaghmore	Ahamlish	Carbury	Sligo	SL002-045	Highland West	569940	854789	exact
SO010	Conor's Island	Ahamlish	Carbury	Sligo	SL002-054	Highland West	566622	852280	exact
SO011	Dernish Island	Ahamlish	Carbury	Sligo	SL002-057	Highland West	567708	852400	exact
SO012	Ballyconnell	Drumcliff	Carbury	Sligo	SL004-031	Highland West	556449	846284	exact
SO013	Moneygold	Ahamlish	Carbury	Sligo	SL005-002003	Highland West	566618	851290	exact
SO014	Streedagh	Ahamlish	Carbury	Sligo	SL005-018	Highland West	563045	850318	exact
SO015A-E	Staad Abbey, Agharrow	Ahamlish	Carbury	Sligo	SL005-022004	Highland West	562861	849298	exact
SO016	Grange	Ahamlish	Carbury	Sligo	—	Highland West	565929	849539	exact
SO017	Streedagh	Ahamlish	Carbury	Sligo	SL005-128001	Highland West	563100	850000	estimate
SO018	Conor's Island	Ahamlish	Carbury	Sligo	SL005-194	Highland West	566287	851991	exact
SO019	Horse Island	Drumcliff	Carbury	Sligo	SL007-045	Highland West	556058	844045	exact
SO020	Horse Island	Drumcliff	Carbury	Sligo	SL007-046	Highland West	556107	844075	exact

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Site ID	Site Name, Townland	Parish	Barony	County	SMR	Location Category	ITM Easting	ITM Northing	Accuracy
SO021	Horse Island	Drumcliff	Carbury	Sligo	SL007-047	Highland West	556063	844084	exact
SO022	Raghly	Drumcliff	Carbury	Sligo	SL007-049	Highland West	557601	842536	exact
SO023	Coney Island	Killaspugbrone	Carbury	Sligo	SL008-099	Highland West	562246	839407	exact
SO024	Oyster Island	Killaspugbrone	Carbury	Sligo	SL008-101	Highland West	562733	839381	exact
SO025	Ballincar	Drumcliff	Carbury	Sligo	SL008-197	Highland West	566751	839227	exact
SO026	Rosses Upper	Drumcliff	Carbury	Sligo	SL008-203	Highland West	562784	840220	exact
SO027	Coney Island	Killaspugbrone	Carbury	Sligo	SL008-204	Highland West	562187	839450	exact
SO028	Oyster Island	Killaspugbrone	Carbury	Sligo	SL008-207	Highland West	562820	839254	exact
SO029	Rathlee	Easky	Tireragh	Sligo	SL010-003002	Highland West	531552	837390	exact
SO030	Carrownrush	Easky	Tireragh	Sligo	SL011-004004	Highland West	533499	838602	exact
SO031	Castletown	Easky	Tireragh	Sligo	SL011-014002	Highland West	536681	838339	exact
SO032	Rathlee	Easky	Tireragh	Sligo	SL011-025002	Highland West	532200	837353	exact
SO033	Bunowna	Easky	Tireragh	Sligo	SL011-100	Highland West	537653	838566	exact
SO034	Sraheens	Easky	Tireragh	Sligo	SL011-124	Highland West	538449	838712	exact
SO035	Carrowmably	Kilmacshalgan	Tireragh	Sligo	SL012-124	Highland West	543631	835155	exact
SO036	Skibbolecorragh	Skreen	Tireragh	Sligo	SL013-026003	Highland West	557315	835637	exact
SO037A-I	Shelly Valley, Carrowdough	Killaspugbrone	Carbury	Sligo	SL013-032	Highland West	559984	835106	exact
SO038	Ballinlig	Dromard	Tireragh	Sligo	SL013-087001	Highland West	559085	833113	exact
SO039	Ballinlig	Dromard	Tireragh	Sligo	SL013-087002	Highland West	559021	833159	exact
SO040	Culleenamore	Killaspugbrone	Carbury	Sligo	SL013-088002	Highland West	561220	834410	exact
SO041A-E	Settlement 15, Culleenamore	Killaspugbrone	Carbury	Sligo	SL013-089002	Highland West	561020	834196	exact
SO042	Culleenamore	Killaspugbrone	Carbury	Sligo	SL013-091	Highland West	561058	834007	exact
SO043	Culleenamore	Killaspugbrone	Carbury	Sligo	SL013-117	Highland West	560921	833926	exact
SO044	Killaspugbrone	Killaspugbrone	Carbury	Sligo	SL013-118	Highland West	561100	836607	exact
SO045	Killaspugbrone	Killaspugbrone	Carbury	Sligo	SL013-123	Highland West	560521	836988	exact

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Site ID	Site Name, Townland	Parish	Barony	County	SMR	Location Category	ITM Easting	ITM Northing	Accuracy
SO046	Ballinlig	Dromard	Tireragh	Sligo	SL013-124	Highland West	558824	833179	exact
SO047	Coney Island	Killaspugbrone	Carbury	Sligo	SL014-003*	Highland West	562461	839206	exact
SO048	Doonanpatrick, Sligo Bay	Killaspugbrone	Carbury	Sligo	SL014-004	Highland West	562292	837684	exact
SO049	Doonanpatrick, Sligo Bay	Killaspugbrone	Carbury	Sligo	SL014-004001	Highland West	562291	837663	exact
SO050	Doonanpatrick, Sligo Bay	Killaspugbrone	Carbury	Sligo	SL014-004002	Highland West	562301	837670	exact
SO051	Ballincar	Drumcliff	Carbury	Sligo	SL014-013	Highland West	568006	838196	exact
SO052	Cummeen	Killaspugbrone	Carbury	Sligo	SL014-046	Highland West	565400	836800	estimate
SO053	Settlement 13, Culleenamore	Killaspugbrone	Carbury	Sligo	SL014-135002	Highland West	561613	834232	exact
SO054A-G	Culleenamore	Killaspugbrone	Carbury	Sligo	—	Highland West	561447	834089	exact
SO055	Settlement 14, Culleenamore	Killaspugbrone	Carbury	Sligo	SL014-137002	Highland West	561538	834090	exact
SO056	Culleenamore	Killaspugbrone	Carbury	Sligo	SL014-138	Highland West	561570	833936	exact
SO057	Settlement 12, Culleenduff	Killaspugbrone	Carbury	Sligo	SL014-139002	Highland West	561869	833613	exact
SO058	Culleenduff	Killaspugbrone	Carbury	Sligo	SL014-140	Highland West	561800	833576	exact
SO059	Settlement 18B, Culleenduff	Killaspugbrone	Carbury	Sligo	SL014-141	Highland West	561777	833343	exact
SO060	Culleenduff	Killaspugbrone	Carbury	Sligo	SL014-143	Highland West	561854	833276	exact
SO061	Culleenduff	Killaspugbrone	Carbury	Sligo	SL014-144	Highland West	561944	833246	exact
SO062	Culleenduff	Killaspugbrone	Carbury	Sligo	SL014-145	Highland West	562014	833198	exact
SO063	Culleenduff	Killaspugbrone	Carbury	Sligo	SL014-146002	Highland West	562287	833478	exact
SO064	Settlement 10, Culleenduff	Killaspugbrone	Carbury	Sligo	SL014-148002	Highland West	562377	833474	exact
SO065	Settlement 7, Culleenduff	Killaspugbrone	Carbury	Sligo	SL014-151	Highland West	562362	833233	exact
SO066	Settlement 1, Grange West	Killaspugbrone	Carbury	Sligo	SL014-152002	Highland West	562694	833481	exact
SO067	Settlement 2, Grange West	Killaspugbrone	Carbury	Sligo	SL014-153002	Highland West	562850	833663	exact

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Site ID	Site Name, Townland	Parish	Barony	County	SMR	Location Category	ITM Easting	ITM Northing	Accuracy
SO068	Settlement 4, Grange West	Killaspugbrone	Carbury	Sligo	SL014-154002	Highland West	562977	833768	exact
SO069	Glen	Killaspugbrone	Carbury	Sligo	SL014-155	Highland West	562922	833341	exact
SO070	Settlement 8, Luffertan	Killaspugbrone	Carbury	Sligo	SL014-156002	Highland West	562881	833286	exact
SO071	Settlement 9, Luffertan	Killaspugbrone	Carbury	Sligo	SL014-157002	Highland West	562929	833276	exact
SO072	Settlement 3, Grange West	Killaspugbrone	Carbury	Sligo	SL014-158002	Highland West	563080	833358	exact
SO073	Luffertan	Killaspugbrone	Carbury	Sligo	SL014-159	Highland West	563040	833141	exact
SO074A-D	Grange North	Killaspugbrone	Carbury	Sligo	—	Highland West	563586	833610	exact
SO075	Settlement 6, Grange East	Killaspugbrone	Carbury	Sligo	SL014-179002	Highland West	564243	833536	exact
SO076	Culleenduff	Killaspugbrone	Carbury	Sligo	SL014-256	Highland West	562010	833537	exact
SO077	Scardan More	Killaspugbrone	Carbury	Sligo	SL014-294	Highland West	564365	836896	exact
SO078A-C	Glebe	Skreen	Tireragh	Sligo	SL019-005002	Highland West	552315	832791	exact
SO079	Ballinlig	Dromard	Tireragh	Sligo	SL019-046	Highland West	559153	832642	exact
SO080	Tanrego West	Dromard	Tireragh	Sligo	SL019-057001	Highland West	559556	832107	exact
SO081	Tanrego West	Dromard	Tireragh	Sligo	SL019-057002	Highland West	559745	831961	exact
SO082	Tanrego West	Dromard	Tireragh	Sligo	SL019-057003	Highland West	559898	831924	exact
SO083	Tanrego West	Dromard	Tireragh	Sligo	SL019-057004	Highland West	560123	831659	exact
SO084	Tanrego East, Carrowmore	Dromard	Tireragh	Sligo	SL019-057005	Highland West	560265	831574	exact
SO085	Tanrego East, Carrowmore	Dromard	Tireragh	Sligo	SL019-057006	Highland West	560410	831497	exact
SO086	Tanrego East, Carrowmore	Dromard	Tireragh	Sligo	SL019-057007	Highland West	560546	831365	exact
SO087	Settlement 11, Seafield	Kilmacowen	Carbury	Sligo	SL020-007002	Highland West	563597	832569	exact
SO088	Breeoge	Kilmacowen	Carbury	Sligo	SL020-039003	Highland West	565001	831461	exact
SO089	Breeoge	Kilmacowen	Carbury	Sligo	SL020-098	Highland West	564579	830536	exact
SO090A-C	Kilboglashy	Ballysadare	Leyny	Sligo	SL020-109007	Highland West	566546	829572	exact

Appendix 3: Locations of Irish Shell Middens

Site ID	Site Name, Townland	Parish	Barony	County	SMR	Location Category	ITM Easting	ITM Northing	Accuracy
SO091	Kilboglashy	Ballysadare	Leyny	Sligo	SL020-109012	Highland West	566519	829642	exact
SO092	Kilboglashy	Ballysadare	Leyny	Sligo	SL020-109013	Highland West	566583	829442	exact
SO093	Streamstown	Ballysadare	Leyny	Sligo	SL020-133003	Highland West	562929	829296	exact
SO094	Breeoge	Kilmacowen	Carbury	Sligo	SL020-228001	Highland West	564800	831500	estimate
SO095	Breeoge	Kilmacowen	Carbury	Sligo	SL020-247	Highland West	564674	831761	exact
SO096	Breeoge	Kilmacowen	Carbury	Sligo	SL020-248	Highland West	564579	831885	exact
SO097	Balladrihid, Carrowgobbadagh	Ballysadare, Kilmacowen	Tireragh, Carbury	Sligo	SL020-256	Highland West	567408	830376	exact
SO098	Lisheenacooravan	Kilmacowen	Carbury	Sligo	SL020-258	Highland West	562593	832298	exact
SO099	Luffertan	Killaspugbrone	Carbury	Sligo	—	Highland West	566800	829300	estimate
SO100	Woodpark	Killaspugbrone	Carbury	Sligo	—	Highland West	562600	833000	estimate
WA001	Tramore Burrow	Drumcannon	Middlethird	Waterford	WA026-066	East	660712	600573	exact
WA002	Tramore Burrow	Drumcannon	Middlethird	Waterford	WA026-086	East	660835	600578	exact
WA003	Tramore Burrow	Drumcannon	Middlethird	Waterford	WA026-092	East	661363	600663	exact
WA004	Lisselty	Rathmoylan	Gaultiere	Waterford	WA027-025003	East	662615	600351	exact
WA005	Rathmoylan	Rathmoylan	Gaultiere	Waterford	WA027-039002	East	666001	599435	exact
WA006	Kilmacleague West	Kilmacleague	Gaultiere	Waterford	WA027-090	East	663248	602074	exact
WA007	Kilmacleague West	Kilmacleague	Gaultiere	Waterford	WA027-091	East	663255	602058	exact
WA008	Kilmacleague West	Kilmacleague	Gaultiere	Waterford	WA027-092	East	663239	602087	exact
WA009	Kilmacleague West	Kilmacleague	Gaultiere	Waterford	WA027-093	East	663237	602091	exact
WA010	Creadan	Killea	Gaultiere	Waterford	WA027-095	East	670475	603420	exact
WA011	Bewley	Kilmolash	Decies-without -Drum	Waterford	WA029-026002	East	612715	595018	exact
WA012A-B	Strandside, Abbeyside	Dungarvan	Decies-without -Drum	Waterford	—	East	626683	592953	exact
WA013	Tramore Burrow	Drumcannon	Middlethird	Waterford	WA026-093	East	661223	600668	exact
WW001	Rathdown Upper	Delgany	Rathdown	Wicklow	WI008-011003	East	728828	713724	exact
WX001	Townparks	St John's	Forth	Wexford	WX037-079	East	682200	607600	estimate

Appendix 3: Locations of Irish Shell Middens

Site ID	Site Name, Townland	Parish	Barony	County	SMR	Location Category	ITM Easting	ITM Northing	Accuracy
WX002	Bannow Island	Bannow	Bargy	Wexford	WX045-044	East	682237	607598	exact
WX003A-B	Grange	Fethard	Shelburne	Wexford	WX050-011004	East	679364	605146	exact
WX004A-C	Tintern Abbey, Tintern	Tintern	Shelburne	Wexford	—	East	679375	610107	exact