Romano-British Fishing:

An interdisciplinary evaluation of the archaeological remains pertaining to halieutic practices in Roman Britain.

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Submitted for the degree of Doctor of Philosophy

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October 2020

Declaration: I confirm that this is my own work and the use of all material from other sources has been properly and fully acknowledged.

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by Lee Antonio Graña Nicolaou, University of Reading

Submitted for the PhD in Classics and Archaeology, 2020

Abstract

The study of Romano-British fishing practices has lacked a comprehensive assessment of the tool remains, relying solely on fish bone assessments and thereby providing an incomplete picture from which to determine the methods and scale of halieutic practices in the Roman province. By adopting and expanding on methods of interdisciplinary research advocated in mainland Europe, this thesis assesses the combined evidence from Roman Britain and exposes the diverse and discrepant fisheries that exploited aquatic resources throughout the Roman occupation.

The study hypothesises on the methods, scale, and distribution of Roman fishing practices in the province of Britain during the mid-1st to early 4th centuries AD, as portrayed by the available evidence. An assessment of the various artefactual and ecofactual resources is conducted, including fish bone remains, literary and pictorial evidence, fishing tools, and fishing installations. The accrual of hundreds of artefacts allows their dissection in preliminary catalogues and classifications, providing a more robust database for a region-wide assessment and for promoting further research. The classifications make it possible to identify morphological patterns that appear to relate to the fishing practices used in Roman Britain. An additional updated catalogue of fish bone assemblages augments the preceding work by Locker (2007), with the addition of recent discoveries and, where possible, the inclusion of chronological context.

One crucial aspect of the thesis is that it highlights various persistent obstacles and challenges in the study of ancient fishing practices, namely a deficient recording system of halieutic artefacts, discrepant sampling and assessment strategies of ecofacts, and the absence of interdisciplinary approaches to the British record. The preliminary catalogues of artefacts conducted for this investigation reveal a wide range of halieutic evidence, consistent with the distribution of Roman settlements and military fortifications. Freshwater resources appear to be the most ubiquitous targets of Roman fisheries, albethey small-scale events; meanwhile marine and brackish-water case studies highlight few yet existent large-scale fisheries supplying the major urban settlements. As a preliminary holistic study, the thesis outlines necessary changes and additions to halieutic research in Britain, including a more thorough assessment of the Iron Age and early Medieval evidence with which to more critically determine the influence of the Roman annexation of Britain on the exploitation of aquatic resources.

Acknowledgements

The study of fishing in the ancient world is not a young subject, nevertheless it is relatively limited in the number of published material and contributing authors. Most of the material that is included in this assessment has been acquired from museum collections, undigitized grey literature, and the support of commercial units. Museums have suffered severely in the UK due to underfunding over the last decade, leading to the closure of many centres, and a reliance on volunteers, who ensure access to our archaeological heritage. I owe a debt of gratitude to the numerous individuals, from diverse fields, who have offered their time to support my research and would be remiss to exclude them from the acknowledgements:

Manse Ahmed, Survival expert and experimental archaeologist; Mark Atkinson, Archaeology South-East; Paul Booth, Oxford Archaeology South; Rose Broadley, Historic Environment, Kent County Council; Sharon Cook, Oxford Archaeology South; Alex Croom, Keeper of Archaeology at Arbeia Roman Fort and Museum; Jessica Dowdell and Ben Paites, Colchester and Ipswich Museums; Peter Forward, black smith and experimental archaeologist; Paula Gentil, Curator of Archaeology at Hull and East Riding Museum; James Harris, Corinium Museum; Helen Hovey, Collections Manager at the Department of Antiquities, Ashmolean Museum; Alison Locker, Ichthyologist; Cameron Moffett, English Heritage; Jason Monaghan, Rachael McCutcheon, Philip De Jersey, and Amanda Cook, the Museum of Guernsey; Elizabeth Montgomery, West Cheshire Museums; Rebecca Nicholson, Oxford Archaeology South; Keith Parfitt, original editor of publication and current excavations at Dickson's Corner; Louise Rayner, University College London; David Rice, Gloucester Museum; Victoria Ridgeway and Dougie Killock, Pre Construct Archaeology; and David Thorold, Verulamium Museum.

A PhD is a life changing experience, not simply because of the opportunities it may afford, but because of the impact it has on the student during completion (both positive and negative). I would not have considered pursuing this research if not for the circumstances in which I found myself, supported by family, friends, and colleagues. I would like to thank Oxford Archaeology for accommodating me during the first half of the PhD, especially Dr. Rebecca Nicholson for her patience and input on my research. I would like to thank Raul Leon, Kunsang Vincentz, Carolina Cordero, and Thomas Edwards, for their support and feedback, particularly Raul for once again losing sleep to provide helpful advice and technical support. I would like to thank Dr. David Walsh (University of Kent), for providing a lifeline to several libraries and resource under the restrictions of the COVID crisis. I would also like to thank my immediate and extended family for their unlimited confidence in my abilities, especially when I falter; as my aunt Elaine has drilled into me, “it is not a question of ‘if’ but ‘when’ you finish”. My father, Francisco, and brother, Eloy, have mastered indirect support, knowing when best to steer clear of the subject of ‘the PhD’ and instead supporting my passion for fishing. My mother, Shirley, has nurtured a desire to achieve goals that I have long considered beneath my station, for which this stressful endeavour is in part her fault. I know that I am not an easy man to be around when the stress of the work takes its toll and I acknowledge my fortune in having the love and support of my wife, Corie Edwards, without whom this thesis and other achievements in my life would not have been possible, let alone attempted. I would dedicate the thesis to her, if not for fear that she would think I was blaming her for it.

During the course of this research, I have encountered numerous pitfalls. What was once supposed to be a career-boosting three-year project mutated into an odyssey of unforeseen circumstances. This not only emphasises the depth of gratitude I owe my friends and family, but also the unyielding support of my supervisors, Professor Annalisa Marzano and Associate Professor Gundula Müldner. Their patience and support has been above and beyond their professional role. Their kindness and integrity has been my fortune.

For Tuck (Everlasting).

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1. Introduction

Figure 1: Fish brooch from Denton with Wooton (Image from Portable Antiquities Scheme: DOR-1A0981)

Archaeohalieutic research concerns the investigation of past fishing methods via the study of archaeological evidence, including ichthyofaunal ecofacts, structures, and artefacts, augmented for the Roman period by literary sources and pictorial representations. It is an evolving discipline that focuses on the interpretation of the human exploitation of aquatic resources and the resonant cultural, social, and economic implications. Assessments and interpretations of past fishing methods have primarily developed either as an extension of ichthyoarchaeological studies, where fish bone remains and human diets are the primary focus, or historical interpretations of primary sources pertaining to fish and/or fishing. Both avenues must often work with scarce data and have therefore included ethnographic material, correlating recent traditional methods with potential parallels in both artefactual and ecofactual deposits. This focus has often restricted the interpretation of the tool remains, which have therefore continued to provide a limited supply of tangible data from which to propose further hypotheses of function.

Due to the inconsistency of the available data, such as the absence of clear patterns of artefact morphology and distribution, there have been few holistic studies of fishing, in which the various archaeological remains are assessed as combined evidence of ancient fishing practices. Only recently have such endeavours been developed via international collaborations with a focus on Mediterranean evidence (Bekker Nielesen 2005; Bekker Nielesen and Bernal 2010; Bernal 2009; 2011); Britain, however, is yet to produce a detailed assessment of the evidence acquired from over 200 sites and over the last 100 years. This thesis attempts such an undertaking by presenting the archaeological data in a comprehensive catalogue of tool remains while demonstrating the connectivity of the ecofactual, artefactual, and environmental evidence for fishing, and thereby presenting a more representative picture of fishing practices in this remote Roman province.

1.1 Research Questions and Objectives

This study attempts to produce a clearer picture of the fishing practices used in Roman Britain, of which there is a large gap in our understanding. Where the Romans were fishing, the scale of such events, and the impact it had on the Romano-British population, are unexplored research questions. The various aquatic environments (rivers, estuaries, coastal zones, and the sea) theoretically could have supplemented both small and large-scale fisheries; meanwhile, the cultural context of the intended market (military, urban, or private rural residence) is a significant component for understanding the demand for fish and subsequent success of fisheries across the discrepant communities of Britain. The link between these producers and consumers are the archaeological remains of both the tools used for fishing, and the remains of the catch (the fish), as yet unassessed as a combined resource. The subsequent primary objectives of this research are quite broad in their goal, though the method of their resolution is complex:

- What fishing methods were used in Britain during the period of Roman occupation?
- Where did fishing take place? In what aquatic environments and what geographical locations?
- What was the scale of Romano-British fisheries?
- How does aquatic exploitation relate to geographic, cultural, and environmental conditions?
- To what extent are the Romano-British fisheries consistent with practices identified in other Roman provinces?

Previous attempts to answer these questions have concluded that the available material is limited in quantity and application (Alcock 1997; Locker 2007). This is in no small measure due to the delayed development of fishery studies in the 20th century and, therefore, the poor level of artefact recovery and publication. By 2020, a much larger pool of halieutic remains have become available for investigation; however, what data can be extracted from the disparate resources and how it can be applied to an interpretation of fishing practices is also an under-researched subject (Bernal 2010, 105). By following methodologies established within the Mediterranean and adapting them to the Romano-British evidence, further research questions must be answered to reach the targeted objectives of the thesis:

- What archaeological evidence is currently available?
- What resources remain insufficient in quantity or quality to be included in this assessment?
- What data can be extracted from the tool remains?
- Do the various resources relate to each other? And if so, how?

There are of course numerous constraints due to the novelty of this study within the confines of the Romano-British period (AD 43 to 410) and the limited number and scope of published works on the subject; nevertheless, this is not intended as a definitive study, rather it is an attempt to establish a foundation for continued halieutic research in Britain. Subsequent objectives of the thesis are based on the availability of materials and the consolidation of successful methodologies for their assessment and interpretation. The most pertinent materials to date include fishing hooks, netting needles, net weights, processing sites, holding tanks, and fish bone remains. The latter organic remains stand out due to their more numerous recovery and publication (e.g. Locker 2007). Additional halieutic artefacts labelled here 'miscellaneous items', are far fewer in number and are therefore a limited resource for fishery interpretations, though recorded examples are included.

There are no previous publications or studies that have attempted to collate the artefactual remains from Britain and, therefore, no guidelines for their identification and interpretation within a Romano-British context. One objective is the production of catalogues of relevant material, highlighting morphological characteristics and, where possible, proposing a regional typology and/or preliminary classification criteria with which to support more detailed assessments of further discoveries.

Fish bone remains have been the subject of more critical and holistic examinations in Britain, that is, up to the early 2000s (Locker 2007); yet, they have never been examined alongside the tool remains. One objective is thus a combined assessment of artefacts and ecofacts, to both determine if previous interpretations of fishing practices based solely on ichthyofaunal remains are well founded, as well as to highlight novel patterns that may aid in the interpretation of

Roman fisheries. To attempt such a study, it is first necessary to include and examine the additional fish bone assemblages recovered since the early 2000s.

1.2 Roman Britain, A Brief Natural and Cultural History

The British Isles are an archipelago composed of 123 islands, over 60,000 ponds and lakes, over 9,000 rivers and streams, and over 6,400 km of seaboard (Maitland 1979; Bertram 1891), it is thus a significant aquatic ecosystem. Britain has a temperate oceanic climate caused by a meeting of dry continental air from the east, wet air from the Atlantic, and a warm current provided by the Gulf Stream; these external influences are relatively consistent throughout the country resulting in the absence of climatic extremes and more regulated influences on local biota (Barrow and Hulme 1997), anthropogenic impacts notwithstanding. There are notable discrepancies between the marine environments that surround the British isles, influenced primarily by topography (Lee and Ramster 1981), yet the relative consistency of the British environment, alongside its physical isolation from mainland Europe, reflects the insulated nature of the aquatic ecosystems that were encountered by the Romans. For this reason, the species identified throughout the region are largely consistent from north to south.

Fish is a general term that refers to several classifications within the animal kingdom of species that live in various aquatic environments. The over 23,000 and growing number of species worldwide are extremely diverse, which is reflected to a relative extent in the morphological discrepancies of the bones, scales, and fossilised cartilage that survive in the archaeological record. It is the bony fish (*Osteichthyes*) that provide the majority of ecofact remains in the form of diagnostic skull, jaw, and vertebrae fragments. Britain benefits from having a relatively consistent aquatic fauna, a consequence of the relatively uniform climate and environmental conditions of the archipelago. There are several hundred species recorded in the rivers, estuaries, and coastlines (Wheeler 1978), a minority of which provide a viable food source or economic resource; indeed, the archaeological evidence for the Roman period has produced a relatively low number of seventy-one species from thirty-six families. This consistency of species provides a more uniform dataset with which to identify patterns in relation to the accompanying tool remains, and with which to hypothesise on the impact of Roman cultural influences.

Britain became part of the Roman Empire following the invasion of AD 43, under the emperorship of Claudius Caesar, and politically relinquished in AD 410 under the emperorship of Honorius Augustus. The invasion saw an initial rapid annexation of native territories throughout most of modern-day England, many, but not all, conquered by force. This military endeavour was characterised by the establishment of fortifications on or in proximity to native settlements, with subsequent colonies, farm-complexes, and rural villas occupying much of the southern terrain, and with a more permanent military presence remaining in the northern and western territories (Mattingly 2007). By the 2nd century, Roman Britain was indeed a multicultural province, where natives, soldiers, and colonists of various ethnic backgrounds settled and interacted (Leach et al. 2009; Müldner 2013, 145). Similarly, by the 4th century and into the 6th century, Britain continued to house a mixture of cultures, with north-eastern Germanic tribes (such as the Angles and Saxons) interacting with eastern settlements, both aggressively with military raids and passively via trade and settlement (Mattingly 2007, 346). Though currently theoretical due to a poor level of research, it is plausible that fishing in Roman Britain also reflects this cultural maelstrom of interactions between disparate societies and the various aquatic resources. The environmental, geographic, and cultural influences are indeed a significant element in halieutic interpretations (Bekker-Nielsen 2010, 190), and are therefore further assessed alongside the archaeological evidence.

1.3 Thesis Structure

The thesis is composed of eleven chapters that organise the discrepant evidence of this interdisciplinary approach to ancient fishing. The first three chapters (including the introduction) consist of various overviews of the available material, how it has been used in previous halieutic interpretations, and how it is applied here. The following six chapters assess the various historical and archaeological evidence individually, presenting the data and proposing preliminary interpretations. The final chapters attempt to correlate the evidence in a region-wide assessment, answer the research questions and/or highlight where further research is essential.

Chapter 2 is a literary review dedicated to highlighting the various subdisciplines and foci of Roman fishing studies. The first half of the chapter concentrates on current theories and approaches to the interpretation of Roman artefact and ecofact remains from the Mediterranean. The second half summarises the work conducted in Britain and the most recent understanding of Roman fishing in the country.

In Chapter 3 (Methodology), the chosen structure and argument for this thesis is outlined. The archaeological remains included in the study, and the criteria by which they have been chosen, is provided. It is argued that the interpretation of the archaeological remains requires the inclusion of ethnographic evidence; how this resource is used is elucidated here. Also defined in this chapter is the distinction of geographical regions based on topographic and aquatic environments; these have been included to separate the data and provide regional divisions based on the aquatic resource rather than political boundaries or alternative economic patterns.

Chapters 4 to 9 set out the diverse evidence for fishing practices from Roman Britain, grouping the primary sources (Chapter 4), fishing hooks (Chapter 5), lead net weights (Chapter 6), netting needles (Chapter 7), miscellaneous artefacts (Chapter 8), and fish bone remains (Chapter 9). Each chapter includes an assessment of the archaeological data followed by an interpretation of the evidence.

Chapter 10 is the synthetic discussion and interpretation of the combined archaeological remains. Previously highlighted distribution patterns are correlated with the accompanying evidence, first by region and then in a holistic overview of the province. Finalising arguments are provided in the conclusion (Chapter 11) alongside the summarised contributions of this work and the suggested progression of the subdiscipline.

Three appendices are provided to include the various catalogues and data tables referenced throughout the work. Appendix A is divided into three parts, which include catalogues for the fishing hooks, net weights, and netting needles, respectively. Appendix B is a detailed catalogue of fish species identified in the Romano-British archaeological record, including a short assessment of known habits and habitats and a list of the archaeological sites at which they have been found. Appendix C is a collection of tables providing the metadata of the relevant artefacts and ecofacts, divided into five parts; the fish bone assemblages are provided in two formats, divided first by site and second by the species NISP (number of individual specimens) per site.

2. Literary Review: Roman Halieutic Studies

The study of ancient fishing practices is the complex study of diverse tools used in equally diverse aquatic habitats for the capture of a multitude of different species, with their own diverse habits. The discrepant archaeological evidence reflects an equally varied interaction of social, economic, cultural, biological, and environmental aspects in fishing practices (Bekker-Nielsen 2010, 187). It is therefore no surprise that the works which precede this thesis, and which may be defined as 'halieutic studies', are interdisciplinary by nature. It should also be recognised that previous studies do not follow a consistent methodology but instead present discrepant approaches toward the interpretation of one or several fishing practices, conditional on the available archaeological and historical resources. The numerous works are complex and wide-ranging to the extent that the following chapter is dedicated to disseminating previous research and highlighting the most successful methods and conclusions.

2.1 Aims and Objectives of Halieutic Research

By the second half of the 20th century, it was understood from both the archaeological and historical evidence, that fish consumption was ubiquitous throughout the ancient world and that fishing was an activity of notable economic value (Corcoran 1957; Curtis 1991). This assertion followed decades of research dedicated to a particular aspect of aquatic exploitation: the large-scale processing of fish via salting and sauce production; an academic phenomenon recognized as the 'garum factor' (Bernal 2010, 83). The early investigation of fish-processing facilities, i.e. structural remains, incorporated historical evidence to highlight the large economic scale of this industry in antiquity and by extension the fisheries supplying them (e.g. Ponsich and Tarradell 1965). The iconographic record such as mosaics were numerous by this time and were considered a sufficient resource for relating the tools and fishing methods that would have supplied the processing sites (Bernal 2010, 84). Among the diverse fishing techniques supported by the primary sources, the use of large nets for surrounding shoals of blue-fish (sardines, mackerel, etc.) from shore or on boats, have been described (e.g. Manilius Astr. 5.656-81) and depicted (e.g. the fishing scene on the Nile mosaic from Leptis Magna; see

Figure 3). There is no evidence to suggest off-shore fisheries comparable to modern methods of large-scale fishing were available in antiquity (Trakadas 2009), for which the seine net (a wall of mesh of equal depth to the water in which it was used: Jenkins 1973, 223), and similar types of nets, continue to present the probable method of supply for fish processing facilities (Marzano 2013, 117-118).

It was not until the appraisal of additional archaeological evidence, namely fishing equipment, that attention has since been drawn to the complexity of alternative fishing methods only alluded to in the primary sources. Notable discrepancies between literary sources and archaeological remains have been critically assessed (e.g. Alves 1988-89; Brewer and Friedman 1990; Trousset 1998; Rustico 1999), and various studies have concluded that the artefactual remains do not support the scale of fishing required to complement fish-processing facilities but instead relate to a range of fishing practices with various scales of productivity (e.g. Højte 2005, 135; Bernal 2010, 85; Marzano 2013, 32-38). Three discernible tiers are highlighted in halieutic studies:

1. Recreational fishing, as a leisure activity by individuals, often wealthy men using the angling method (e.g. Maganto 1992, 223; Alcock 2006, 105; Bekker-Nielsen 2010, 191; Marzano 2013, 17). Consumption is often secondary or irrelevant, while the methods of capture have no quantifiable commercial value (Ayodeji 2004, 65).

2. For the capture of food as a supplementary resource and for local consumption (e.g. Trakadas 2009, 189; Bekker-Nielsen 2010, 187; Gomez 2013, 21; Dütting 2016, 398), considered to have a low yield and no quantifiable commercial value.

3. To supplement the market of both fresh and preserved fish with potential trade-links to regional and inter-provincial markets (e.g. McCann 1979, 393; Bekker-Nielsen 2005, 85-87; Cottica and Divari 2010, 362; Marzano 2013, 33). This has obvious but variable commercial value, further divided into small-scale and large-scale commercial fishing (Ayodeji 2004, 65).

There is evidence to support all three objectives, collated from primary sources and archaeological remains, with notable overlaps in certain regions. Italy, for example, has produced archaeological evidence of large-scale fishing (e.g. McCann 1979), consumption of local species that were likely caught individually (e.g. Rowan 2014), and descriptions of fishing by elites, such as Pliny the Younger fishing from his bay window at the Larian lake-side villa (Ep. 9.7.4). Identifying the latter via archaeological remains has been suggested for individual finds among villa sites (Alcock 2006, 105), however, it remains the least distinguishable practice.

Differentiating evidence of both small-scale and large-scale fishing activities remains an underdeveloped subject (Bernal 2010, 84) and presents a continued problem in identifying the divide between what is considered supplementary and commercial. The mentioned case study of the Cardo V sewer in Herculaneum (Rowan 2009) is an example of remains that can be attributed to both local subsistence catches by individuals, or the market supply by a fishery with a capital on this local resource (Nicholson et al. 2018). Ayodeji (2004, 65) division of commercial fishing into small and large-scale endeavours, attributes the latter to fish-processing facilities only; however, the productivity of small-scale 'commercial' fisheries, as described by Ayodeji (2004), may be considered large-scale in terms of the economic and alimentary value of the acquired resource. Marzano (2013) identifies the productivity of fish farms, traps, and weirs used in relation to coastal lagoon ecosystems and lakes, which could have provided large volumes of fish but which reveal evidence of both marketable and subsistence fisheries for the benefit of individuals (Ibid. 59, 66).

To narrow the parameters of scale among ancient fisheries, emphasis must be made on the tool remains, especially where accompanying ichthyofaunal evidence is insufficient and where structures pertaining to the conservation of fish are non-existent (e.g. Van Neer and Parker 2008). It has been noted that tools are seldom found alongside fish bone remains due to the disconnection between producer and consumer in most circumstances (Morales 2010, 48). This accounts for the sparse studies of ancient fishing tools, which are often the result of isolated finds (Bernal 2010, 105). Halieutic study therefore requires a broader examination of often disconnected evidence, which, as suggested by Bekker-Nielsen (2004), is further conditioned by a complex network of both natural and cultural factors (Figure 2). For hypotheses of scale to be possible, collaborative efforts and regional comprehensive assessments are pivotal, drawing on multiple assemblages of artefacts within the wider environmental and cultural context.

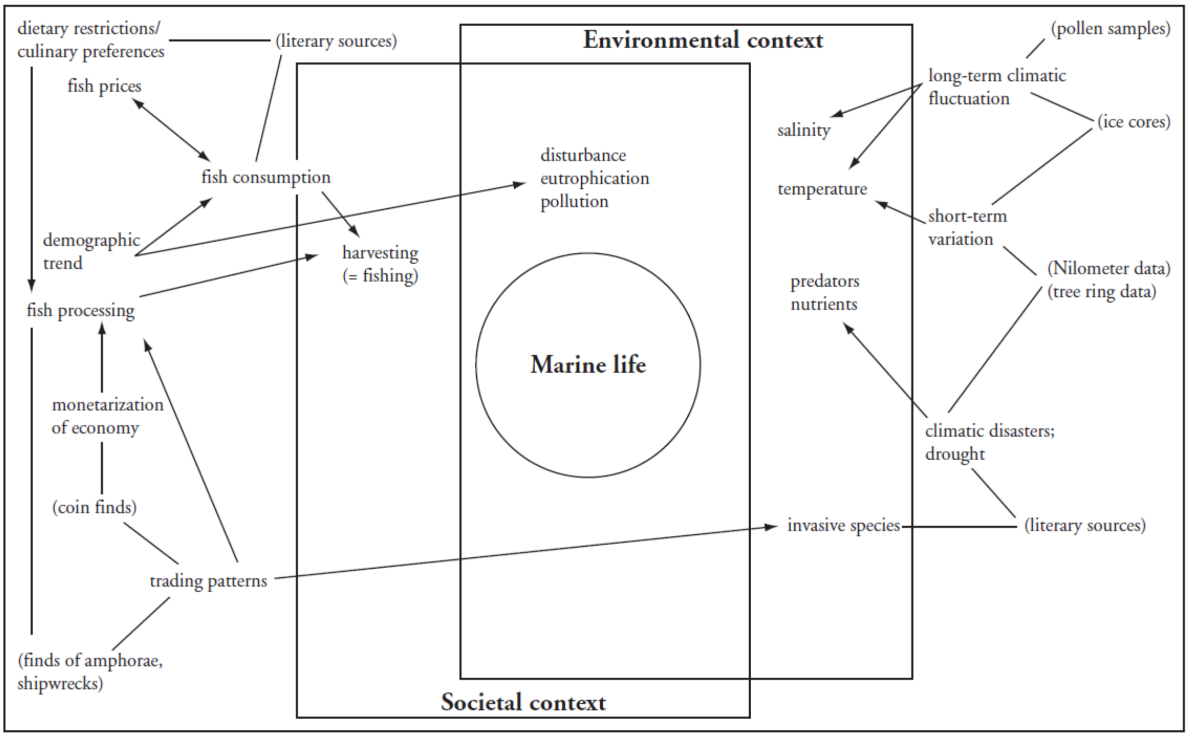


Figure 2: Fishing in the wider Societal and Environmental Context (Bekker-Nielsen 2010, 190).

As late as 2007 archaeologists and historians from across Europe gathered to encourage initial observations of theoretical relationships between tool remains, fish bone assemblages, and the long-established primary sources (the SAGENA project: Bernal and Bekker-Nielsen 2010, 17). It has been argued that only by soliciting a more abstract approach to the undervalued archaeological remains can the foundations for more critical and comprehensive studies be set (Ibid.), no matter how defective or incomplete each set of data might be (Morales 2010, 52). Since the conference held in 2007, there have been numerous conferences aimed at the investigation of the previously undervalued tool remains and their contribution to the subject of ancient fishing: '*SAGENA'* (Bernal 2011), '*Fish and Ships'* (Botte and Leitch 2014), '*Recursos del Mar y Productos Transformados en la Antigüedad'* (Bernal 2014), *'The Exploitation of Maritime Resources in Antiquity'* (Gallet and Gonzalez 2016) and '*The Bountiful Sea'* (Trentacoste et al. 2017); accompanied by various additional collaborative efforts (e.g. Arévalo et al. 2004; Bekker-Nielsen 2005; Lagóstena et al. 2007; Bernal-Casasola 2008a; 2009; 2011; Bernal et al. 2011; Garcia-Vargas and Bernal-Casasola 2009; Bernal-Casasola and Garcia-Vargas 2012; Botte and Leitch 2014; Dütting 2016; Vargas Girón 2020). The resulting objectives are clear:

- Cataloguing and assessment of discrepant resources, including both ecofacts and artefacts previously overlooked.
- Assessment of literary and pictorial sources in relation to archaeological remains.
- The identification of morphological consistencies among the tool remains and the creation of preliminary typologies.
- Incorporation of ecological and environmental evidence.
- Observations of technological continuity over the last 2,000 years, demonstrating and advocating the use of ethnographic comparisons for certain practices.

As highlighted by Bernal (2010, 105) many aspects of halieutic interpretations remain in an infant stage, surpassed in methodologies and accrued data by various other Romanist subjects. The study must continue to support ichthyofaunal and artefactual assessments, while maintaining an interdisciplinary methodology and recognising the component structures, as outlined by Bekker-Nielsen (2010), that is, the capacity of the cultural subject, the surrounding environmental conditions, and the targeted natural resource, as a collective context. The Roman period is further supported by primary sources, while the understanding by the archaeologist as to the function of the artefacts appears largely conditioned by ethnographic comparisons. This complex interconnection produces more numerous assessment criteria for the interpretation of fishing practices, which can hinder as well as promote halieutic research.

2.2 Interpretation of Primary Sources

Fishing has a historical origin that precedes the Romans by thousands of years, not only with Egyptian hieroglyphs (Radcliffe 1921) but also earlier pictorial depictions in the form of prehistoric cave paintings (Cleyet-merle 1990; Morales 2008). Nevertheless, it is not until the Greek texts describing various halieutic practices that an interpretation of the subject is encountered, adopted, and developed in earnest by the Romans. The literary evidence of the Roman interaction with aquatic resources is composed of diverse genres. From poetry to prose, natural history to private letters, and epigraphic remains, the aspects of fishing discussed are various, composing a list of over 100 authors and works (for a full catalogue of literary sources see Ayodeji 2004, 309-315). Most of these sources are anecdotal and often secondary references to certain fish as a luxury food item; nevertheless, the subject of fishing (*halieutica*) is also well represented in a diverse collection of texts that depict both a range of fishing methods and a detailed knowledge of the habits and habitats of many species (Marzano 2013, 18). The addition of mosaics provides illustrations of fish species, tools, and fishing techniques, some of which are not present in the literary record (Monteagudo 2010, 161).

The sources provide a unique insight into how the Romans understood both the practice of fishing and the resource itself, the fish. Cultural preferences, when it comes to fish species, are indeed a significant aspect in determining the objective of the fisheries supplying them. On the one hand, it is advised (Bernal 2010, 84) that caution is necessary as the literary sources, with few exceptions, relate the practices and preferences of a small proportion of the Roman population, largely based on Mediterranean experiences and the observations of authors of elite social status; while on the other, according to Bekker-Nielsen (2004), primary sources can benefit the investigation of all three factors in fishery studies (human, ichthyofaunal, and environmental). Trakadas (2010, 367) has identified phases of changing academic interests on the subject, with an initial focus on processed fish products, followed by an interest on naturalists and the animal kingdom. It is only in the last few decades that the practice of fishing has become a focus of the study of Roman history (Ibid. 368).

2.2.1 The Success of Fish

First, the primary sources can provide the historical background of the cultural/societal context on which the archaeological remains are assessed (Trakadas 2009, 8). In contrast to prehistoric societies, there is a detailed collection of first-hand evidence of the cultural development of Europe and the northern African provinces, providing a platform from which to advance more complex theories of fishing as a distinguishable economic and cultural phenomenon during the Roman empire. Epigraphic and literary sources allude to the organisation of fisheries in the Mediterranean as professional associations, both familial and via partnerships, and with a political voice in the matters of coastal fishing (Marzano 2013, 305-306). Inferences have been made on the significance of fishing to regional economies based on evidence of taxation on fish (Bekker-Nielsen 2005, 83). The request for reduced taxes in Byzantium (Tacitus *Ann*. 12.63), for example, appears to be in part a result of the success of the exploitation of local aquatic resources and thus increased taxes on the produce (Marzano 2013, 239). This success is further identified in recorded conflicts between maritime villa owners and trespassing fishermen accessing coastal fishing grounds (Ibid. 255), a quarrel that, as with issues on tax, reached the Emperors themselves. By the 4th century AD, the edict of Diocletian (AD 301) attempted an empire-wide implementation of a maximum price on goods, including the most expensive fish. This has been considered an attempt to cap the hitherto inflation of prices of aquatic resources (Curtis 2005, 43; Marzano 2013, 290).

A reason for such success and value is alluded to by the various texts that describe the extravagance and wealth assigned to various species of fish and their consumption by elite members of society. Various contemporary opinions on this matter have survived, namely criticisms of the expense of fresh and processed fish among elite Romans (Horace, Sat. 2.4.73; Martial 3.77.5; Pliny H.N. 9.31; Athenaeus, Dei. 6.224; Juvenal, Sa. 4.23). Beyond such criticisms are indirect representations of a wealthy market in fish, which combined with the numerous and ubiquitous pictorial representations on mosaics and frescos, depicts a culture richly invested in aquatic fauna (Monteagudo 2010, 184). It has been noted that fish did not play an equally important role in the identification of wealth among earlier civilisations, which may be evidence of a Roman-lead expansion of this economic sector (Martinez 1992, 220).

One of the more popular aquatic subjects among the literary record deals with processed fish, namely fish sauce, which is a noted indicator of the value of aquatic resources in Roman culture and the extent to which it was exploited (Ponsich and Tarradell 1965). Roman historians and satirists either condemn it, as do Martial (3.77.5), Seneca (Ep. 95.25) and Artemidorus (Oni. 1.62), praise it, as do Galen (Nat. Fac. 3.24) and Athenaeus (4.13), or describe the methods of production, for which we have the works of Columella (12.55.4), Manilius (Ast. 5.656-681), Pliny (N.H. 31.93-95), Ps. Gargilius Martialis (62) and Ps. Rufius Festus (Bre.). Rather than ease the identification of specific processed-fish products, the often vague or contradictory descriptions in the literary sources (of *salsamenta, liquamen, allec, garum*, and *muria*) have resulted in ongoing debates over the highly contested nomenclature for describing pastes, sauces, oils, infusions, or blends and their discrepant economic value (Corcoran 1963, 204; Van-Neer and Parker 2008, 145; Garcia and Bernal 2008, 145; Curtis 1978, 51; 2009; Grainger 2013; In Press). Among the criteria for which sauce was likely produced is the species or general type of fish that were being used. These descriptions are rare, for example the mention of 'small fish' by Pliny (HN.31.95: *coepit tamen et privatim ex iutili pisciculo minimoque confici*). Pliny alludes to the use of small fish being a novel method of production of sauce and paste, replacing the more popular tradition of *garum* made with mackerel (Pliny HN 31.43: *scombro*). The descriptions of various processed goods have begun to be considered as evidence of a widespread consumption of fish by a range of social classes (Bekker-Nielsen 2005, 14; Grainger 2012, 5). The implications of this larger market on the fisheries supplying them are strictly hypothetical and in need of development.

2.2.2 Fishing Practices

Whether exaggerated criticism or accurate descriptions, the relative popularity of fish in Roman society begs the question: were fishing practices equally driven by the demand and value of the resource? to which the simple answer is yes (Marzano 2013, 276). Various texts have been written on the art of fishing, categorised by Roman authors as '*Halieutica'.* The most significant surviving work is that of the 2nd century AD author, Oppian, both in length and diversity of fish and fishing methods described. To our detriment, the additional examples by Demostratus and Leonidas of Byzantium have since been lost and are only referenced in other works. Additional sources include or allude to fishing practices in their description of aquatic fauna or distant cultures, such as the works of Pliny the Elder (*HN*) and Athenaeus.

The four basic methods of fishing described by Aelian (*NA* 12.43) are recognised and reiterated by modern historians, often as a result of their grouped identification in archaeological remains from the Roman period (e.g. Munk 2005; Beltram 2010; Bernal 2010; Vargas 2011; Galili et al 2013; Dutting 2016). Oppian's *Halieutika* is a more controversial work for modern historians, due to the poetic license that may have influenced his use of terminology and range of descriptions (Bekker 2005, 84; Marzano 2013, 17). The use of the hexameter in this poem, influenced by the Hellenic revival, has raised the question of whether Oppian used outdated terms for fishing equipment and excluded alternative fish names to ensure poetic fluidity (Bekker 2005, 84). In the case of nets, additional classifications may be inferred from the various terms used by Athenaeus (*Deip*. 7.284) and Diodorus Siculus (17.43), yet it is argued that the various names do not describe the form of the nets, for which assigning a fishing method may be injurious (Alfaro 2010, 55). As archaeological evidence for fishing has increased and received greater attention, rather than support the available written sources, further discrepancies have begun to emerge (e.g Van Neer et al. 2010, 1622; Bombico 2015, 23).

One alternative primary source that has influenced archaeological interpretations for decades is the recovery of pictorial representations of fishing activities. The vast majority are depictions on mosaics from the North-African coast (housed in the Bardo Museum in Sousse, Tunisia), which in many cases match the description by classical authors, such as Oppian and Aelian. Several historians highlight the significance of the additional details provided by mosaics and absent from the literary sources (e.g. Bekker-Nielsen 2005; Bernal 2010; Monteagudo 2010). These include the type and scale of certain nets (Trakadas 2006, 260; Locker 2007, 143; López 2010, 170), the various roles of fishermen from land and at sea (Bekker-Nielsen 2005, 91), the versatile use of fishing craft (López 2010, 169; Bekker-Nielsen 2005, 88), the additional tools made of organic materials, otherwise lost (Vargas 2011, 205), or the various species of fish being targeted (Alfaro 2010, 57; Marzano 2013, 23).

Figure 3: Fishing in the Nile mosaic, from Leptis Magna (Image from Tripoli National Museum)

General scepticism is advised, conditioned by the inherent bias of the artistic license used by the craftsmen. This is represented in the mixing of real and mythological aquatic scenes (López 2010, 181); simplifying otherwise complex fishing events (Bekker-Nielsen 2005, 87); or the visibly limited knowledge of aquatic fauna by the artist (López 2010, 168-1869). Only six examples of mosaics depicting fishing have been identified in Iberia (Monteagudo 2010, 161), and none in Britain, which is indicative of the regional phenomenon of mosaics in North Africa (Bernal 2010. 84). A comprehensive study of the geographic distribution of mosaics and the depicted species or fishing events is yet to be undertaken (Bekker-Nielsen 2004, 3), for which there is currently a limited application of this resource in the interpretation of regional practices.

2.2.3 The Aquatic Fauna

The final subject of interest is the fish themselves, for which the primary sources provide invaluable information about numerous species, their habits, and habitats. Several of the texts that are available were written by Roman naturalists (e.g. Pliny HN; Aelian NA), following Greek traditions in the description of animal life (Marzano 2013, 17-18). The collection of texts describing fishes by Thompson (1947) reveals hundreds of identified species, which is a testament to the detailed knowledge of aquatic fauna by the Romans. Mosaics can prove equally detailed and have been considered a personal understanding by the artist of the available species, perhaps resulting from purchased examples at a local fish market (Bekker Nielsen 2010, 198). Alternatively, these mosaics may relate to the dietary preferences of the clients ordering the mosaics (Marzano 2013, 23). Once again, it is important that the regional discrepancies not be ignored (Bernal 2010, 84); however, no comprehensive overview of these resources has yet been produced (Bekker-Nielsen 2004,3), for which this too remains an undervalued resource with unexplored applications.

2.3 The Fishing Tool Remains

Fishing tools relate to objects used in the capture of aquatic fauna or for the manufacture of various fishing equipment. The most represented examples include the fishing hooks, the net weights, and the netting needles (Trakadas 2009; Bernal 2010, 84; Vargas Giron 2020). Although represented by thousands of artefacts throughout the Roman Empire (Bekker-Nielsen 2010, 200), these devices have lacked adequate assessments, to the extent that their interpretation has relied on drawing parallels with the primary sources and modern examples (Bernal 2016, 202). To distinguish morphological and functional disparities, archaeologists have urged the creation of catalogues and classifications with which to identify patterns of use and distribution (e.g. Bekker-Nielsen 2005; Bekker-Nielsen and Bernal 2010). Various attempts at classifications have been conducted at regional levels (e.g. Galili et al. 2002; Bernal 2010; Vargas-Giron 2020). These studies remain at an early stage of development (Bernal 2010, 105) and are dependent on a continued recovery and adequate recording of further examples. The most recent work, by Vargas-Giron (2020), establishes preliminary typologies of what is considered the largest collection of fishery artefacts from a single region of the Roman Empire, within Iberia; in doing so, he acknowledges the limitations of the most comprehensive study to date and identifies its role in ensuring more ample recording methods of further discoveries (Ibid. 15). The data acquired from previous studies of fishing tool remains is therefore limited, though important to follow in order to augment rather than replace ongoing objectives of the wider halieutic subject.

Whether tools were used for the capture of particular species depends on our understanding of their regional distribution and in determining the environments in which they were used. Bekker Nielsen (2010, 188) divides Roman fishing techniques into nine sub-categories based on the available literary and archaeological evidence, whereby the four methods are represented in different stages of productivity and effort (Figure 4). The discrepant fishing methods are here perceived as reactions to both the intended scale of capture and the environmental conditions. Some discrepancies in scale have been argued for various fishing methods, such as the wide range of catches supported by casting nets (Gallant 1985; Bekker-Nielsen 2005), which highlight the caution that must be taken in assuming scale based solely on the artefact remains out of context.

manpower input	productive capacity: low →		high	water
low ↓	Baskets, creels and pots	Stationary nets	Traps in migration routes	shallow ↓
	Spear, harpoon, trident	Casting-net from shore or boat	Beach seines, dragnets	
high	Hook and line	Seines worked from one boat	Seines worked from two boats	deep

Figure 4: Scale of productivity, effort, and environment of nine Roman fishing methods (Bekker Nielsen 2010, 188)

Although Bekker-Nielsen (2010) considers the depth of water to be indicative of the method of capture, there is no evidence to suggest that various methods were restricted to a specific depth, nor that Romans were targeting offshore and deep fishing grounds (Trakadas 2009). Freshwater environments, for example, are primarily represented by rivers which, although they are shallow water environments, have produced evidence of a range of fishing equipment (e.g. Mylona 2008, 62; Alfaro 2010, 73; Dütting 2015). The hook is one example of Roman fishing equipment that has been recovered in every aquatic environment (marine: Bernal 2010, 87; brackish: Cottica and Divari 2010, 349; and freshwater: Dütting 2016) and considered to have both a low and high productivity (Bekker-Nielsen 2010, 191). It is this versatility that makes the interpretation of fishing equipment an arduous task and the discovery of a tool should not automatically imply the targeted species (Morales 2006, 59; 2010, 45; Hotje 2005, 135-136). To determine if a clearer structure, such as that proposed by Bekker-Nielsen (2010) is tenable, the objects must be assessed individually and within their context, which has been the goal of various studies.

2.3.1 Fishing Hooks

According to Brandt (1984, 72-73), the modern fishing hook has its origin in the invention and use of bronze, with current examples differing only in the tempering of the iron or copper that is now used. The general shape of what is defined as a 'curved hook' (Ibid.), or the 'Simple/J hook', is far older, with bone and wooden examples dating back 42,000 years (O'Connor et al. 2011), but with the same parts and identical goals as the modern hook (Hurum 1977, 18; Brandt 1984, 73). These parts, according to Brandt (1984, 72), are composed of the eye, shank, bend, and point, the latter of which may include a barb (Figure 5). The 'eye' refers to a style of perforated 'terminal' to which the line is attached, which may also be named the 'head' (Brandt 1984, 73), 'flat' or 'ring' (Hurum 1977, 69-71), depending on the shape.

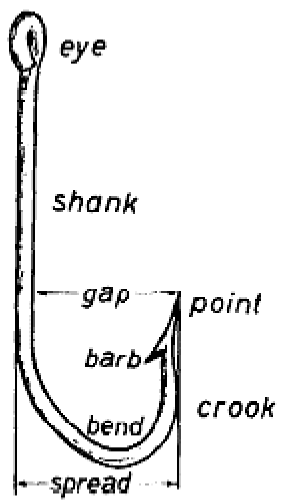


Figure 5: The modern hook, as defined and illustrated by Brandt (1984, 72)

Thousands of different types of hooks exist today, based partly on the manufacture's style and the material used, but also largely influenced by the fisherperson and intended market (Hurum 1977, 69). Every part of a hook is composed of variations that supposedly affect its performance and improve the chances of catching specific species of fish (Hurum 1977, 44-46; Brandt 1984, 73). An estimated 60,000 variations of hooks have been recorded by the largest modern producer, *Mustad*, since their establishment in 1877 (Hurum 1977, 46), making a modern classification system almost impossible. Where general morphological consistencies are recorded are in the style of terminal, barb, and differences in size (Ibid. 70-77). It is with these consistencies that similar patterns emerge in the archaeological record for Roman fishing hooks, from which further hypotheses of function may be inferred.

Hooks have been recovered throughout the Mediterranean (Garcia 1981; Galili et al. 2013, 150; Magantos 2015, 223; Bernal 2016, 201; Vargas 2020, 56), leading to an extensive collection of artefacts. Nevertheless, the methods of analysis have been highlighted to be under the standard capacity of modern archaeological assessment (Bernal 2008b, 183), "a consequence of traditional interpretative methods which have persisted in the Mediterranean" (Ibid.). The early work of Garcia (1981) has attempted a classification of the prominent features of bronze hooks recovered from southern Iberia, working off the preliminary classifications of Déchelette (1910) and Galliazzo (1979). A focus on the barb, the profile shape (circular, square or rectangular), and the direction of the point, have been used to determine if, like modern examples, typological variants were present among the ancient hooks; however, the evidence available is deemed to be too simple in morphology and too poorly recorded to allow chronological assessment, thereby preventing a more analytical interpretation (Garcia 1981, 322). A similar conclusion has been reached in the interpretation of Roman hooks from the Black Sea region (Munk 2005, 137-138) and in the Netherlands (Dutting 2016, 393), where even scale is an aspect emitted from earlier records. Perhaps, due to this chronological uncertainty and poor record, few studies have followed.

Working on the Iberian classifications proposed by Garcia (1981), a further categorisation of Iberian hooks has been proposed (Figure 6) for ensuring a more consistent record of these artefacts for posterity and to aid with on-site identifications (Bernal 2008a). Bernal (2010) has divided the hooks by general type: simple (J shaped hooks), double or multiple (the Ω shaped hooks), and chained. Vargas (2011) has since expanded on the three types by identifying the various sizes, composed of very small (<25mm), small (25-40mm), medium (40-80mm), and large hooks (>80mm) (Ibid. 213); as well as the type of terminal (where the line is attached to the hook), which has been recorded as one of three possibilities: grooved, hammered (flattened), or simple (unaltered) (Ibid.). Close to 300 examples have been recovered around the Strait of Gibraltar, facilitating such records, yet the consistent issues with on-site recording (Bernal 2008b, 183-184) has substantially slowed progress and no significant hypotheses or typologies have ensued (Vargas 2020). A similar diachronic collection of artefacts from ancient Egypt has prompted an attempt at a typology there (Soria, Forthcoming). Still in its infant stage, this work is influenced by the methods advocated in Iberian investigations and highlights the beneficial direction modern assessments are now taking, as well as advocating the potential of typologies for further halieutic studies.

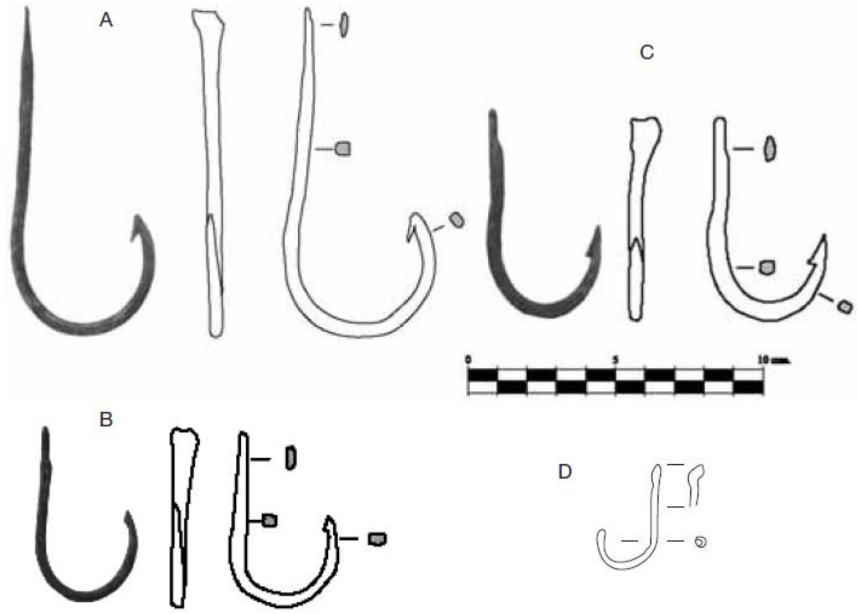


Figure 6: Hook size classification with large (A), medium (C), small (B), and very small (D) (image from Bernal 2010, 90)

While typologies may currently be problematic due to the early methods of data collection, broader morphological discrepancies have been identified and classified, based on the general shape of the hook or more evident functions. The multiple-hook-line or long-line, for example, has been recovered in Italy, at Herculaneum (Bernal et al. 2009), from the Comacchio wreck (Rossi 1990), and in Ukraine, at Chersonenos (Kadeev 1970, 8). Although deterioration and conservation strategies have prevented a detailed examination of the numerous hooks (in situ and in the original coiled position in the case of Herculaneum), the hooks appear to be consistent in shape and size, suggesting some uniformity in production and, inherently, in the application of this type of hook (Kron 2008). Unlike the chance finds of single hooks, often attributed to angling as a supplementary resource as well as leisure activity, multiple hooks are evidence of fishing in marine waters with marketable intention. The success of these methods for potentially supporting commercial fisheries has been highlighted (Marzano 2013, 32), as has their potential for exploiting distinct species of fish from greater depths (Ibid.).

One aspect that is rarely included in fishing hook assessments is the production method, which, without direct ethnographic comparisons, are difficult to determine from completed hooks. One Phoenician example from La Fonteta, Spain (Figure 7) reveals a manufacturing method that would account for the homogeneity of several fishing hooks (Bernal 2016, 205).

Figure 7: Incomplete hook from La Fonteta, Spain (Image from Bernal 2016, 205).

This involves the manufacture of the bend and barb, prior to the selection of the length of shank, for which, two hooks could be simultaneously produced from one bar. The same method was used in 18th century (Encyclopedie Methodoque 1782; see Figure 8) and continued into the 20th century (Hurum 1977, 44). The manufacture of the barb can be achieved by hammering, grinding, or sharpening, which impacts the shape (Ibid. 48). As such, the production method has a direct impact in the resulting shape of the hook and its constituent parts. There are no current studies on identifying these aspects among Roman artefacts, yet the recovery of incomplete examples (Bernal 2016, 205; and one example from London, H53) may prove influential for developing typologies based on manufacturing.

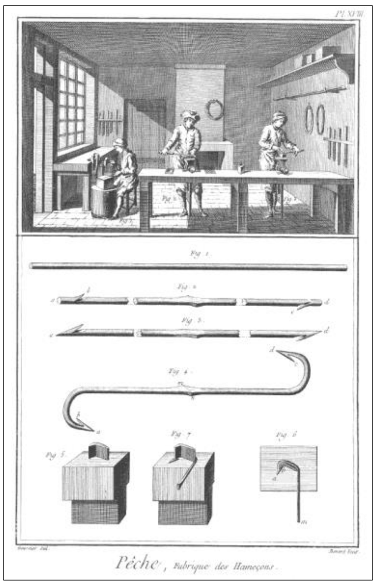


Figure 8: The manufacture of a fishing hook. Image from the Encyclopedie Methodoque 1782

Current studies therefore identify the ancient fishing hook as a diverse tool with both subsidiary and potential commercial applications. Environmental conditions play an influential role, as evidence of small-scale fishing with commercial value is restricted to marine/coastal waters. Typologies are restricted to regional assessments in which size is the primary indicator of intended capture. Attempts at assigning particular hook types to methods of capture are restricted to the chained examples for the capture of sharks (Bernal 2010). The halieutic interpretation of hooks remains limited, as we have seen, as a result of poor recovery and recording techniques to date (Garcia 1981, 322). Some attention has been drawn to the alternative diagnostic elements of the hook, such as the terminal (Vargas 2011) and the material (Vargas 2020), a consequence of the growing collection of evidence in the Iberian Peninsula. These attributes should be considered as significant in further works and assessed in detail to determine similar discrepancies in other provinces.

2.3.2 Net Weights

The study of net weights has been described as remaining in an "embryonic state" (Bernal 2010, 105), not as a consequence of insufficient examples (quite the opposite is the case), but due to the diverse range of types identified in the Mediterranean, providing a complex collection with which to determine the types of nets to which they were attached (Galili et al. 2002; Bernal 2010, 105). More recent studies of Iberian examples reveal a complex collection of over ten classifications of lead net weights (Vargas Giron 2020). These resources are often considered in association with the most relevant archaeological remains, the fish processing sites of southern Iberia and northern Africa (Bernal 2010, 83). Little is known about how weights correlate to small-scale fishing practices, or how morphology relates to the type of net that was used.

Regardless of their complexity, fishing net weights play a valuable role in the study of ancient fishing practices due to their durability and morphological consistency. The latter aspect has promoted several classification systems of lead, stone, and ceramic weights, developed around assemblages recovered in Israel (Galili et al. 2002), Italy (Ciampoltrini and Andreotti 2003), and Spain (Bernal 2010; Vargas Girón 2020). The Israeli typology (Figure 9) has been devised around the material, shape, and production method extrapolated from the recovered finds from the wreck-site off the coast of Haifa (Galili et al. 2002, 182). The production method is an important component demonstrating the specialisation of manufacture and intended end-product; this is evidenced by the identification of patterns impressed on the lead sheets, as well as evidence of stone moulds for casting the lead, also recovered from the wreck (Ibid. 190;192) and which implies production by the fishermen themselves. Although the original authors have acknowledged the limitations of their strictly regional assessment and a requirement for the addition of ceramic examples and further comprehensive investigations (Galili et al. 2002), this preliminary classification system has been adopted further afield (Bernal 2010; Dütting and Hoss 2014; Dütting 2016).

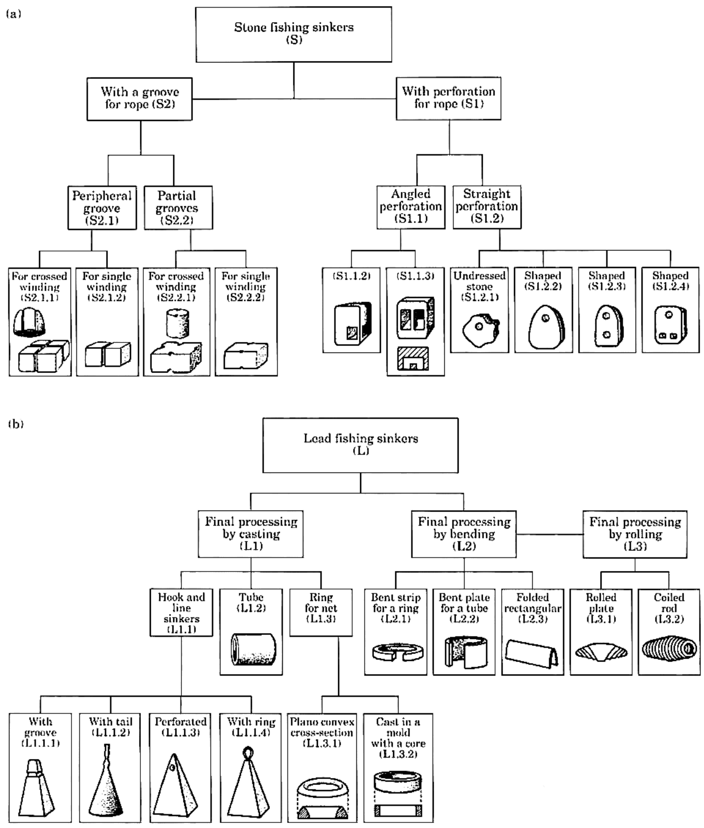


Figure 9: Classification of fishing weights, image by Galili et al. (2002)

Bernal (2010) has produced a more exhaustive study of the Iberian fishing weights and within a broader chronological range (Figure 10). Disregarding the potential manufacturing methods (Ibid. 97), which are a focus of the Israeli study, this more recent typology focuses on consistent morphological characteristics in relation to the intended function. Further sub-categorisations have been added to the types discussed by Galili et al. (2002), which are suggested to highlight previously overlooked forms (Bernal 2010, 97; Figure 9). Subsequent alterations to the terminology ensue, such as the description of the ‘folded rectangular’ (Galili et al. 2002) as the ‘rolled plate’ (Bernal 2010); and the ‘tube’, ‘bent plate’ and ‘rolled plate’ (Galili et al. 2002) later grouped together as the ‘cylindrical’ (Bernal 2010). These discrepancies can prove to be hazardous for continuing studies unless the appropriate classifications are highlighted in detail. The consensus remains that typologies will continue to be static until a more comprehensive study is made possible, for which reason regional classifications are currently advised (Bernal et al. 2010, 345).

Correspondance with Galili *et alii* 2002 (in brackets)					
Stone	PI1	Perforated	Angular hole	Simple (S 1.1.2)	
	PI2			Double (S 1.1.3)	
	PI3		Straight hole	Irregular (S 1.2.1)	
	PI4			Shaped and with one hole (S 1.2.2)	Pear shaped
	PI5				Circular/Doughnut
	PI6			Shaped with two holes (S 1.2.3)	
	PI7			Shaped with three holes (S. 1.2.4)	
	PII1	Grooved	With lateral grooves		Crossed (S 2.1.1)
	PII2				Simple (S 2.1.2)
	PII3		With notches		Crossed (S 2.2.1)
	PII4				Simple (S 2.2.2)
	PIII1	Simple	Pebbles (circular)		
	PIII2		Irregular		
Lead	PLI1	Ring shaped	With lateral perforated appendix		
	PLI2		Whole section (L 1.3.2)		
	PLI3		Partial section (L 2.1)		
	PLI4		Flat-convex section (L 1.3.1)		
	PLII1	Cylindrical	Hollow/Tubular		Whole section (L 1.2)
	PLII2				Partial section (L 2.2)
	PLII3		Solid		Rolled (L 3.1)
	PLII4				With grooves
	PLIII1	Cone/truncated cone		With distal appendix (L 1.1.2)	
	PLIII2			With groove	
	PLIII3			Perforated	
	PLIV1	Cubical		With groove	
	PLIV2			Perforated	
	PLV	Clamps-rods			
	PLVI	Off-centre/Crescent-shaped			
	PLVII1	Spherical		With groove	
	PLVII2			Perforated	
	PLVIII1	Sphenoid		With groove	
	PLVIII2			Perforated	
	PLIX1	Rolled plate		Square shaped	
	PLIX2			Rectangular shaped (L 2.3)	
	PLX1	Pyramidal/Truncated pyramid		With horizontal groove (L 1.1.1)	
	PLX2			With metal appendix (L 1.1.4)	
	PLX3			With verticalgroove	
	PLX4			Perforated (L 1.1.3)	
	PLXI1	Pear-shaped		With groove	
	PLXI2			Perforated	
	PLXII	Triangular perforated			
	PLXIII	Tubular			

Figure 10: Classification system developed for Lead, Stone and Ceramic weights, image by Bernal (2010, 86)

In addition to a change in terminology is the addition of clay weights (Bernal 2010; Vargas-Girón 2011, 222-225; Vargas Girón 2020), none of which were recovered at the Haifa wreck and are therefore absent from the Israeli classification. Clay weights vary in morphology, though numerous examples consist of reused ceramic discs with holes drilled in the centre leaving a ring-shaped artefact (Vargas-Giron 2011, 224). Many are highly problematic to identify due to the similarity of ceramic weights used for textile production, such as spindle whorls and loom weights (Alfaro 2010, 77; Dütting 2016, 395); nevertheless, where identification has been confirmed, it has been shown that they too have been used throughout the entire Roman period (Vargas-Giron 2011, 222).

Morphological continuity throughout the Roman period, of metallic, stone and ceramic weights, suggests the absence of a chronological evolution of the typologies, an aspect highlighted by several scholars (Bernal-Casasola 2008b, 184, 202; Galili et al. 2013, 157; Vargas Giron 2020). The most recent overview of the evidence from the Mediterranean (Vargas Girón 2020) has presented the geographical distribution of the various types of weights (Figure 11), demonstrating the variety of types used across the Empire and thus absence of a regional disparity (Ibid. 109-111).

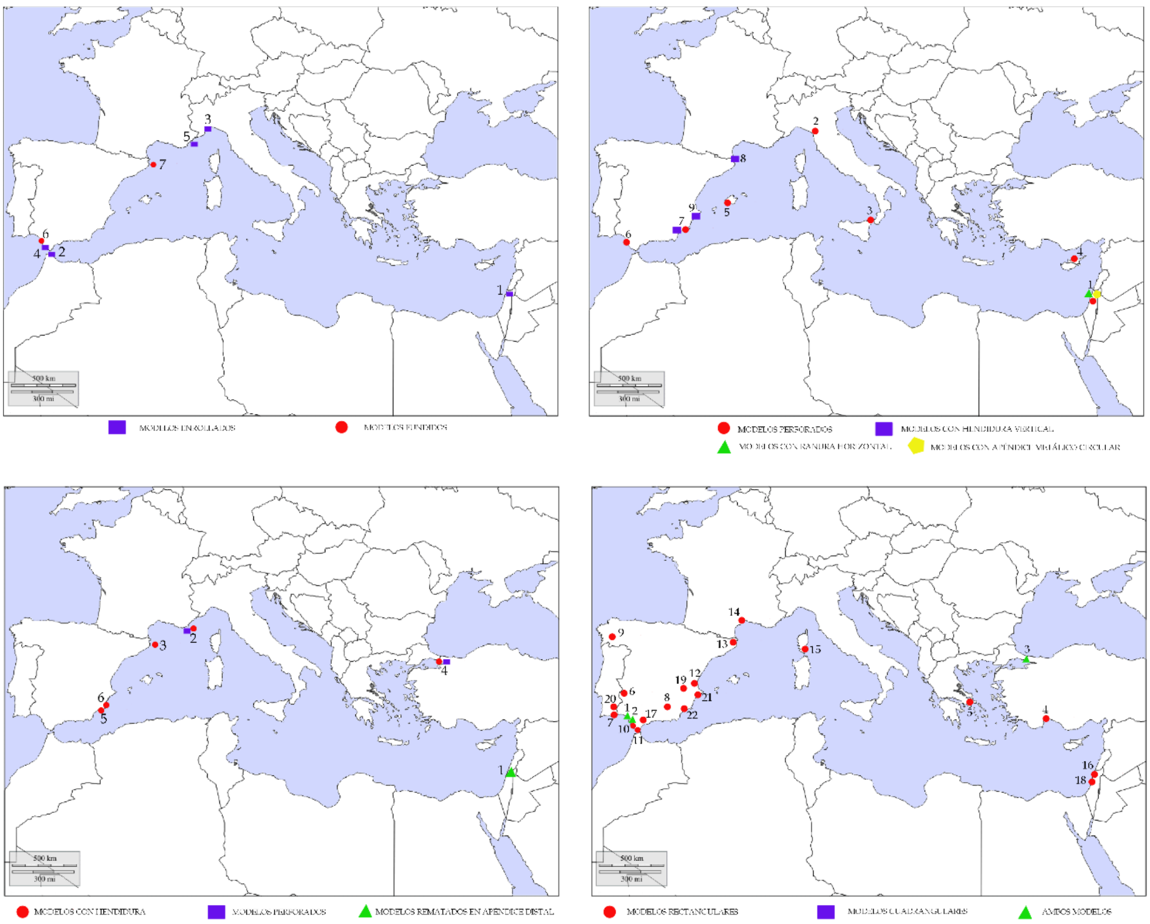


Figure 11: Mediterranean distribution of lead weights, including rolled lead weights (a), pyramidal lead weights (b), conical lead weights (c), and plated lead weights (d) (Images from Vargas Girón 2020, 109-111).

Although excluded from Vargas' work (2020), the study of rolled and cast cylindrical weights has extended beyond the Mediterranean, most notably with the work conducted on the net sinkers from the Netherlands and Belgium (Dütting and Hoss 2014; Dütting 2016). The absence of lead-cylindrical types in the Netherlands during the Iron Age is indicative of their introduction by the Romans, in stark contrast to their presence in the Mediterranean where they were incorporated from the Bronze Age period onwards (Dütting 2016, 395) and where chronological inferences are thus restricted. Dütting (2016), highlights the potential military role in this introduction of fishing equipment, which, alongside the fishing traps recovered by fortifications, is indicative of a subsistence fisheries with notable effects on frontier food supplies.

Among the various weights, rolled lead examples seem to be the most consistent form (Galili et al. 2002; 2013; Bernal 2010; Vargas 2020), with some morphological discrepancies pertaining to their manufacture (Vargas Girón 2020, 97). The rolled lead weights from Israel have been inspected further (Galili et al. 2013) and attention has been drawn to the diameter of the perforation through which the net-cord would run. Three groups of diameters have been proposed (Ibid. 153-154): weights with perforations around 1 mm in diameter, between 2 to 8 mm and those with 10 mm diameters. Alfaro (2010) highlights that the thickness of the cord directly impacts the strength of the net or line to which the weights are attached; this produces a maximum weight capacity, which according to Galili et al. (2013, 154) may indicate the net that was used. Such observations are based on ethnographic comparisons with existing cast, gill or trammel, and seine nets (to which the diameters are assigned, respectively), but the authors advocate the production of experiments and further research to determine the likelihood. (Ibid.). The current suggestion remains that small diameters will reflect light and small nets, while larger diameters reflect the use of larger more robust nets. If further research can narrow the types of nets and thus fishing methods assigned to the various sized lead weights, further hypothesise may be proposed on the methods of fishing that were used by the Romans as well as their scale.

2.3.3 Netting Needles

Netting needles, also known as shuttles or navettes (Trakadas 2009, 21; Bernal 2010,85), are tools used in the production of nets. They were used by housing a length of cord and facilitating the knotting of a mesh fabric. The type of needle identified in the production of ancient nets is known by its modern term, the Mediterranean-filet (Brandt 1984; Figure 12 d). It consists of a bifurcated rod, that is, two prongs emanating from either end of a central rod, around which the cord is wound (Figure 13). Some examples have an inverted 'V' shaped tail (e.g. Stead 1976), but most have near-symmetrical ends or 'eyes', with convex shaped prongs ending in a 2 mm or narrower opening through which the cord is passed.

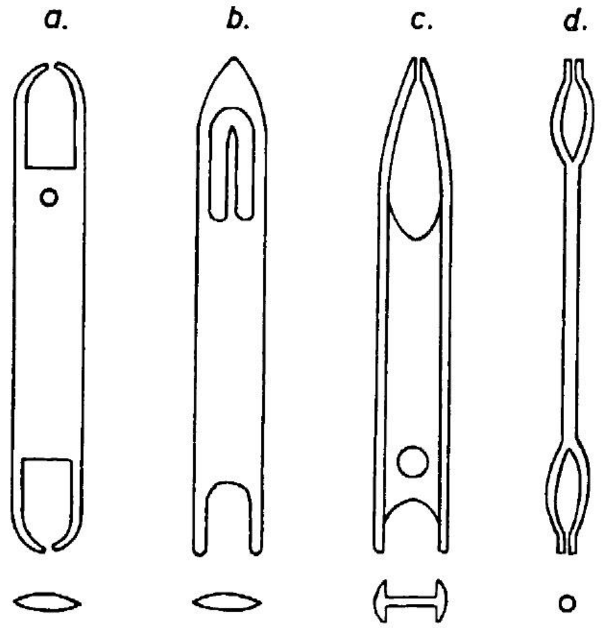


Figure 12: Types of netting needles. The filet (a), the tongue (b), the Icelandic (c), and the Mediterranean filet (d). (Brandt 1984, 209).

Examples for the Roman period have been found throughout the Mediterranean and beyond, ranging in sizes between 150 and 240 mm (e.g. Garcia-Alonso 1981, 325; Galili et al. 2002, 85; Bernal et al. 2009, 229; Alfaro 2010, 63; Bernal 2010, 11; Dutting 2016, 394; Cottica and Divari 2010, 356). According to Bernal (2010, 137), needles are numerous throughout the Mediterranean but due to the absence of any detailed assessments or typologies, they have been excluded from the most recent Roman halieutic studies. While no typologies exist, Garcia-Alonso (1981, 324) has attempted a general classification based on the shape of the profile of the prongs (square, rectangular and circular) and the length of the rod. It has been suggested that the size of the needle might be used to extrapolate the mesh size (Alfaro 2010, 60; Bernal et al. 2010, 341). A proposed minimum estimate is that the mesh gauge is equal to the width of the prongs (Ayodeji 2004, 151; Trakadas 2009, 21), although ethnographic examples suggest a mesh diameter averaging double the width of the prongs (Winch 1987). A variety of mesh diameters would have been used, with fine meshes better suited for the small clupeids which dominate the large-scale fisheries of the Mediterranean (Morales 2010, 41). It is nonetheless difficult to extrapolate fishing method as various nets were used by the Romans and could have the same mesh diameter: from single-manned casting nets to group-worked seine nets that could have surpassed 100 m in length but been used for the capture of small fishes. Examples of Roman fishing nets, preserved under optimal conditions in Egypt, reveal diverse sizes of mesh and nets used in one location (Thomas 2010, 147). An additional problem comes from inferring fishing as the intended function, as nets were also used for hunting and fowling (Marzano 2013, 18). Alfaro (2010) has highlighted the need for a collective study of evidence of net-use within a region to determine if the weights, needles and, where possible, net fragments can better reveal their intended function.

Figure 13: Reconstructed examples of Roman netting needles 240 and 180 mm respectively (Illustration by L. Graña).

2.3.4 Net Fishing

Nets were optimal fishing tools, capable of producing the largest catches and evocative of the technological and logistical capabilities of the manufacturers. Nets were used as both active and passive equipment; 'active' defines a hunting tool to capture moving fish and 'passive' as a stationary barrier or temporary trap (Trakadas 2009). Nets could be produced by weaving a mesh, that is, without knots; however, knotted nets were stronger, more efficient, simple to manufacture, and more common (Alfaro 2010, 57). The cord was knotted to produce a mesh with consistent diameters, which had to be smaller than the targeted fish to prevent their escape. Numerous types of nets existed in the Roman period, more than likely including variants that are not described in literary sources or depicted in mosaics (Alfaro 2010 56-57). Of those that are depicted, several types stand out due to both their consistency in Roman examples and continued use to date, which include the cast-net and variations on the seine net, also described by Oppian (3.80-84). The former is thrown, forming a rapidly sinking dome over a school of fish, thereby trapping them; the latter consists of a wall of mesh, often equal in depth to the water where it is used (Jenkins 1973, 223), and requires two or more people for encircling of a school of fish at a shoreline or out at sea, and with or without a boat, thereby preventing the escape of the fish.

Archaeological remains of nets are extremely rare, given the fragile nature of the organic materials used, nevertheless, examples have been recovered in Iberia (Alfaro 2010), Italy (Deiss, 1995, 58), Israel (Yadin 1962, 233) and Egypt (Thomas 2010). These sparse remains are considered more reliable than the literary remains (Alfaro 2010, 55) because they also provide us with data absent from the pictorial or literary record, such as mesh diameters, natural materials used, and types of knots. A comprehensive study of nets by Alfaro (2010) is a significant resource in identifying the structural components of these organic resources and their subsequent manufacturing methods. Size is not often a datum available, given the sparse remains that survive, however, the arid conditions of Israel have preserved one example measuring 10 x 6.5 m and dated to the 2nd century AD (Yadin, 1962, 233; as cited by Alfaro 2010, 71). The next largest examples are the Egyptian fragments from Myos Hormos at only 0.74 m long (Thomas 2010, 147). Both the Israeli and Egyptian examples were recovered without any attached weights (Ibid.), which may imply a non-fishery function. In the case of the Israeli example, an alternative interpretation is that it was a fowling net for birds, supported by the absence of other fishing equipment and its discovery at an inland cave site (Alfaro 2010, 71).

Four fragmented nets were recovered in Spain, two from La Albufereta, Alicante, dating to the 4th century BC (Alfaro 1984, 150); a third from a nearby shipwreck of Flavian date; and the fourth, of uncertain date, recovered in a river environment at Zaragoza (Royo and Acín 1991). These examples reveal the more common extent of preservation of such deteriorated organic remains in more fragile anaerobic conditions. Regardless the level of decomposition, the thickness of the cord and diameter of the mesh is a datum that is available among the Iberian examples (Alfaro 2010, 72-73). The measurements vary with thicknesses of 0.2 mm to 3 mm and mesh diameters from 10 to 30 mm (see Alfaro 2010 for full assessment). Similarly, two types were uncovered at Myos Hormos and Berenike, the former consisting of a coarse thread of 3.8 mm and a mesh spacing of 35 mm, and the latter consisting of a fine thread of 1 mm and mesh spacing of 12 mm (Thomas 2012, 176). The former is represented by twenty fragments and the latter by three (Thomas 2010, 147). The consistency of mesh sizes suggests a systematic and consistent manufacturing process, most likely with the implementation of tools such as netting needles (Alfaro 2010, 63-64). Meanwhile the narrow diameter of the cord highlights the use of fine-meshed nets intended to capture small prey in large quantities, perhaps by means of casting nets (Thomas 2010, 147).

The fragments investigated by Alfaro (2010) and Thomas (2010), provide us with examples of cord thickness and knot production that relate to the manufacturing tools. The study of the more robust and numerous examples of net weights and netting needles are therefore influenced by these fragile fragments.

2.4 The Ichthyofaunal Remains

Current methods of ichthyofaunal assessment derive from a series of published methodologies for acquiring and assessing fish bone remains (e.g. Ryder 1969; Casteel 1976b; Wheeler and Jones 1989; Colley 1990). Wheeler and Jones' '*Fishes'* (1989) has set the methodological standard, which has provided the broader field of archaeology with a detailed description of the applications of ichthyofaunal data in anthropological studies, as well as a guide for ecofact collection via more intensive environmental sampling strategies onsite. These guidelines remain the primary resource for modern field archaeology and environmental assessment, with minor addendums produced in the last thirty years (e.g. Colley 1990; Jones 2011) and supported by the Fish Remains Working Group (FRWG), which has helped consolidate the subdiscipline since its foundation in 1981 (Morales 2014, 3649). The data that can be extracted is as follows:

a. Species identification (family or genus when necessary)
b. Size estimations and subsequent weight estimations
c. Specimen age
d. Minimum number of individuals (MNI) and number of identified specimens (NISP)
e. Season of capture

f. Taphonomy
    a. Butchery
    b. Weathering
    c. Decay (animal and human digestion, natural decay, and acidic decay)
    d. Scavenging
    e. Cooking and/or burning
    f. Alternative fish processing (salting, fermenting, or drying)

Various applications of this data are possible depending on the objectives of the assessment and the quantity and quality of the remains (Wheeler and Jones 1989). These include:

a. Economic and dietary significance: based on the predominant species within an assemblage, evidence of processing, the size of an assemblage, or the consistency of remains within an archaeological site (chronologically).
b. Ecological information: which can vary widely and include inferences on the type of aquatic environments, the level of health of those aquatic ecosystems, the subsequent impact of human occupation, and the occurrence and scale of different species.
c. Fishing catching methods.

2.4.1 Halieutic Interpretations

The investigation of the ichthyofaunal remains has suffered from scarce and poorly conducted research up until the late 20th century (Morales and Rosello-Izquierdo 2008, 243). This has resulted in the general absence of ichthyofaunal assessments alongside the development of historical-archaeological studies of ancient fishing practices. Prehistorians have led the discipline in the direction of fishery interpretations, including ethnographic evidence and experimental archaeology to hypothesise on the methods of capture of the identified fish bone remains (e.g. Wing and Reitz 1982; Noe-Nygaard 1983; Enghoff 1986; Wheeler and Jones 1989). Such works have had some influence on the interpretation of fishing in antiquity and medieval periods, leading to ichthyofaunal assessments with halieutic interpretations, though requiring the inclusion of ethnographic comparisons (e.g. Enghoff 2000; Van Neer et al. 2005; Barret 2004; Van Neer and Wouters 2012).

It has been emphasized that fishing methods can rarely be inferred from the fish bone assemblages alone (Morales 2014, 3655). A common oversight are the paradigms of actualism and equifinality (Morales 2008, 61), whereby ecofacts should be considered as the result of variable natural and cultural occurrences. Emphasis must be drawn on the ever-changing nature of aquatic fauna, geographically, chronologically, and biologically (Pauly and Cheung 2017), by which it may not be productive or even possible to make modern comparisons of species distribution with past examples (actualism). Meanwhile, an identified species can be the result of one of numerous methods of capture, transportation, and deposition (equifinality), rendering direct correlations strictly theoretical (Morales 2014).

The primary focus of Roman fishing practices has followed the well-established interpretation of processed fish products, analysing assemblages recovered from processing sites (e.g. Gabriel 2016), amphorae remains (e.g. Bernal 2009), and negative features (e.g. Van Neer et al. 2005; Nicholson 2012b). Following the historical record, ichthyofaunal studies confirm the use of a diverse range of small shoaling fish, namely clupeids such as sardines and herring (e.g. Gabriel 2016; Van Neer et al. 2005; Locker 2007), with regional exceptions of small cyprinids in Germany (Van Neer and Wouters 2012, 249), other freshwater species in Egypt (Van Neer and Lentacker 1994), and cetaceans and large tuna also being included to an unknown extent along the strait of Gibraltar (Arevalo and Bernal 2007; Bernal 2009, 14). The recovery of large quantities of small fish allude to large-scale fisheries using various types of nets. The suggestion of a particular type of net is once again dependent on ethnographic examples of 19th and early 20th century fishing methods (Trakadas 2009, 21); however, the equifinality paradigm is partially subverted by the limited methods of capture of large quantities of small fish.

It is the smaller assemblages that prove far more complex to interpret. Where few diagnostic elements are recovered, ichthyologists are often limited to species identification. Species have been used to determine the environment in which they were likely caught and thus the methods of capture that could reach those location. The doctoral thesis of Gomez (2013) has investigated fish bone remains from twenty-four midden sites from the Iron Age to Medieval periods in Northwest Spain. The species of Roman date include solitary species such as ballan wrasse (*Labrus bergylta*) and conger eel (*Conger conger*), or deep species such as hake (*Merluccius merluccius*), alongside the ubiquitous clupeids. The inclusion of ethnographic evidence, considered due to the noted continuation of those fisheries until present day, have led Gomez (2013, 152) to highlight the use of hooks and long-lines as the most likely methods of capture (Ibid. 245). A similar conclusion is suggested by Rowan (2013) on the analysis of 300 otoliths recovered from the Cardo V sewer in Herculaneum. The dominance of sea breams (*Sparidae*), of which the *Pagellus sp.* is the most common, are compared to local ethnographic examples of coastal fisheries to support the interpretation of a Roman fresh fish market supplemented by fisheries using either hooks or weirs (Ibid. 66-68). It is with a closer inspection of the additional bone elements that a further assessment (Nicholson et al. 2018) reveals numerous small species that are instead interpretated as deriving from the bay using boat or shore-based nets such as seines, in which the fewer sparids were likely a bycatch (Ibid. 282). This example draws attention to both the uncertainty of assigning fishing methods to species identification, and, more importantly, the influence of sampling strategies and comprehensive fish bone assemblages on the subsequent interpretations. Various Roman assemblages have revealed a variety of species that are indicative of a market with multiple contributing fisheries from diverse environments (e.g. Gomez 2013; Harland 2017; Nicholson et al. 2018). This is often a result of a coastal or estuarine market with access to marine, brackish, and freshwater systems. In these cases, the dilemma of equifinality is amplified, as the range of fishing methods is further divided by the range of fishery locations.

Other than species identification, another consistent datum that is included in assessments is the quantification of the assemblage. The two established units of measurement are MNI (minimum number of individuals) and NISP (number of identified specimens) (Grayson 1973, 432; Casteel 1976b). MNI refers to the aggregate estimation of individuals by combining the maximum number of representative bones from a single individual; for example, ten caudal vertebrae belonging to the eel species (*Anguilla anguilla*) would equate to 1 MNI from that sample, as one eel can have many caudal vertebrae; meanwhile, ten left-sided dentaries would equate to 10 MNI, as an individual only has one left-sided dentary. NISP refers to all fragments and provides a more accurate representation of the size of an assemblage; however, depending on the specialist, NISP is often restricted to diagnostic fragments, those identifiable to species, family, or genus levels (Locker 2007); this is a significant discrepancy if we consider that undiagnostic fragments can equate to 95 % of recovered bones from a site (Morales 2014, 3650), a figure that is important for determining the volume of the assemblage.

A combination of MNI and NISP have been used in the assessment of Roman assemblages (e.g. Van-Neer et al. 2005; 178; 2007, 177; Locker 2007; Boethius 2016, 173), though often for posterity rather than assessment. One alternative method of quantification is the Number of Occurrences, initially suggested in the 1980s (O'Connor1985), but included in more recent holistic studies (e.g. Locker 2007; Thomas et al. 2013; Orton et al 2014; Orton et al. 2016; Orton et al 2017). This method identifies the occurrence of a species within a single deposit, context, or site (depending on the excavation strategy), regardless of the number of individuals or the constituent bone fragments. This method can prove problematic if assigning economic value to the identified species (Wheeler and Jones 1989, 152-153); however, it can prove useful in determining distribution patterns in a region wide assessment of multiple assemblages, as has been advocated by Locker (2007).

2.5 The Aquatic Environment

It is understood that discrepant aquatic environments directly influence the fauna that reside within, with various fluctuations having a direct impact on biota structures (Morales 2008, 44-45; Graham and Harrod 2009, 1145); it has also been argued that these discrepancies have a further influence on accessibility by fishermen and the adaptability or restriction of various fishing equipment (Brandt 1984, 3-4; Wheeler and Jones 1989, 174-175). One suggestion is that net fishing in the Roman period was strictly shore-based due to the technological limitations of both the nets and fishing vessels available at the time (Trakadas 2009, 20,24), rendering them incapable of reaching the depth and sustaining the volume of fish required for the capture of benthopelagic species such as cod (*Gadus morhua*). Bekker-Nielsen (2004) outlines this interdependence of human, ichthyofaunal, and environmental factors as key contextual components of fishing practices (Figure 2). This relationship is influenced by fluctuating variables, some natural (climate, salinity, tidal, and faunal) and some human (pollution, land-reclamation, urbanisation, and cultural organisation), which restricts direct parallels being drawn between regions. In any assessment of fishing practices, the discrepant aquatic environments from the region under investigation should first be highlighted; this will directly impact the interpretation of the tool and fish bone remains.

2.6 Ethnographic Evidence

The comparison of ancient and modern fishing methods has had an early inclusion, relying first on drawing parallels between the literary sources and the traditional methods still in use in 19th century Europe (Yates 1843), and continuing into the late 20th century with the inclusion of archaeological evidence. Gallant (1985) stands out as a significant yet controversial study of ancient fisheries, in which modern Mediterranean and Southeast Asian fishery statistics are included to suggest that fishing in antiquity had less economic significance than previously stated (Ibid. 7). This argument has since been rebutted (Bekker-Nielsen 2002, 31; 2005, 87; Lund 2005, 103; Mylona 2008, 8-9; Marzano 2013, 51) and caution has been advised for any further inclusion of ethnographic evidence; nevertheless, ethnography continues to be used and is considered necessary to interpret otherwise complex and disparate archaeological remains (Marzano 2013, 3; Bernal-Casasola 2016, 202). Marzano (2013, 2) has noted a growing detachment between the modern consumer and their aquatic produce, both in how it is acquired and its social and economic context, which clearly impacts the academic interpretation of past methods.

Brandt's '*Fishing Methods of the World*' (1984) has been greatly used by ichthyoarchaeologists (e.g. Galili et al. 2002, 198; Morales 2008, 44; Morales and Rosello-Izquierdo 2008, 250; Gabriel and Bearez 2009, 338; Alfaro-Giner 2010, 59,73; Morales 2010, 30; Dutting 2016, 390). This appears to be, in part, due to an absence of region-based ethnographic studies, unless purposely included by the ichthyologist (e.g. Colley 1990; Nicholson 1993; 1995; Rowan 2014; Hamilton-Dyer 2014), but also due to the value of this comprehensive resource to a dramatically transformed practice. A survey of ethnographic material relating to fishing from Poland has demonstrated the success of museum-based collections of artefacts, as opposed to a historical record only (Trapszyc 2009, 211-213). As the collections include tools used in the first half of the 20th century, many of which are unrecorded, it is noted that the post-war transformation of fisheries has resulted in a loss of most of the traditional methods once used (Ibid. 212); a stark reminder of the level of transformation witnessed over the last century.

Under ideal circumstances the continuity of fishing practices in a particular region are recognisable archaeologically and historically from antiquity to modern day (e.g. Garcia-Vargas and Florido 2010; 2011). This continuity has been termed '*traditionalism*' (Marzano 2013, 302), and highlights a more reliable method of anachronistic comparison than the association of global traditional methods regardless of geography (e.g. Brandt 1984). Various Roman halieutic studies have, to some extent, identified traditionalist fishing practices (e.g. Corcoran 1957; Powell 1996; Ayodeji 2004; Garcia-Vargas and Florido 2010; 2011; and Bernal-Casasola 2016, 206). This may take the form of a particular fishing tool, fishery location, or the continued exploitation and processing of a particular species.

There remain inherent and persistent problems in the comparison of ancient and modern fishing techniques, as there are in the comparison of fish bone remains with modern species (Wheeler and Jones 1989, 175; Morales 2010, 45). The concepts of equifinality and actualism discussed above should be recognised as influential of both the ecofacts and the artefact remains. There are no alternative methodologies for ensuring more reliable interpretations of fishing practices (Wheeler and Jones 1989, 175); it is thus argued that the use of comparative evidence is justified (Hodder 1982, 211), albeit conditional on the insurance that all available materials are provided and critically assessed and that comparisons should include a range of similarities, both environmental and cultural (Ibid.). Once again, the Roman period benefits from an array of primary sources, which provides context for the interpretation of various artefacts and fish bone remains, an attribute that is non-existent for the investigation of earlier fishery cultures. Bernal and Bekker-Nielsen (2010, 21) have highlighted the need to persist with a historical-archaeological analysis of the remains, until such a time as when more detailed catalogues and typologies of fishing equipment are available. This need for a comparison of recovered artefacts and ecofacts with the diverse literary sources has been reiterated more recently by Bernal (2016, 202), emphasising the slow yet necessary progress yet to be made in the field.

2.7 Romano-British Halieutic Studies

Figure 14: Bronze disc from Wroxeter, Shropshire, depicting an eagle catching a fish (Bush-Fox 1912).

Britain, as one would expect from a satellite Roman province, reveals discrepancies of halieutic practices resulting from its geographical isolation and quasi-independent cultural development. Following this tradition of isolation, the academic studies conducted therein are also distinguishable from those conducted on the mainland, both due to the availability of material and the methods of assessment. The following section is dedicated to disseminating the published and unpublished materials from which much of the acquired data originates and for highlighting the state of knowledge at the time of commencing this thesis.

2.7.1 Iron Age Britain and Fish

Within the melting pot of European culture that was Roman Britain, fishing may have been directly impacted by introduced methods and tools previously unrecognised or scarcely used by Iron Age Britons. This suggestion follows a series of studies incorporating ichthyofaunal, artefactual, and isotopic evidence (e.g. Cunliffe 1995; 2004; Dobney and Ervynck 2006, 403; Muldner 2013). The 117 Iron Age sites studied by Dobney and Ervynck (2006) have produced eleven fish bone assemblages only, consisting of sparse remains acquired following adequate sampling strategies to deter excavation bias. The most productive sites are large inland settlements at Danebury, Dragonby, Maiden Castle, and Gussage All Saints, but the fish bone remains represent c. 0.01 % of the recovered animal bones (Rainsford and Roberts 2013, 35). Coastal sites are generally absent, though some evidence of marine fish consumption has been identified in England (Dobney and Ervynck 2006) and deep-sea fishing requiring sea-going vessels has been proposed for the site of Dunbar in Scotland (Russ et al. 2012). Isotopic analyses have revealed an increase consumption of marine foods during the Roman period, especially at military and civilian settlements (Muldner 2013, 146). This impact seems much more varied on the rural population of Roman Britain (Ibid. 138), where freshwater fish consumption is more difficult to identify via isotopic analysis (Rainsford and Roberts 2013, 33), but also where Iron Age traditions may have persisted. These traditions have been interpreted by Rainsford and Roberts (2013) as potential taboos towards fish based on a variety of ritual and alimentary factors. The primary reasoning for the absence of fish consumption is attributed to the domination of agricultural activity in Britain (Cunliffe 2004; Dobney and Ervynck 2007; Rainsford and Roberts 2013), which both transformed the landscape and the dietary practices of the population. Evidence of Roman fishing practices may therefore be considered as introduced practices with closer parallels to mainland Europe than the sparse evidence of native fisheries (Locker 2007). The absence of large-scale pre-Roman fisheries, such as those identified in other Roman provinces (e.g. Carthaginian Iberia and North Africa: Bernal 2010; monarchic Egypt: Soria-Trastoy, Forthcoming; Hellenic Greece: Mylona 2008, 84-85) may account for the delayed and reduced scale of fishing in Britain; however, further research of Iron Age and early fishing practices is strongly advised (Dobney and Ervynck 2006).

2.7.2 Romano-British Studies

Fishing tool remains in Britain have been recovered since the 19th century (e.g. Smith 1854), yet, to date they have not been collectively analysed. Greater strides have been made with the fish bone remains recovered since the 1960s but with a focus on dietary trends (e.g. Alcock 1998; Locker 2007). Instead, the economic themes heavily researched by previous scholars are a result of the most prominent archaeological and historical evidence, such as the agrarian and mineral markets (e.g. Frere 1987; Millet 1992; Salway 1993; Mattingly 2006; Southern 2012; Moorhead and Stuttard 2012; De la Bedoyere 2015), in which the subject of fishing is absent, regardless of the available case studies of Roman fishing practices at that time. Even in Birley's '*The People of Roman Britain*' (1979), an example of a work which bypassed the heavily scrutinized structural remains to focus on the lives of diverse people with discrepant professions, and written after the publication of several archaeological reports which highlighted a growing panoply of fishing tools (Smith 1854; Budge 1907; Bushe-Fox 1926; 1949; Brailsford 1962; Richmond 1968; Cunliffe 1968; 1971; Liversidge 1973; Stead 1976), fishing was not mentioned once. One must assume that Birley and contemporary historians would have had access to the evidence; the question is thus: why not include it? Those works which have attempted to understand and interpret the significance of fishing to Romano-Britons answer this question by revealing a bias in the adopted methodology. Whether conditioned by the scarcity of the archaeological remains from Britain, or by the interpretations adopted from the Mediterranean (e.g. Liversidge 1973; Alcock 2001), the subsequent studies depict a familiar picture of 'Roman' fishing in Britain, one that overplays the cultural significance of aquatic fauna as a symbol of wealth and foreign extravagance and, therefore, downplays the alimental and economic significance of this aquatic resource to a range of social hierarchies.

Of the substantial number of books written about Roman Britain, which deal with diverse aspects of economic and subsistence living, only four authors have included, to varying degrees, the practice of fishing in their works: Liversidge (1973, 363), Alcock (2001; 47-53; 2006, 105), Allason-Jones (2011) and Millett et al. (2016). In Liversidge (1973), two paragraphs on fishing provide a summary of the technology available, suggesting the methods of capture in Britain based on pictorial and literary evidence recovered throughout Europe. Liversidge (Ibid. 363) further correlates the literary sources to the archaeological evidence from the northern frontiers, from Britain and Germany (only two hooks are mentioned for Britain, from Stockton and Keynsham). The passage is indeed scarce and there are no detailed assessments of the artefacts, but it represents the first acknowledgement of the practice in a general work and should thus be considered a significant footing of subsequent interpretations. Alcock (2001) elucidates on the significance of fish and shellfish, expanding on her brief article written for the '*Oxford Food Symposium on Fish*' (1998) and providing a more detailed summary of the archaeological evidence for Roman Britain, indeed, the most detailed synopsis to date. A review of the pictorial, ichthyofaunal, and tool remains, while a fraction of the available evidence, has allowed Alcock (2001; 2006) to correlate her findings with the literary sources and pictorial representations from the Mediterranean. She has been able to produce a short synopsis of the fishing culture one might expect from Britain. To that end, Alcock (2001) argues that the British evidence reveals an attempt to adhere to the formulaic cultural practices of Rome. This, she argues, is visible in the decorative mosaics at Witcombe and Lufton villas, where fish species are barely discernible but iconographically related to several Mediterranean examples (Ibid. 52); and it is also revealed in the discovery of bronze fishing hooks at London, Fishbourne, Verulamium, and Silchester, which, she states, due to their location and material composition suggest a continued practice of fishing as a leisure activity by wealthier individuals (2006, 105).

By 2007, an accumulation of fish-bone assessments, following more effective and standardised environmental sampling strategies, had surpassed the ad hoc collection of recorded fishing tools, leading to a focus on the ichthyofaunal data. Locker has produced an empirical study (2007) that hypothesises on dietary trends and processed-fish products, highlighting potential regional trends in fish consumption. She does not, however, discuss the tool remains for Britain, but highlights evidence from contemporary Mediterranean studies to summarise the potential methods of capture (Ibid. 142-143). Locker's conclusion that fish played a minor economic role in Roman Britain appears to have convinced subsequent studies (Allen 2011, 381; Maltby 2015, 187; Harland 2017,21), further supported by the absence of evidence to the contrary over the next decade (e.g. Hamilton-Dyer 2014, 113; Orton et al. 2017, 15). One adverse effect of this successful report is a continued absence of research into the accompanying tool remains thereafter.

Both Allason-Jones (2011) and Millett et al. (2016) acknowledge the practice of fishing in their works on Roman Britain, but this appears to be the consequence of Locker's (2007) publication on fish-bone remains rather than any research into evidence of fishing practices. In the case of Millett et al. (2016), it is clearly stated that their observations are 'a summary based on the results of Locker' (Ibid. 801). Allason-Jones does go one step further, stating that the number of fishing hooks recovered in Britain does not coincide with the ichthyofaunal evidence (2011, 231). The suggested hypothesis is that many hooks may have been made of iron, rather than bronze, reducing the likeliness of their survival in the archaeological record (Ibid.). Nevertheless, it should be noted that we do not know what archaeological evidence was available to Allason-Jones, given the lack of any studies into the tool remains nor her elucidation on the data; it is therefore difficult to determine whether this hypothesis is well-founded. Many subsequent ichthyoarchaeological studies are used as more direct evidence of the dietary traditions of local settlements, bypassing fishing practices altogether. This is a persistent dilemma in halieutic research.

One negative result is the summary of these activities as recreational or with minor economic roles. Whether a short review of the tool, pictorial or ichthyofaunal evidence, all the mentioned scholars correlate the practice of fishing with that of hunting in the Roman period. In the case of Alcock (2001, 51), her reference to Pliny the Younger, who infers that fishing, hunting and studying are an equal aspect of Roman leisure activities when away from the city (Epi. 2.8), supports the scarce recovery of hooks from villa sites (e.g. Bulleid and Horne 1926, 132; Joan 1949; Cunliffe 1971; Neal 1997). Liversidge (1973, 363) suggests that fishing could have played a bigger role, but acknowledges the connection to hunting, placing her summary in the '*Recreations'* chapter of her book. This ascription is followed by Millett et al. (2016) and Allason-Jones (2011), though the latter acknowledges that it was likely a more significant activity than is currently apparent (Ibid. 231). The few authors who have included the subject of fishing in their works recognise the absence of evidence, or, at the very least, the absence of a critical examination of the evidence. It is the case that a re-examination may not reveal a practice of great economic significance, representative of the Mediterranean fish-processed and fish-farmed markets and their relevant fisheries; however, the absence of the previously discovered archaeological tool remains from all of the mentioned works is evocative of a lack of research into Romano-British fishing practices.

2.7.3 Romano-British Fishing Artefacts

The unique appearance and relative ease of identification of fishing hooks have facilitated their publication throughout the 20th century, though often as mere footnotes and with no illustrations from which to attain data (see Smith 1854; Budge 1907; Bushe-Fox 1926; 1949; Brailsford 1962; Richmond 1968; Cunliffe 1968; 1971; Stead 1976; Manning 1985; Brewer 1986; Mould 1993; Ayers 1994; Neal 1996). Many such tools are stored away and difficult to access for further assessment. Dozens more artefacts can be found in private and museum collections as well as unpublished reports. Individual hooks of iron and bronze have been recovered throughout Britain, from freshwater and coastal environments (e.g. Brailsford 1962; Cunliffe 1968). These hooks vary in length from 20 to 70 mm, and all but a few questionable examples have a barbed point, which differentiates them from hooks with alternative uses. There is an absence of any critical assessment of these objects and a scarce body of work which attempts to hypothesise on their cultural and economic significance to Roman Britain or their association with the growing number of ichthyofaunal assemblages.

Netting needles, for the production of nets, have also been recovered throughout Britain (e.g. Mould 1993; Blagg 2004). These tools could be used to produce various types and sized nets, each with differing methods of use and developed towards specific ecosystems and species of fish, but also for fowling birds and hunting mammals (Alfaro 2010, 71); therefore, one cannot infer the methods of capture based on the manufacturing tool alone. Additional evidence for fishing nets are net-weights made from lead (e.g. Brewer 1986; James 2003). Other materials may have been used, for instance, terracotta and stone, but these resemble other objects, such as spindle whorls or loom weights (Alfaro 2010, 77) and are therefore difficult to distinguish and often overlooked. The possibility of textile weights being re-used for fishing should also be considered (Dutting 2016, 395), which further complicates the location and assessment of these objects. The more characteristic lead weights in Britain are often rolled sheets of lead. These form cylindrical shaped objects of varying sizes and which can weigh from under 10 to over 60 g. Additional lead weights or sinkers can be of various shapes and sizes but are extremely rare. Both the rolled weights and netting needles highlight the various nets that could have been used, from small casting nets to large seine and drag nets, requiring from one to over a dozen people, respectively. The Vindolanda tablet 593 represents the single confirmed literary reference to a fishing tool from Roman Britain, describing a potential drag-net: *evericlvm piscatori(um)* (Vindolanda Tablets Online II). The net is requested alongside a hunting net and fowling net, defending the centralised manufacture of nets and the versatile nature of netting needles. We must also recognise the military context of this letter, as tablets were primarily used to communicate between defensive fortifications at the British frontier (Bowman and Thomas 1994).

Other than such descriptions of the various artefacts relating to fish consumption, there are no suggested interpretations relating the objects accompanying ichthyofaunal data, nor how their distribution relates to the cultural context of the various regions in Britain. Not only has the absence of a closer examination prevented more reliable interpretations within Britain, but it has also prevented the inclusion of this evidence in the more comprehensive and collaborative efforts conducted throughout the Mediterranean (e.g. Bekker-Nielsen and Bernal 2010). This is a primary motivation for the subsequent study.

2.7.4 Romano-British Ichthyofaunal Studies

Fish bone assemblages have been found at over 100 sites throughout Britain, varying in size and composition, but also in the method of assessment. Throughout the 1960s and 1970s, academic interest in the role of fish in ancient diets was a consideration that had seen scarce and often anecdotal inclusions in the published reports of well-established archaeologists (e.g. Richmond 1968; Webster 1964; 1974; Frere and Joseph 1974). The study of Roman material culture had been led by experienced classicists who remained somewhat detached from the contemporary advances of ichthyofaunal studies that had developed in the United States, Europe, and Japan (Olsen and Olsen 1970; Grayson 1973; Casteel 1978; Limp and Reidhead 1979; Matsui 2007, 3). While Sir Mortimer Wheeler (1961) had acknowledged and reflected on the likely retrospective criticism by future archaeologists of the quantity of lost evidence (namely ecofacts), few Romanists (Wheeler included) had requested the support of ichthyologists or even zoologists to assess the more evident bone remains. Davies (1971), who published on the diet of Roman soldiers in Britain, has named a few species of fish from a handful of military sites to which there are no references and, on closer inspection, no published material or preserved ecofacts. Later, Frere and Joseph (1974) have highlighted the curiosity that: "sea-fish but not fresh-water are present" at the inland site of Longthorpe, among a collection of ecofacts labelled "food bones" (excavated from 1965), none of which have been preserved for further study. Both cases demonstrate the capacity to assess, yet reluctance or inability to elucidate on such evidence. There are worrying considerations when one acknowledges the frequent use of the term "food bones" at early sites, for example the Roman wells excavated by Wheeler (1936), who describes only the larger ecofacts, such as crustaceans and bivalve shells. Attempting to quantify these potential case studies is now superfluous to the data acquired from modern examples. Instead, these early investigations are stark reminders of the scale of lost environmental remains during the development of this discipline, especially at significant excavations of Roman settlements. It is also reflective of the slow integration of ichthyoarchaeology, and environmental archaeology in general.

By the late 1970s the inclusion of archaeology-minded scientists to the field had led to a profound change in the approach to ichthyofaunal studies (Morales 2014, 3649). For Roman Britain, this was reflected in the sudden increase in published site reports where fish bones were not only highlighted but studied to assess the environmental implications (e.g. Wheeler 1974; Buckland 1976; Jones 1977; 1978; Wilkinson 1979). While these are contemporary with many of the Romano-British excavations where no such studies were attempted, they represent an alternative method of archaeological investigation and one that has developed alongside the field of commercial archaeology. Commercial excavations have followed stricter laws, most notably with the inclusion of the Planning Policy Guidance 16 document (PPG 16) in 1990, which ensures the adequate treatment of archaeological remains within the planning process of further construction work. No longer are the excavations of Roman sites solely fuelled by academic objectives or private interests, but instead by the necessity to salvage valuable data under threat of urban development. Subsequently, a change in the quantity and quality of ichthyofaunal remains has ensued.

The adverse effect of an increased environmental appreciation and recovery at commercial sites is the limited funding and therefore publication of the accumulating material. Though in keeping with the framework established in the 1980s (Wheeler and Jones 1989) the accrued data is now largely composed of grey literature (e.g. Armitage 2000; Ceron-Carrasco 2002; Ingrem 2000; Jacques et al. 2004; Jones 1983; Liddle 1988; Locker 1981; Nicholson 1993). Although much remains unpublished, the specialisation of the profession (ichthyoarchaeology) and the dominance of commercial assessments, has resulted in the appearance of a consistent group of experts in the country. The archaeologists referenced above are the primary ichthyoarchaeologists who have dealt and are dealing with fish-bone assessments; namely: Andrew Jones (English Heritage and affiliated with several archaeological units), Rebecca Nicholson (Oxford Archaeology), Alison Locker (Museum of London Archaeology and English Heritage) and Philip Armitage (Pre-Construct Archaeology). This has been beneficial in facilitating the collection of data for more inclusive studies (Locker 2007) and ensuring consistency in the type and quality of the material, though many exceptions persist.

2.7.4.1 Persistent Issues in Methodology

The primary issue with recovery is the absence of consistent sampling strategies at the excavation phase, let alone a detailed description of the methods used upon publication (Locker 1997, 249; Nicholson 1995, 3; Harland 2017). Often, the fish bones that reach ichthyologists for assessment are hand collected examples at sites with no sieving systems in place (e.g. Grant 1975, 378). Indeed, many of the ichthyofaunal reports for Roman-Britain are the result of laboratory-based assessments disconnected from the excavation and recovery methods on-site (Locker 1985; Wheeler 1993; Izard 1993; Cerón-Carrasco 2002). At the same time, there are examples where effective sampling strategies are used yet few fish bone remains are recovered (e.g. Locker 1986a; 1986b, 3; Nicholson 1993; 2000). This leads to alternative interpretations, either highlighting the infrequent consumption of fish at a site (Nicholson 1993) or the alternative natural transforms that could have created the assemblage, namely animal rather than human deposition (Binford 1981; Nicholson 1992, 38), or the rate of degradation and destruction of bones caused by soil acidity (Nicholson 1996). As such, the total number of Roman fish bone assemblages for Britain remains a skewed figure. While excavation and recovery techniques have improved globally during the last decades, there is an unclear disparity among the provenance of the assemblages.

The discrepancies of ecofact collection have a direct effect on the interpretation of the data. This has resulted in both scarce interpretations of the fish-bone remains by ichthyoarchaeologists in their lab reports (Jones 1978; Locker 1985; 1986a; 1986b; 1992), and the sparse attempts at a comprehensive overview of the data for Roman Britain as a whole (Locker 2007). Perhaps due to such underlying issues of data collection, attempts at wider economic assessments have turned to environmental evidence from abroad; for example, the study of military diets (Davies 1971), where only three assemblages available at the time from Britain are viewed in conjunction with evidence from France, Germany, and Israel. By highlighting potential parallels, the more researched continental provinces have been used to hypothesise on the diets of Romano-Britons, with obvious interpretative drawbacks.

2.7.4.2 Comprehensive Assessments

The first attempt at an inclusive study, in which the available ichthyofaunal data has been collated to hypothesise on fish remains for the entire country, is the work of Alcock, *'Pisces in Britannia'* (1998). By the late 1990s over fifty Romano-British assemblages had been published, allowing Alcock (1998) to hypothesise on the dietary significance of discrepant resources, which she divides into freshwater fish, saltwater fish, and shellfish. To our loss, her paper, produced for the 1997 '*Oxford Symposium on Food and Cookery'*, has been reduced to a summary of a broader interpretative project. Only two-thirds of the Romano-British assemblages are mentioned in an attempt to place Britain within the wider context of the Roman Empire. Beyond the assertion that fishing played a minor role in Roman Britain, Alcock (Ibid.) also highlights similarities with the Mediterranean, namely the success and large-scale consumption of oysters and the import of processed fish, potentially fish sauce. In this context Britain is considered a microcosm of Mediterranean fisheries.

Locker's (2007) publication, '*In Piscibus Diversis*', marks the only comprehensive study of the Romano-British fish-bone evidence. What is presented is a collection of metadata acquired from published and unpublished material from 109 sites and mapped to distinguish any dietary patterns from the British evidence. While Alcock (1998) describes the broader subject of fishing by defining the fisheries in place, including some fish bone assemblages in her evidence, Locker (2007) focuses on the ichthyofaunal remains, providing only a summary of Roman fishing practices in her introduction. Once again, the restrictions of a short publication prevent further elucidation on supplementary evidence for fishing in Britain (such as tools, processing installations and iconographic resources); as a result, Locker includes a brief section on '*Secondary Sources*' (Ibid. 142-144), providing a general summary of Roman traditions, namely literary evidence, amphora imports, and fish-sauce production. This section is a combination of British and Mediterranean evidence to contextualise the following ichthyofaunal data and the concluding remarks. An important example to highlight is the interpretation of the Lincoln and Peninsular House (London) assemblages as evidence of *garum* or *allec* (Ibid. 149) and fish sauce (Ibid. 151) (respectively), conclusions that are based on Iberian examples provided by Curtis (1991, in Locker 2007, 142). The complexities of identifying individual sauces based on bone remains is an unending debate (Grocock and Grainger 2006; Grainger, in Press) and one with influential consequences on the interpretations of processing methods and facilities. Other forms of preservation may have been available, such as salting, pickling, smoking, or drying; none of which are considered, perhaps due to the difficulty of their identification.

In addition to limited comparative evidence, Locker (2007) acknowledges the inherent bias in the data she is researching. From the article, one can see four aspects that influence whether faunal remains recovered are accurately represented.

1. First, taphonomy, that is: the level of preservation, namely the fragile nature of fish bones depending on species and soil type and the resulting bias from post-depositional processes (Ibid.)
2. Second, the difference in bone quantities between species, namely the 'eel-effect', whereby the larger number of vertebrae in the common eel (*Anguilla anguilla*) may result in higher representation than other species in an archaeological deposit (Ibid. 144)

3. Third, the sampling strategy bias, that is, the level of consistency of fish-bone recovery methods between sites, whether hand collected, dry sieved on-site or wet sieved in a flotation device (Ibid. 142)
4. Fourth, the method of assessment and publication of the material, which considers the number of assemblages without quantifiable data (Ibid. 144), either due to unpublished or partially assessed assemblages.

Indeed, these are the inherent flaws in many ichthyoarchaeological investigations and there is little that can be done to avoid it once excavation and assessment phases are completed.

Though inherent flaws may be present in the individual data collected from discrepant resources, it is nonetheless important to acknowledge the methodology Locker (2007) has used and the results she has acquired from this unique research. A total of 8,796 bones are included, which are identified specimens (NISP) to species, genus, or family level from 109 sites throughout England and a single site from Scotland (Ibid. 144); none have been acquired from Wales. Assemblages vary in size, from a single diagnostic bone fragment to thousands of bones, in the cases of Peninsular House in London (Ibid. 151) and from quayside deposits in Lincoln (Ibid. 149). Due the scale of these large assemblages, small subsamples have been taken and assessed (thus the number of bones identified do not represent the total NISP). The inconsistency in NISP between large and small assemblages leads Locker to interpret species distribution based on Number of Occurrences per site.

A total of ten tables are included in the publication, dividing the data by species, site, and date. Additionally, the sites are divided into seven regions within England: North, Midlands, South West, South East, London City, London Southwark, and East London Cemeteries. The cemetery assemblages from East London are studied independently due to the nature of the deposits, suggested by the initial assessor to be directly associated with cremation burials (Rielly, unpublished: as referenced by Locker 2007, 152). There is no explanation for the criteria used for the separation of the remaining regions, nor are their borders geographically defined, with which to include additional sites in future. In addition to the tables that list species and number of fragments, are several bar-charts that compare the frequency of species and/or families. A total of seven charts are provided, one for each region (apart from the London cemeteries) and one showing the overall frequency for the country (see Figure 16).

Locker (2007) provides us with a detailed summary of the ichthyoarchaeological evidence for Roman Britain via the quantifiable data available by the 2000s. In doing so she also highlights the inherent disciplinary flaws that have resulted in the discrepant empirical data. Nonetheless, her conclusions support the hypothesis of a consistent and supplementary diet of predominantly freshwater and estuarine fish throughout the Roman occupation of Britain (Ibid. 158). Eels (*Anguilla anguilla*) are recognised as the most frequent remains throughout the country, though probably indicative of small fish bone deposits (Locker 2007, 146-147), while clupeids compose the largest assemblages, perhaps related to the manufacture of local processed products (Ibid.).

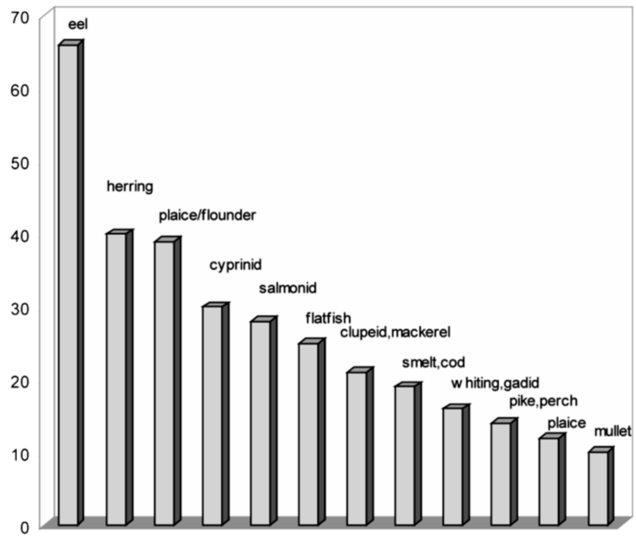


Figure 15: The percentage of fish species or families for all sites (Locker 2007, 146).

In the subsequent thirteen years, additional sites have been recovered that portray a similar picture of small freshwater assemblages, but with some exceptions that highlight the potential significance of processed fish in Britain. One such site is the recent discovery at Stanford Wharf, on the Essex bank of the Thames Estuary (Biddulph et al. 2012). The site represents an Iron-Age to Roman salt-production centre in which a large fish-bone assemblage has been recovered, composed of salt-encrusted clupeid bones. There are an estimated 1000 vertebrae of smelt (*Osmerus eperlanus*) per gram of residue, obtained from a sub-sample of 10 L, producing a total of 920 g of fish bones (Nicholson 2012, 119). That would equate to 920,000 bones for a single subsample, making this the largest fish-bone assemblage in Britain. Though the assemblage was recovered from a ditch and no clear structure for processing fish has been discovered, the evidence of salt-encrusted bones suggests they were being preserved and/or processed (Ibid.). Indeed, the processing of fish in soil-cut features is not without precedence for earlier periods on the continent (Boethius 2016). Among the species identified, herring, smelt and gobies, fish which gather and migrate in vast numbers and in estuarine environments, dominate the assemblage. Just how this facility functioned and how the processed fish may have been exported from the site is yet to be determined.

As well as the evidence for fish processing, there are sites where intensive and consistent archaeological investigations have facilitated the accumulation of data, thus providing more rewarding applications. The Museum of London monograph: '*Roman Southwark, Settlement and Economy*' (Cowan et al. 2009) is an inclusive overview of the forty-one excavations undertaken in Southwark between 1973 and 1991. An integrated study of archaeobotanical, geoarchaeological, architectural, and environmental evidence provides us with an invaluable insight into the topography and transformation of the Roman Thames. The identification of several natural channels and a potential fish-holding tank (Ibid.) provide a detailed context of the contemporary environment from which to interpret the ichthyofaunal remains. Rielly (2013) hypothesises on the existence of a large market for fish in Britain, emphasising the importance of the fish trap discovered at 117 Borough High Street and highlighting the dates for the potential fish sauce production centre in London (at Peninsular House: Bateman and Locker 1982), "which coincides with the 2nd-century cessation of garum imported from the Mediterranean" (Ibid.).

Orton et al. (2017), include the ichthyofaunal data for Roman London in their study of Medieval fisheries. The aoristic analysis reveals the frequency of ichthyofaunal data in contrast to the volume of samples taken (Figure 15). At first glance, the evidence appears to support their interpretation of the scarcity of fish bone remains from Roman samples taken throughout the city (Ibid. 10); however, the chronological consistency of the stratigraphic deposits from which samples are taken need closer examination. The clear majority of over 1000 samples are dated to AD 50-100, a period of great significance in London as it marks the Boodican revolt, the destruction of the city c. AD 60, and the creation of a charcoal-rich layer throughout the area of investigation. These appear to become targeted deposits for archaeological assessment, regardless of the potential for organic material. A description of feature-types from which the samples are obtained reveals a much more thorough extraction for the Roman period, where occupation deposits, cut features and "other" (no specification) deposits are equally targeted in addition to pits (Ibid. 13). For the Medieval-period excavations, no such lengths are taken to recover samples, over 90% of which are from pit deposits alone. Fish bones are remarkably fragile, features such as pits and dumps therefore provide better prospects of bone survival and retrieval, especially concerning refuse pits in which bones were often intentionally deposited (Wheeler and Jones 1989, 69-70). It should be considered that the increased sampling ratio for Roman London (perhaps fuelled by the desire to retrieve as much from Boodican charcoal-rich deposits as possible), and the sampling of features with more volatile taphonomic conditions for fish-bone survival, have skewed the results of ecofact recovery frequency suggested for Roman London (Orton et al. 2017,11).

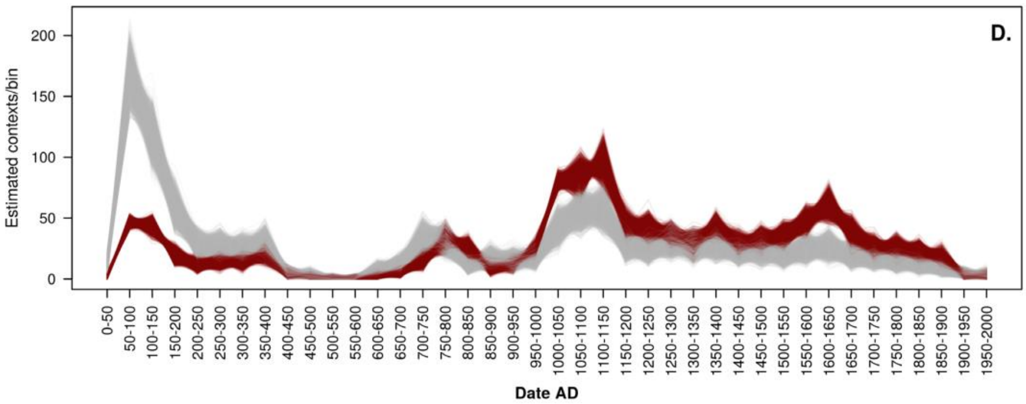


Figure 16: The analysis shows the frequency of fish-bone remains from London (red) in correlation to the frequency of environmental samples taken (grey) (Orton et al. 2017, 11).

Evidence for small-scale fisheries throughout the rest of the country are fewer in number, yet a comprehensive assessment conducted in Chester (Harland 2017), demonstrates the value of a complete ichthyoarchaeological assessment following an effective sampling strategy. Harland (2017) divides the data by context, chronology, species, NISP, element type, and taphonomic modifications; the accrued data is interpreted alongside environmental and ethnographic evidence from the region of the River Dee and Dee Estuary, supporting broader hypotheses of the provenance of the fish and thus the fisheries that were likely present. A vivid picture is painted of a city that was provisioned by various fisheries on both freshwater and brackish water environments using a combination of shore-based nets, and of a fresh-fish market that was available and popular among the local population (Harland 2017, 25). This study is unique in both detail and in the assessment of an assemblage that is not related to a processed-fish product. It sets a standard for continued ichthyofaunal and halieutic research in Britain.

3. Methodology

The subject of fishing is broad in terms of the range of archaeological evidence, yet the available material from Britain is relatively scarce due to the issues of preservation and publication discussed previously. The thesis must draw on a wide range of discrepant and often disconnected evidence to be able to approach the research questions outlined in Chapter 1. These can be summarised here as:

- Identifying the method, scale, and distribution of fishing practices in Roman Britain.
- Determining which and whether current evidence is representative of local and/or regional fishing practices.
- Identifying relationships between fishing practices and cultural discrepancies.

The previous chapter has outlined the diverse range of methods used in the interpretation of ancient fisheries and advocated the requirement for both catalogues of artefact and ecofact remains and an interdisciplinary approach to their analysis, including ethnographic, historical, and environmental evidence where possible. This is what is attempted in this thesis and, due to the novelty of the study within Britain, it is deemed essential to divide the evidence into individual chapters prior to their collective assessment. The thesis involves the analysis of primary sources, fishing tools, and fish bone remains collected from published and unpublished material throughout Britain. The assessment employs methods adopted from archaeology and classics, as well as those considered here 'halieutic', which are based on the combination of historical, archaeological, and ethnographic studies, as discussed in Chapter 2. The following chapter identifies the various resources included in this thesis, the criteria for their inclusion and assessment, and the intended application of the acquired data.

3.1 Primary Sources

As previously discussed, the Roman period benefits from a rich resource of literary and pictorial sources. The descriptions and depictions, while largely restricted to the Mediterranean, provide a valuable insight into various aspects of ancient fishing practices: some of the tools that were used, the preference of species, the environments frequented by fish, their migratory and feeding habits, and regional discrepancies. Geographical and literary biases have been adequately highlighted elsewhere (e.g. Bekker-Nielsen 2005; Bernal 2010; Marzano 2013); however, several literary extracts remain an important resource for aiding in the interpretation of the archaeological remains and for incorporating ethnographic evidence adequately and convincingly (Bernal and Bekker-Nielsen 2010, 21). Chapter 4 provides and assessment of the literary sources that are considered relative to the species identified in Britain and fishing methods alluded to by the recovered artefacts. Extracts from Pliny (*HN,* 1st century AD), Oppian (*Hal.* 2nd century AD), Aelian (*NA*, 3rd century AD), Athenaeus (*Deip*. 3rd century AD), and Ausonius (*Mos*. 4th century AD) directly describe several fishing tools and practices, while indirectly describing certain environmental factors that are important for determining the location of ancient fisheries. Some extracts imply certain tools were used for the capture of particular species, which, although noted biases of direct correlations must be considered (Morales 2010 45-46), may coincide with the archaeological evidence.

Britain has thus far produced only one confirmed literary reference to fishing, Vindolanda Tablet 593, with the addition of two unconfirmed examples (Tab. Vindol. 302 and 596), which are examined in closer detail in the context of the Roman military settlement in which it was found. Pictorial depictions include an overview of several Mediterranean mosaics that have influenced previous interpretations. A few details that are often overlooked, concerning the depicted tools, are highlighted in connection with the artefact remains recovered from Britain. In addition, these detailed mosaics are compared to British examples to determine consistencies in design, or alternative cultural perceptions of ichthyofauna that may relate to culinary practices and therefore targeted species. In addition to British mosaics are pictorial representations via stone inscriptions and on metal artefacts, the latter of which includes a large collection of zoomorphic brooches recovered throughout the country. While these objects provide no direct association to fishing practices, they are indicative of potential cultural ties to the aquatic fauna, which may relate to the distribution of fish bone and tool remains. Both the literary and pictorial sources described in Chapter 4, are referenced in the subsequent chapters following the assessment of the tool and fish bone remains, where potential correlations are identified.

3.2 The Tool Artefacts

Fishing hooks and net weights have consistently been the most numerous halieutic artefacts recovered throughout Europe (e.g. Trakadas 2009; Bernal 2010; Dütting 2015; Vargas-Giron), which during a preliminary overview of published material was found to be the case in Britain. A more complex panoply of fragile and enigmatic artefacts is represented across the former Roman empire, including ceramic and stone net-weights, metal projectiles, ceramic traps, and net fragments (e.g. Galili et al. 2002; Bernal-Casasola 2010; Alfaro-Giner 2010; Thomas 2010). On closer inspection, none of the latter have been identified in Britain, though numerous objects with unconfirmed functions and dates require a closer examination in future (namely ceramic loom weights). A general overview of published works and grey literature relating to fishing equipment has been conducted and additional tools have been recovered. These consist of netting needles, gorges, potential fishing weirs, and a trident. Of these, the needles are the most represented with twenty seven artefacts identified throughout the course of the thesis; they are therefore the focus of a more diagnostic assessment alongside hooks and weights, while the remaining objects are only briefly assessed (labelled as miscellaneous artefacts).

In addition to published excavation reports, a thorough investigation of digitised grey-literature has been conducted, using the resources of the Archaeological Data Service (https://archaeologydataservice.ac.uk/), the Internet Archaeology website (https://intarch.ac.uk/), the Portable Antiquities Scheme database (https://finds.org.uk/database), and additional online archives provided by commercial archaeology units across the country. A large proportion of the artefacts are only referenced in published and unpublished reports, which has required accessing assemblages at commercial unit and museum storage facilities, including: the Museum of London, the British Museum, Gloucester Museum, the Hull and East Riding Museum, Arbeia Roman Fort and Museum, the Ashmolean, Pre-Construct Archaeology, English Heritage, and Oxford Archaeology. Additional finds that have been cited as existing in museum collections could not be accessed during the time frame of this thesis. Various museums lack the resources to facilitate access to stored collections, meanwhile many museums and storage facilities have been closed due to lack of government funding over the last decade (Larkin 2018). A few artefacts, though referenced in archaeological reports, were recovered in the mid-20th century and are no longer traceable to a museum or commercial unit (these are noted in Appendix A, Parts 1, 2, and 3). Vice versa, there are a few artefacts that have been identified on display at museums, for which there is no published record. Examples from the British Museum are noted as originating from Mediterranean excavations and not the UK, for which reason they have been excluded.

One of the challenges in accruing artefactual data is ensuring that the artefacts have been adequately assigned to a stratified context, which is rarely confirmed in unpublished reports and museum collections. The Portable Antiquities Scheme has provided the least reliable resources, due to their provenance from chance finds by metal detectorists. Several of these examples have been dated as Roman to Post-medieval and have therefore been excluded from the assessment, though included in the Appendix for posterity. The catalogues provided in the Appendix are intended as living documents, to be altered as research in this discipline progresses. The subsequent assessment has attempted to include 'Roman' dated material only to ensure the proposed classifications are accurate, although notable examples recorded as Roman are considered unlikely fishing implements or post-Medieval in date; these are outlined in Chapters 5 to 7. The role of fishing tool data in this assessment is fourfold:

1. The identification of morphological consistencies
2. Geographical distribution and the identification of potential fishery locations.
3. The correlation of tool remains with discrepant aquatic environments.
4. The correlation of tool remains with the ichthyofaunal evidence.

Mapping the tool remains alone can prove beneficial in identifying targeted aquatic environments, concentrations of markets, large-scale fisheries, and ties to Roman settlements. The inclusion of a classification system and the identification of morphological consistencies among the various tools can provide more information on the methods of capture, the potential targeted species, the skill of the craftsman, and explanations for the identified distribution patterns; it Is also important for advocating assessment criteria to ensure a more consistent record of further discoveries. The subsequent sections are tasked with describing the fishing tools and the morphological parameters chosen for their assessment, following the typologies and classifications described in Chapter 2.

3.2.1 The Roman Fishing Hook

The current number of fishing hooks from Roman Britain stands at eighty. This does not include close to three dozen examples from unstratified contexts, unrecorded private collections (metal-detected finds that are yet to be assessed), anecdotal references in early reports, and very recent and unrecorded discoveries (only two of which have been included in this investigation). It is possible that a typology may aid in the further identification and interpretation of Roman hooks, as such, the classification proposed here is intended as a preliminary typology of Romano-British examples. The hooks included in this study have had various levels of valuation, from mere illustrations without descriptions -and vice versa- to a detailed summary of the specifications alongside clear images. The majority, however, fall into the former category. Half of the artefacts have been assessed for the first time for this thesis, which is a result of the absence of published records and a testament to the undervaluation of these objects in archaeological studies.

All the hooks included in the thesis have been described as fishing tools of Roman or potential Roman date in either published or unpublished records. Several examples are considered unlikely fishing implements (elucidated in Chapter 5) but have been included to identify typological inconsistencies and facilitate future identifications. Excluded British examples include hooks recovered from the Guernsey shipwreck (Rule and Monaghan 1993), due to its association with the Gallic province and distance from Britain. Any other exclusions identified hereafter within the British Isles are unintentional and a result of limited resources and time with which to access more obscure examples. Numerous artefacts are truncated but reveal discernible morphological attributes that are considered as evidence of a fishing hook and therefore included. To facilitate such identifications the hook is studied in its constituent parts, of which six attributes have been identified:

1. General shape
2. Size
3. Point (barbed or pointed)
4. Terminal
5. Profile shape
6. Material

The size and general shape have been considered significant aspects in previous typologies (Bernal 2010; Vargas-Giron 2020), and the terminal has received a preliminary overview

(Vargas 2011). In the interest of developing this field of study, the various types described in the former classifications are included and expanded according to the British evidence. Size ratios are not directly adopted but, as with additional classification criteria, are based strictly on the Romano-British evidence; they require a closer examination as to why they have been chosen and what they can tell us. It should be noted that a typology may not prove fruitful at this stage; that said, current data can highlight morphological patterns that may be elucidated with further studies and with the support of more numerous and assessed artefacts, for which it is considered an essential contribution to the field.

A complete catalogue of Romano-British fishing hooks is provided in Appendix A, Part 1, including illustrations, measurements, and references. They are further assigned identification numbers used to reference them in the text, labelled as H1 to H80. The original small find and/or museum record numbers are listed in the appendix. A list of sites and the subsequent metadata is provided in Appendix C, Part 1.

3.2.1.1 Classification Criteria

Though the terminology used is influenced by diverse modern examples, the classification system proposed in this thesis is based on the prominent morphological discrepancies from the Romano-British evidence alone. All the terms used are defined here (Figure 17).

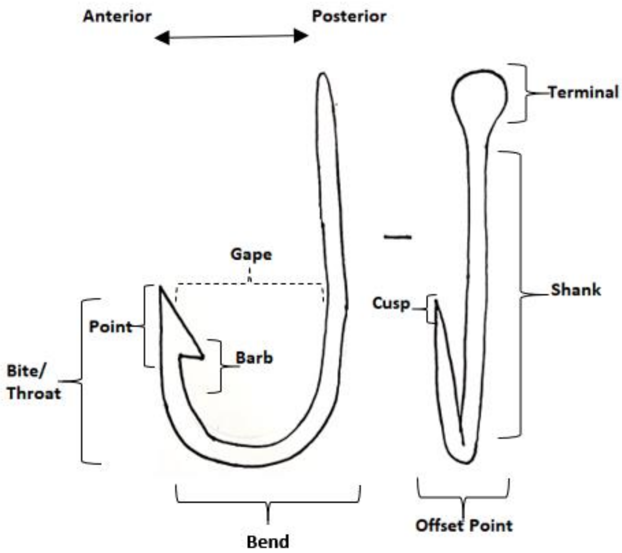


Figure 17: The distinguishable parts of a fishing hook (Illustration by L. Graña)

Based on the recovered examples, the Romano-British hooks are divided into six 'shapes', seven 'point' types, five 'terminal' types, three 'profiles', and either copper (Cu.) or iron (Fe.) 'material'. The size ranges are small, medium, and large, which vary in dimension, depending on the 'shape type' of the hook. The 'very-small' size defined by Vargas (2011; 2020) is excluded due to the undefined partition of hooks above and below 25 mm lengths. The various shapes and the point and terminal subtypes are represented by at least one example (Figure 18), although such scarce representations are heavily scrutinised in Chapter 5. All fishing hook illustrations available have been included in the catalogue in Appendix A, Part 1.

a. Shape

The first classification is the overall shape. Shapes are a significant aspect of function in modern hooks. The angle of a barb can be altered in three dimensions to facilitate or inhibit the bite and trapping of certain species. This can be achieved by altering the 'gap', or 'gape', which is the distance between the point and the shank in the horizontal plane; and altering the 'frontal length', commonly known as the 'throat' or 'bite', which is the distance from the internal base of the hook to the point-cusp (Figure 17). Both are directly conditioned by the 'bend' but can also be independently altered during the construction phase. An additional aspect is the length of the shank, which is used to distinguish the J and elongated-J types. Meanwhile, the number of point-extensions differentiates these two types from the less common double and quadruple types. The shape is therefore considered an intentional manufacturing process with theoretically discrepant intended methods of application. Six shapes have been identified:

The '**J' shaped** or **'Simple'** hook. The most common type.

The '**Elongated-J'** shape which has a longer shank, relative to the depth of the bite.

The **'Double'** hook, or 'Omega-shaped' (Ω) hook. It includes two points facing opposite directions.

The **'Ring'** or **'Circular'** hook. It consists of a rounded shank with curve commencing shortly after the terminal and continuing in a circular fashion toward a high-set point.

The **'Quadruple'** hook. An uncertain type based on two examples from London. It is composed of four small barbs at opposite corners of a rectangular profile and facing inwards.

An additional type, the **'Incomplete'**, has been added to include all those hooks that have been truncated or are unfinished, and for which it is impossible to confirm an overall shape.

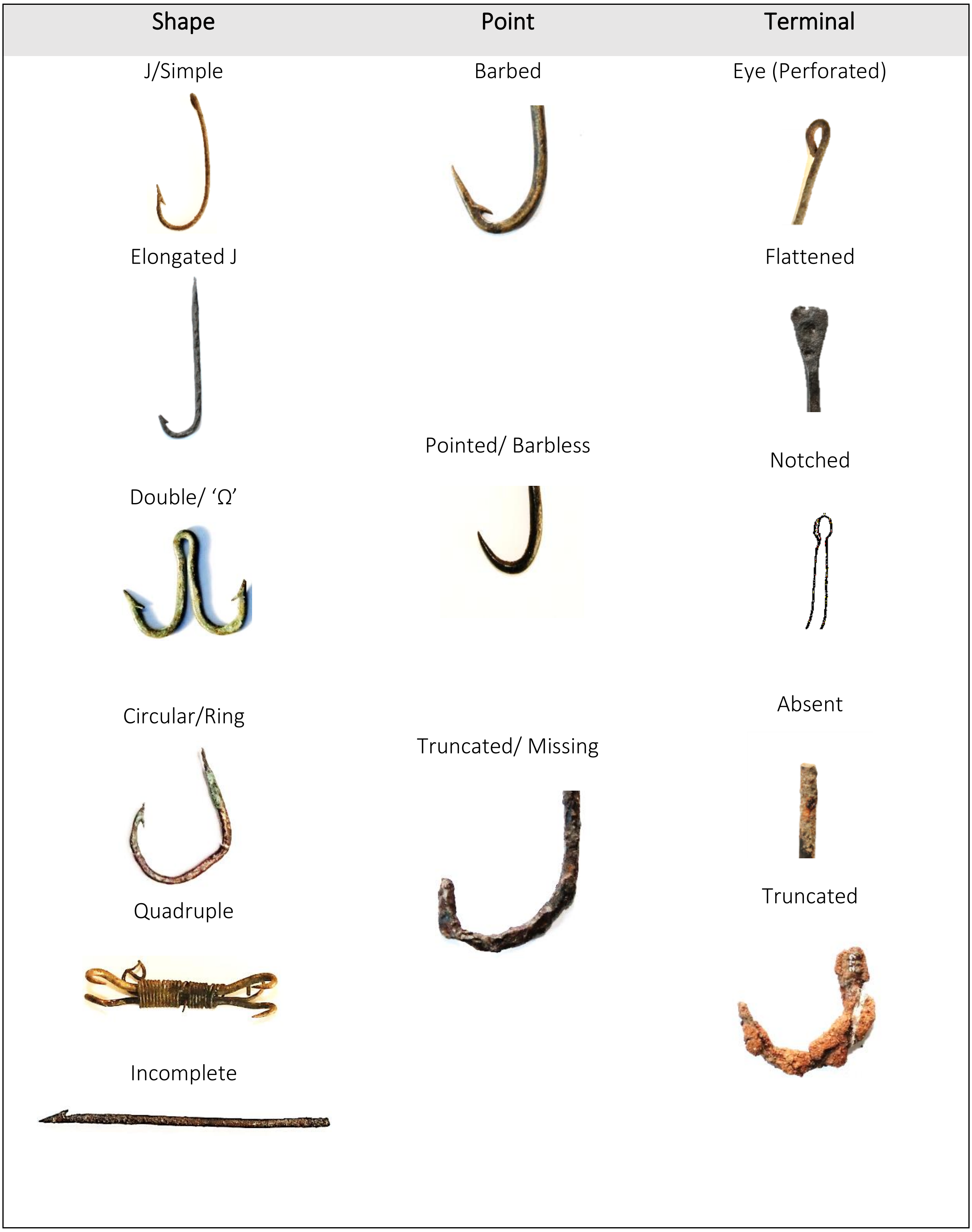


Figure 18: Roman examples of each Shape, Point and Terminal Types identified for Roman Britain.

One final aspect that is also evidenced by few and potentially damaged artefacts is the 'off-set' hook. As mentioned, the alteration is three-dimensional, as the point can be intentionally off-set from the angle of the shank (Figure 17). This aspect is common for modern hooks, either for targeting large bottom feeders or allowing a greater range of sizes of fish to be caught with a single hook (Hurum 1977); nevertheless, the discovery of a few potential Roman examples begs the question as to whether this was an intentional construct, or merely a post-production alteration caused by damage. As any of the former shapes of hook can theoretically be offset and as there is insufficient data with which to determine if this aspect is restricted to one type, it is not included as a separate classification at this time, but it is an aspect that must be recorded among further discoveries to determine its intended use.

b. Size

The second factor to consider is the size of the hooks. As different fish have diverse buccal diameters, the hook diameter affects the size of the individual or even the species that are susceptible to capture by this method. It is also important to consider the manufacturing process as a potential influence on the resulting size. Previous size classifications of 'large' (>80 mm), 'medium' (40-80 mm), 'small' (25-40 mm), and 'very small' (<25 mm) (Vargas 2011, 211) are based on length alone and do not include width; this has been included in this assessment to determine consistencies between length and width and thereby assess truncated examples for which the total length is unknown. In addition, the various shapes should not adhere to the same size ranges. The elongated J hook, for example, may have a shank that falls under the medium estimate by Vargas (2011), but a bend and width that resembles the 'small' or 'very small' hooks in that classification. Size ranges are therefore determined and proposed for the individual shapes, which, with the current collection, is only possible with the J, elongated-J, and double types.

c. Point

The third aspect is the 'point' of the hook, that is, the penetrating tip. This part has been divided into three types: 'barbed', 'pointed' (barbless), and 'truncated/incomplete'. The barbed hook is the most diagnostic as a fishing implement and consists of seven identified types (Figure 19), with an eighth representing truncated or undiagnostic examples. Modern nomenclature is used where possible, though their function as described by modern hook-producers will not be inferred for the Roman equivalents without further assessment. Furthermore, terminology varies among different countries, for which reason it is important to describe the examples included here.

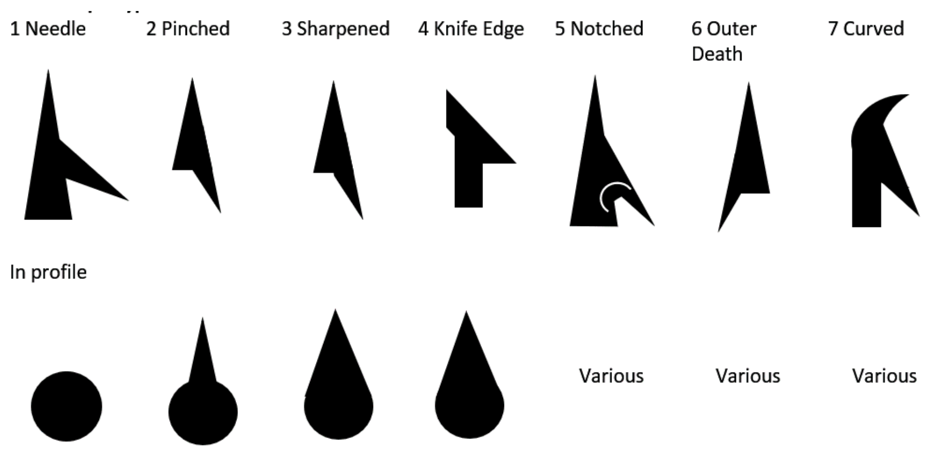


Figure 19: Barb types in lateral profile (top) and corresponding dorso-ventral profile (bottom). Type 8 (not included here) is the incomplete or truncated barb (Illustration by L. Graña)

Needle-Barb: an inward projection of a simple conical barb with no sharpened edges.

Pinched: a lateral projection created by flattening the side of the point with a hammer.

Sharpened: a 'V' shaped profile achieved by an abrasive method, as opposed to hammering.

Knife-Edge: as with modern examples, these are sharpened edges that extend dorsally and ventrally, creating an isosceles-trapezium edge (commonly termed the 'banana-shaped' barb), producing a greater cutting surface with which to ensure penetration.

Notched: these are additions to either sharpened or needle-point barbs including a notch in the posterior underside of the barb projection. It may be an intentional construct for ensuring a more effective cutting edge, or a decorative result of the manufacturing process.

Outer-Death: an anterior projected barb. It can take any of the forms described already, though projecting in the anterior direction, from the outer edge and away from the gape and shank.

Curved or **Beaked**: a characteristic long inward curve to the point in the posterior direction, with a low-lying barb at the base.

Truncated or **Incomplete**: mostly comprised of iron examples with missing barbs or corroded by oxidation to the extent that assessment is impossible without the appropriate conservation methods. Some may still be classified as barbed due to an undiagnostic yet visible projection on the posterior edge of the point.

d. Terminal

The fourth aspect is the terminal, which is the dorsal projection of the shank to which a line is attached. The terminal is always placed higher than the end of the point to ensure the line is not damaged by the fish. Modern examples of terminals are numerous, and this seems to depend on size as well as species, as the method of attaching a line may affect the maximum volume of weight of a fish (Hurum 1977, 71). The four types included here (with a fifth representing truncated or missing/incomplete terminals) are further divided into subtypes based on the manufacturing process.

The **eye** terminal: a circular opening that facilitates the tying of a line through the hook, as opposed to around the shank. This opening can be created by three methods (Figure 20). 'Looped', whereby the shank is looped at the terminal to form an enclosed or semi-enclosed ring; 'pierced', whereby the terminal has a simple perforation, much like a sewing needle; and 'flattened and pierced', which is formed by piercing a hole through a larger surface area that has been formed by flattening the shank with a hammer.

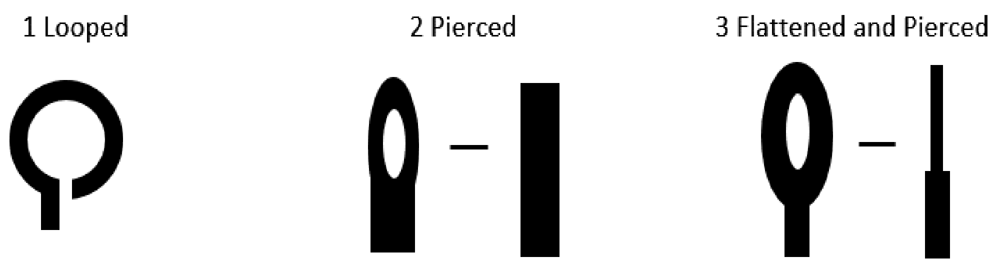


Figure 20: Terminal Type 1, the 'Eye', with subsequent Subtypes (Illustration by L. Graña).

The **flattened** terminal*:* this terminal allows the knotting of a line around the shank. It is formed by hammering the terminal of the hook to produce a flat surface that is wider than the shank, thereby preventing the knotted line from slipping out. The subtypes are 'rounded', 'square' and 'irregular' (Figure 21*)*. The latter seems to be the result of the natural spread of the metal when hammered, though it can also be a result of damage to the hook. The former two can be formed as a result of the profile of the shank, as a square shank may facilitate the production of a quadrangular terminal; however, some examples are neatly produced, suggesting they were purposely and meticulously formed.

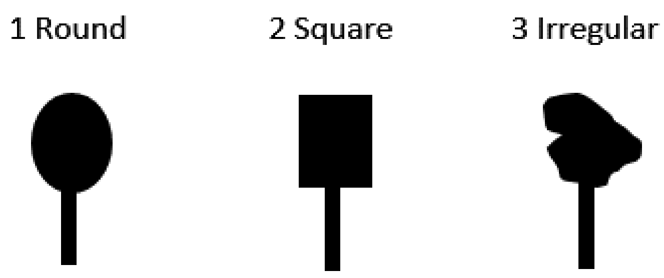


Figure 21*: Terminal Type 2, the 'Flattened' type, with subsequent Subtypes (Illustration by L. Graña).*

The **notched** terminal: formed by creating a concave groove around the shank deep enough for the line to be attached without slipping. Though common in modern examples, it is represented by a single hook (H28), due to an undetailed illustration. Therefore, this type may not be represented in Roman Britain.

The **absent** terminal: is included as a fourth type as there is the possibility of a deliberate absence using an already tapered shank to attach a line. This is most likely the result of unfinished or neatly truncated hooks, though such uncertainty warrants documentation for posterity. Where damage is evident, the additional type of **truncated** terminal is assigned. This is common among the corroded iron examples and often includes a low-lying truncation down the length of the shank.

e. Profile and Material

The profile of the hook describes the shape of the metal rod that is used to form the structure. The three types identified are 'square', 'circular', and 'mixed'. The latter is based on the tendency for some Roman hooks to be irregular in profile or have both altered square and circular profiles depending on the area of the hook. This is considered a result of the manufacturing process and the alteration of an existing square or circular blank via percussive or abrasive manipulation.

A similar uncertainty arises from the material type. All the Romano-British hooks included in this thesis are either copper-alloy (Cu.) or iron (Fe.) and it is at present unclear if the material type is related to function, fashion, neither, or both. A much larger proportion of Romano-Mediterranean hooks are constructed of copper alloy (Vargas Girón 2020), yet currently forty-one (55 %) of Romano-British fishing-hooks are copper and twenty-nine (45 %) are iron (percentiles of diagnostic examples only). This unprecedented high number of iron examples is an important and interesting aspect that will be further discussed in relation to the historical context and marine environment.

3.2.1.2 Towards a Typology

The classification criteria are based on identified or previously described morphological attributes. The latter follows definitions in Britain that require confirmation and are therefore subject to analysis in Chapter 5. There are various examples of fishing hooks that alternate between the various types and subtypes, for which the identification of a specific typology may not be possible at this time; nevertheless, the included aspects consist of all attributes that may have been deliberately controlled in the manufacturing process of the fishing hook. It is important to recognise that it is as yet unknown which aspects were or could be intentionally manufactured in antiquity, as one or multiple morphological aspects could also have been the by-product of the manufacturing process or the material used. The classification must therefore ensure a greater number of parameters with which to determine consistencies (Table 1). The assessment of the fishing hooks (Chapter 5) highlights morphological consistencies and geographical patterns that are suggestive of a fishing hook typology.

Table 1:Classification of fishing hooks, divided by type and subtype.

Hook parts	Distinguishable elements	
Shape	J (J shaped/ simple)	
	L (Long/Elongated J)	
	R (Ring shaped/ Circular)	
	D (Double Hook)	
	Q (Quadruple Hook)	
	I (Incomplete and/or unable to specify)	
Size	S (Small)	
	M (Medium)	
	L (Large)	
Point	B (Barbed)	1.Needle point 2.Pinched barb 3.Sharpened barb 4. Knife edge 5. Sharp/pinch with posterior notch 6. Outer death 7.Curved/ beaked 8. Undiagnostic
	P (Pointed)	
	T (Truncated)	
Terminal	E (Eye)	1. Looped 2. Pierced 3. Flattened and pierced
	F (Flattened)	1. Rounded 2. Square 3. Irregular
	N (Notched)	
	A (Absent, potentially by design)	
	T (Truncated/Missing)	
Profile of shank	S (Square)	
	C (Circular)	
	M (Mixed)	
Material	Fe. (Iron)	
	Cu. (Copper)	

3.2.2 The Lead Net Weights

The 313 British lead artefacts included in this thesis fall under two categories that can be described as: the alteration of a cast lead sheet to create a cylindrical or quadrangular object (Figure 22), or, for three examples, the direct casting of lead into a cylindrical shape. All have a perforation or gap running along the longest/horizontal axis, through which the cord of a line or net would have run. The halieutic function assigned to these examples is supported by their continued use in modern fisheries (Figure 23) and the absence of confirmed alternative functions for most of the objects identified in Roman Britain. Various additional types of fishing weights were used throughout the Roman empire (see Galili et al. 2002; Bernal 2008b; 2010;

and Vargas 2011) but have not been identified in published archaeological reports in Britain. The cylindrical lead artefacts represent the largest collection of both published and unpublished weights and are therefore the focus of this investigation.

Figure 22: Romano-British lead net weight from Gloucester. W34 dated to between AD 43 to 410 (Illustration by L. Graña)

The subsequent assemblages have been acquired from museum collections, commercial units, archaeological reports, and grey literature. The limitations of the author in accessing and assessing the numerous artefacts should highlight that this is not a complete or exhaustive survey, but it is an initial and necessary step that outlines various types of artefacts. The subsequent classification differentiates lead artefacts that are convincingly net weights (with no proposed alternative function), from those with potential multiple functions; it further defines morphological patterns among the cylindrical sheet weights that may relate to discrepant fishing methods. Many metal detectorists have admitted to discarding various types of these objects due to their resemblance to scrap and due to the absence of published material with which to verify forms, functions, or chronologies (survey produced via detectorists' social media outlet: www.facebook.com/groups/737531112986629). There appear to be no confirmed Iron Age examples, suggesting a Roman introduction; however, there are numerous early Medieval examples (e.g. Rogers 1993; Ayers 1994), which brings into question the date of several hundred unstratified objects recovered from coastal and estuarine environments (see examples from East Riding, Yorkshire, and Blackfriars, London: Appendix A Part 3).

Figure 23: Modern clamped weight on a lead-line used in South-East Spain (Illustration by L. Graña).

The artefacts included in this assessment have been described in published and unpublished reports as 'weights'/'fishing-weights' or 'potential-weights'. As with fishing hooks, several examples are unconvincing as fishing equipment but have been interpreted as such, for which reason it is important to include them in order to highlight discrepant morphologies. A typology is attempted of the altered-lead-sheeting artefacts from Britain, in order to highlight potential morphological discrepancies excluded from former typologies (Galili et al. 2002; Bernal 2010). As most of the artefacts included in this thesis have been assessed by the author, a strict recording system has been produced to ensure a consistent volume of data. The aspects recorded include:

1. The general shape
2. The volume of weight
3. The dimensions (length and diameter)
4. The diameter of the internal perforation
5. The sheet maximum thickness

A complete catalogue of the Romano-British lead artefacts is provided in Appendix A, Part 2. As with fishing hooks, illustrations, measurements, and references are provided. A similar numbering system is used with which the artefacts are referenced in the thesis (W1 to W313).

3.2.2.1 Classification Criteria

The proposed classification of the Romano-British lead finds is based on discrepant forms with well-defined characteristics. A large proportion of the British examples can be classified as either the L1.2, L2.2, L2.3, and L3.1 types identified in Israel (Galili et al. 2002, see Figure 9), or the PLI1, PLI2, and PLI3 types from the Iberian typology (Bernal 2010) (Figure 10). The 'general shape' that is suggested for the British evidence is indeed based on these types, with some minor addendums; however, there are several aspects of interest that are not identified in either of the previous methodologies (Figure 24). The sheet thickness is one aspect added to the classification system proposed in this thesis and only recently discussed in the work of Vargas (2020, 91-92) among the unrolled lead weights. The reason for this addition is to determine the consistency of lead sheets used in the manufacture of these objects. Whether the various sheet-thicknesses coincide with weight types is an aspect that may reveal the extent of specialised manufacturing via a control of the intended volume of weight. Various measurements are absent from published examples and the inclusion of this data has only been possible where accurate illustrations have been provided.

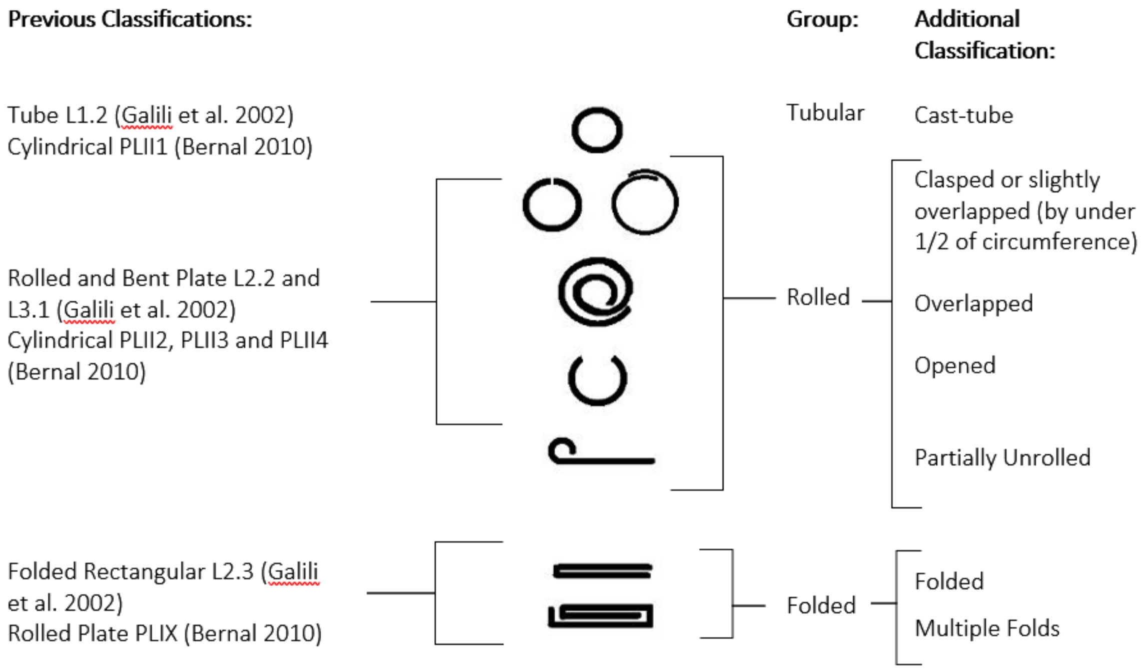


Figure 24:Types of weights made from altered Pb. Sheets. Observations in profile and identifications from previous typologies.

Other shapes of consideration are those that may have resulted from damage, re-use, or post-depositional processes rather than function. These include partially unrolled, opened, and folded examples, all of which may have been produced by the alteration of a clasped weight (the folded type by compression of a cylindrical weight). There are numerous examples of each, for which they have been included as subtypes in the current classification.

The subsequent typology can be grouped into three broad types: ‘tubular’, ‘rolled’ and ‘folded’, which are the aspects that have been highlighted in the previous typologies of Mediterranean assemblages (Galili et al. 2002; Bernal 2010; Vargas Girón 2020). The British evidence has identified seven potential subtypes among these examples based on morphological consistencies. The most diagnostic features that dictate these seven divisions are illustrated below in Figures 24 and 25. The types and subtypes are as follows:

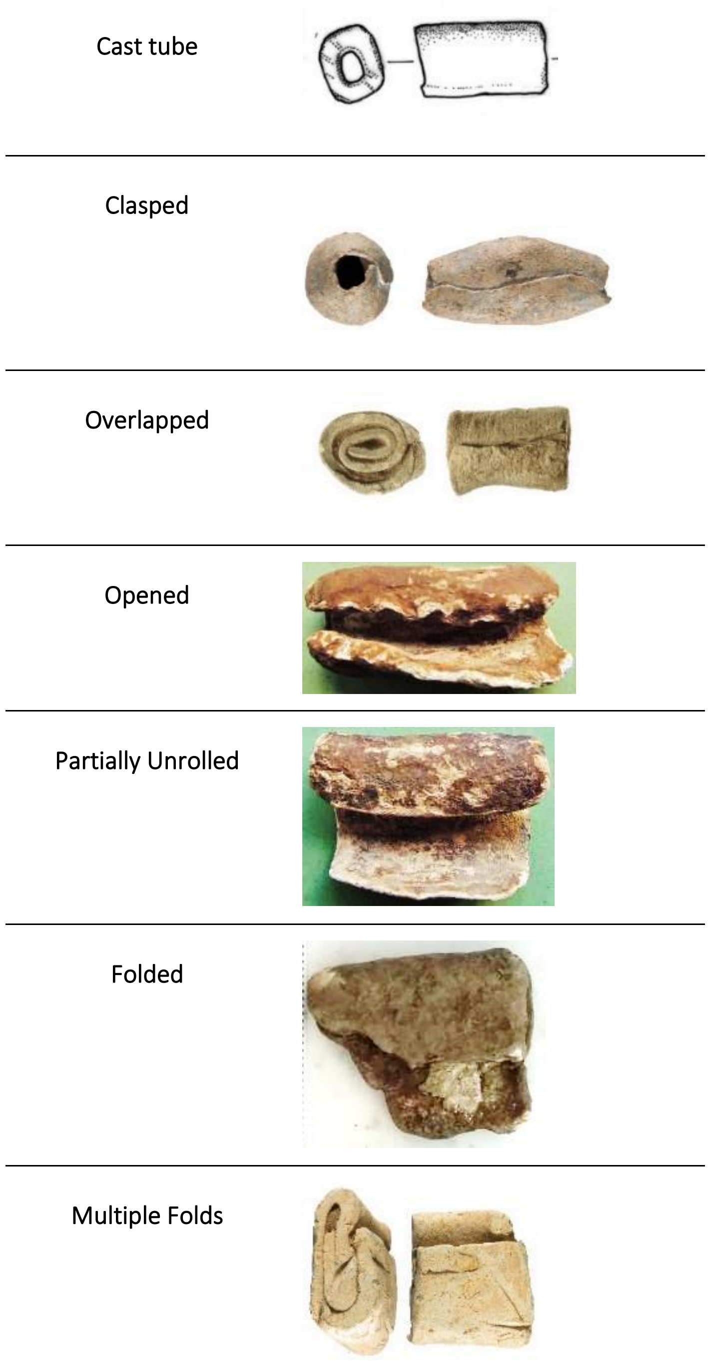


Figure 25:Examples of the seven categorisations of the British lead objects. Illustrations are referenced in Appendix A, Part 2.

Cast -tube: Produced via a mould with a perforation along the horizontal axis, but no opening through which to loop a cord. The cord must therefore be threaded through the perforation rather than wrapped around a cord or net. There is no distinction between this classification and that of the previous typologies, merely an etymological inclusion of the term ‘cast’ to ensure that they are not misinterpreted as a tube or cylinder produced by shaping a lead sheet.

Clasped: Clasped examples are rolled sheets belonging to the broader 'rolled' type which can include a minor overlap of the sheet ends. They can be circular in profile, almost identical to the 'cast-tube' but with a slit where the opposite faces of the sheet meet. They can also overlap, whereby the sheets sit one on top of the other, rather than meeting flush. This overlap is generally short, less than half of the circumference, and rarely reaches a full turn.

Overlapped: This subtype also belongs to the rolled type and follows the same principle and method of production as the clasped but with multiple rolls. These range from double-layered examples to up to four layers (in the case of W37). Multiple rolls equate to a greater volume of weight; however, these examples are unlikely fishing tools.

Opened: One may consider this an 'unclasped' example, where the cylinder can no longer function as a tube due to an opening running along the entire length. It is unclear whether the opening is an original shape or an alteration. If there is a sufficient roll to be fastened to a cord or rope, the object may still function as a weight. An alternative interpretation is the intended unrolling of a weight to remove it from the cord or net, either as scrap or to be re-used.

Partially Unrolled: These examples often retain a cylindrical profile at one end and a partially unravelled sheet at the other. Examples have been identified as the result of post-excavation manipulation in attempts to identify writing on the internal face of the sheet. Others have been found as such and may therefore reflect the removal of a clasped weight from another object, perhaps for recycling. If re-rolled to a cylindrical shape, some examples resemble the clasped type, while others would fall into the 'overlapped' type; a third aspect is that some examples have single rolled side that is sufficient to wrap around a cord, which highlights the possibility of a functional tool with this shape.

Folded: Rather than rolled, a sheet of similar dimensions can simply be folded over a cord creating a quadrangular piece formed by two layers. These are often missing a perforation or gap to determine the diameter of the cord to which they were fixed. They are unlikely examples for Britain but have been identified elsewhere in the Roman Empire (Galili et al. 2002).

Multiple Folds: Only one example of this type has been recovered in Britain (W26), making it an unlikely candidate for fishing equipment; nevertheless, multiple folds are theoretically possible, allowing an increase of weight in a concentrated area. The single artefact includes a perforation that supports the use of a cord on which to attach it. Other examples may exist, though are unlikely to be recorded as anything but scrap material.

3.2.2.2 Non-Fishery Functions

Unlike the barbed fishing hooks, lead artefacts can prove more ambiguous in their identification due to the more discrepant morphologies resulting from their malleable nature and diverse application. Of those objects that resemble the fishing weights, proposed alternative interpretations include a binding tool for fabric containers such as sacks (Tyrell 2015), of which there are no confirmed examples within Britain, or curse tablets, the *defixiones*. These lead sheets, on which curses were written to a god or gods in condemnation of a person to whom the writer wished ill-will, were often rolled into cylindrical scrolls or folded into a rectangular piece prior to deposition. Their frequency in Britain has resulted in several fishing weights being labelled as curses. Many of the rolled lead examples recorded by the Portable Antiquities Scheme are described as curses (see Appendix A, Part 2), as are additional metal-detected finds that have not received a halieutic assessment.

Britain has revealed the largest collection of curses in the Roman Empire, contributing 250 finds to the 500 in total currently recorded (Catalogue of Curse Tablet, CSAD, http://curses.csad.ox.ac.uk/ accessed November 2019), with large assemblages at Bath (130 artefacts) and Uley (eighty-seven artefacts). The lead sheets on which the curses were written were often roughly shaped and could be folded, rolled, or left intact (Ibid.). Examples have been unrolled prior to stricter conservation strategies (Figure 26), but many such finds are often left untouched and with few affordable recourses to infer its true function. On approaching these finds and the net-weights under investigation for this thesis, several aspects have become apparent that may aid in the identification of these objects, for the benefit of both ritual and fishery studies. While there are few publications on the subject of curses (e.g Bowman et al. 2000), there are several online resources up to date with the identification and translation of confirmed *defixiones* (CSAD database). Confirmed curses, those that have been unrolled or unfolded to reveal the scripted curse, are consistent in several aspects:

1. Though often described as lead, many of the examples from Britain have a high tin content and are therefore classified as pewter (Bowman et al. 2000).

2. There are multiple rolls or folds, leading to several layers, rather than the clasped or only partially overlapped sheets that constitute most of the fishing weight examples.
3. On most curses rolling is executed following the longest axis, which shortens the resulting object and allows for the multiple rolls therein. This is in stark contrast to the more convincing weights, which are almost entirely rolled along the shortest axis to ensure a minimum effort, a maximum length and better control over the desired volume of weight.
4. Unrolled curses are often between 60 to 120 mm in length and 40 to 80 mm in width (Ibid.), which gives them a rolled cylindrical length of 40-80mm.
5. Finally, curses are seemingly composed of thin sheets, less than 2 mm thick, though, due to the absence of detailed publications on these aspects of the recovered *defixiones*, is an observation based on a small portion of recorded artefacts (CSAD; examples from Uley, Malborough Down and Hamble).

Figure 26: East Farleigh Roman Villa lead scroll (Left); The same object following unrolling (Centre). Illustration of writing on the East Farleigh defixio (Right). All photos by Maidstone Area Archaeological Group (Photographic archive http://ma.btck.co.uk/ accessed Nov 2019)

With the exclusion of curses, the remaining weights fall largely under the clasped type. These are the most numerous examples and reveal further distinguishable elements, such as size, weight, diameter of the perforation, and sheet thickness. The clasped weights are considered the most likely candidates for fishing nets from the available material. Their component elements are therefore thoroughly assessed in Chapter 6 to determine further patterns that coincide with the alternative evidence for fishing from Roman Britain.

3.2.3 Netting-Needles

Needles are easily identifiable by their characteristic shape, composed of a rod and two semi enclosed eyes (one at either end), each with a partial opening created by the two mirroring concave prongs. This characteristic bifurcated style has facilitated their inclusion in archaeological reports as objects of intrigue, albethey with restricted interpretations. Britain has produced twenty-seven examples of bronze and iron needles for the Roman period, twenty-one (77 %) of which have been included in archaeological publications, a stark contrast to the poorly published fishing hooks and net weights. The absence of any previous typologies or comprehensive studies of these tools (Bernal 2010, 137), restricts our understanding as to how these figures relate to a discernible intensity of net production, let alone the criteria for assessing these objects. Not all the needles are well preserved and iron examples are prone to corrosion, several of which have been truncated as a result. The delicate prongs which house the cordage are easily broken and absent from several artefacts; nevertheless, half of a netting needle is sufficient with which to identify the characteristic shape of a bifurcated rod, allowing the inclusion of four of the twenty-seven examples.

Previous studies discussed in Chapter 2, highlight the sparse data that has been extracted from the assessment of netting needles (Garcia-Alonso 1981; Trakadas 2009; Bernal 2010). The artefact length and prong diameters are considered significant in identifying the mesh diameter, which is a datum included in the assessment of the British examples. In addition to this, classification criteria are included with various objectives: to ensure a more systematic appraisal of the objects in relation to fishing; to highlight discrepancies from later medieval examples associated with hair-net production; and to advocate recording techniques that will ensure a more detailed collection of data for further research.

3.2.3.1 Classification Criteria

The 100 mm variations of the shortest and longest netting needles (Alfaro 2010, 63; Bernal 2010, 11; Dutting 2016, 394; Cottica and Divari 2010, 356) suggests the complete size of the needle appears to be an important factor in its intended use. Whether this measurement reflects the type of cord, intended mesh diameter, or intended net type has not yet been determined. Ethnographic examples are a poor indication of this function, due to the greater use of the toung-type (see Figure 12) and the correlation of needle length with cord capacity (Winch1987), that is, larger needles allow for thicker cords. This is further emphasised by Jenkins (1974, 71), who implies that needle size directly correlates to the size and type of net; however, as is shown in the Romano-British evidence, needle length does not equate to eye diameter, with several examples of long needles having narrower eyes than shorter examples (e.g Allason-Jones and Miket 1984, 174). The size of the Roman netting needles is conditioned by two aspects: the rod and the bifurcated ends. These must be assessed independently to determine if and how they were purposely constructed. Only then can hypotheses of how size relates to net-type be proposed. The chosen method of artefact assessment records six distinguishable elements (Figure 27):

1. The total length
2. The rod length
3. The profile shape and diameter
4. The internal eye diameter
5. The maximum width of the prongs
6. The material

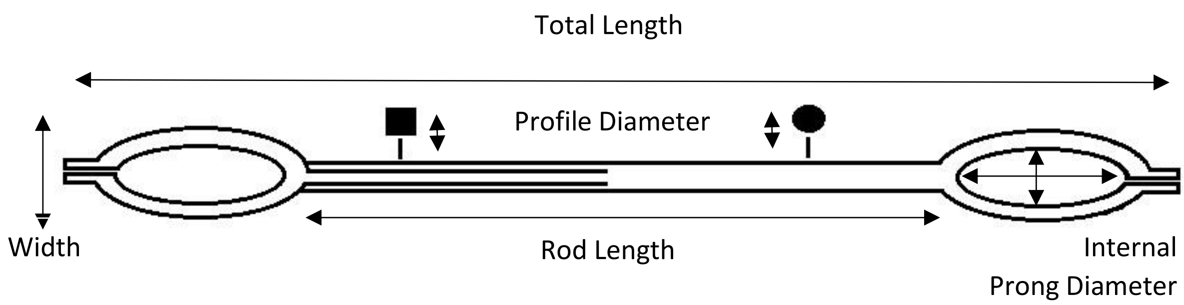


Figure 27: Recording method of Romano-British netting needles (Illustration by L. Graña).

The **total length** is the standard measurement in archaeological assessments and provides the full length of the tool.

The **rod length** measures the shaft running from the base of the prongs at one end to the base of the other prongs at the opposite side. It reflects the length of cord that can be attached to a needle at one time and provides a control over the intended total length of the object.

The **profile shape and diameter** relate to the rod and not the altered bifurcated ends. The shapes can be square or circular. The diameter also impacts the overall weight of the object.

The **internal eye diameter** is a record of the eyes which house the cord and therefore the volume of cord that can be attached at any one time. It does not include the full dimension of the prongs, which can often branch outwards to facilitate the use of the tool (Figure 27).

The **maximum width of the prongs**, or maximum width of the artefact, as suggested relates to the minimum width of the mesh diameter produced. It is important to ensure both ends are recorded to highlight damaged or altered examples, and to determine if the eyes were produced symmetrically.

As stated, truncated examples are numerous but may not need to be excluded from assessments of tool size. Where one end has been truncated at the base of the prongs, but the opposite end survives, an 'estimated total length' is provided to determine the theoretical total length of the object. This proposal is based on the principle that the eyes were intended to be symmetrical. To determine if this hypothesis is plausible, a comparison of eye diameters from complete examples of netting needles is produced (both the internal and external diameters). Due to the numerous truncated examples, an estimated total length can prove beneficial in providing a larger collection of artefacts for comparative assessment.

An additional proposal is the comparison of the identified prong diameters with recovered mesh examples from other Roman provinces and ethnographic examples from Britain. Although alluded to (Bernal 2010, 85; Alfaro 2010, 63-64) this has not yet been attempted for the Roman period. Ethnographic evidence is therefore used to support the interpretative hypotheses on the dimensional parameters of the nets produced with the netting needles. The following discussion also highlights evidence for the relationship between fishing-net and alternative-net-production (for hunting, fowling, etc.). It is argued that the needles are not completely incomprehensible; nevertheless, the subsequent results are indeed preliminary and limited, but a necessary addition for a comprehensive assessment of fishing in Roman Britain to be feasible.

3.2.4 Miscellaneous Artefacts

The focus on the three previous tool-types is largely a result of the comparative scarcity of evidence for alternative fishing methods. Though only represented by a few examples the miscellaneous artefacts and installations merit a general overview to determine the potential scale of alternative fisheries, and their distribution in relation to the previous fishing tools. The miscellaneous evidence includes an iron gaff, which is a large hook used by hand to catch or help haul-in caught fish, recovered at Santhill, Gloucestershire (Timby 1998); an iron trident, similarly used for spearing and hauling fish, recovered at Sheepen in Colchester, Essex (Courtesy of Colchester Museum); three gorges, rhombic shaped pieces of bone used as lures to catch fish by tethering them with a line and waiting for them to lodge in the fish's throat, found at Cressing Temple, Essex (Courtesy of M. Atkinson, ASE), and two at Wroxeter (Cool et al. 2014); potential fish weirs, trapping installations used to funnel fish into traps and recovered in the Thames river at Putney, Surrey (Greenwood 2008, 116-118) and Shardlow, Derbyshire (Matyn 2005, 6); and finally, holding-tanks or fish ponds used for holding live fish and, potentially, farming them, as is suggested for the sites of Southwark, London (Cowan and Wardle 2009, 105) and Shakenoak (Brodribb et al. 2005). The notable site of Bancroft fishpond has been excluded due to its thorough investigation and absence of evidence for fish farming therein (Williams and Zeepvat 1994).

The evidence for miscellaneous artefacts and installations adds to the hypothetical inferences of the scale and diversity of fishing methods of Roman Britain. Their distribution is also important when assessing concentrations of halieutic evidence in discrepant regions, in correlation with the tool and fish bone remains. The potential fishing weirs and farms lack ichthyofaunal evidence due to the absence of sampling during excavation; nevertheless, the structural elements are important to highlight for posterity, as they represent potential fisheries of commercial significance and which require closer examination.

3.3 The Fish Bone Remains

Three quarters of the ichthyofaunal data, from a total of 109 sites, has previously been published (Locker 2007), providing a baseline and working methodology to follow. An additional thirty-one sites have been discovered since 2007 and are included in this assessment. The assemblages consist of all fish bone assessments from England recorded in published papers and unpublished reports. There is only one site from Scotland, recorded by Locker (2007); and no assemblages are yet available for Wales, though fishing tools have been recovered there. Unlike the tool remains, there are no additional assemblages that could be assessed by the author for this thesis due to accessibility restrictions; there are almost certainly additional assemblages in storage across the country with no level of assessment. Where possible the original fish bone reports used by Locker (2007) have been acquired to determine assemblage chronologies, sampling strategies, and undiagnostic material, all of which are excluded from her work due to publishing constraints (Ibid. 144).

All 140 sites provide a disparate quantity and quality of data, which prevents an optimal assessment of the evidence by incorporating the numerous methods proposed by Wheeler and Jones (1989). As discussed in Chapter 2, published assessments that have included size estimations, element type, and taphonomy, are the exception (e.g. Nicholson 2012b; Harland 2017); these examples are examined in a case-by-case basis where additional tool remains are present. Instead, as advocated by Locker (2007), the study is restricted to species identification, quantified by the use of both NISP and Number of Occurrences. The data is presented in various tables based on a species or familial basis and mapped to identify distribution patterns. The evidence is assessed and interpreted in Chapter 9, while all available data is provided in two tables in Appendix C, Part 4.

3.3.1 Phasing

The division of fish bone remains by chronology has resulted in the addition of sixty assemblages up to 2007, producing a total of 169 distinguishable assemblages for the 109 sites identified by Locker. The same has been possible for nine of the thirty-one sites recorded after 2007, producing an additional fifty-one assemblages. This provides us with a total of 221 distinct fish bone assemblages from 140 sites. Such a chronological phasing is important to determine species distribution patterns, cultural context, and relationships with the dated tool evidence. Dates vary in accuracy and several sites have a broad date range that impede the proposal of more convincing hypotheses. Meanwhile, the division of assemblages that consist of a small number of fish bone remains, produces even smaller assemblages of as few as 1 NISP (e.g. Healam Bridge, Ambrey et al. 2017). It is considered important to highlight these as they may reflect natural depositional processes or smaller fishing events than previously suggested by the collective figures for a single site. One figure that influences this interpretation is the number of undiagnostic NISP, which, although often excluded, can encompass c. 95 % of an assemblage (Morales 2014, 3650). One example in Britain is the site of Culvert Street, Colchester, where 72 diagnostic NISP are accompanied by 466 undiagnostic elements. All available figures are included in Appendix C, Part 4.

The numbering system referenced throughout the thesis follows the arrangement of sites by Locker (2007), Sites 1-140, and influenced by the chronological division of assemblages, to which the subdivisions are added in an alphabetic format (e.g. Site 2a, 2b, 2c, etc.). These are listed in Appendix C, Part 4, where the NISP is provided per assemblage. With Number of Occurrences, the assemblages are treated as individual contexts, equating to one occurrence of a species per chronological phase; this is only applicable when determining the continued exploitation of a particular species throughout the Roman occupation.

3.3.2 Nomenclature

Modern Linnaean taxonomy continues to suffer from some contention over the scientific names used to describe certain species. Meanwhile, several common names overlap in the definition of different species (e.g. *bass*) or to describe entire families (e.g. *carps*, or *cods*). It is therefore important to elaborate on the chosen nomenclature. Though the terminology used for this thesis follows that outlined by Wheeler (1978) and maintained by Locker (2007), all names are verified on the online resource, Fish Base (fishbase.org version 06/2017), an updated database of global fishes and their scientific research. A list of the species identified in Romano British assemblages is provided in Appendix B, Part 1. In addition, the habits and habitats of individual species are an influential aspect in fishery interpretations, but, as discussed in the literary review, one that is often restricted to a very brief summary within the text. To ensure the readers have access to a comprehensive description of the relevant species, a catalogue of the 75 species, their most relevant attributes, and the sites at which they have been recovered, is also provided in Appendix B, Part 2.

3.3.3 Sampling Strategies

The provenance of the assemblages is questionable at best, with many reports excluding information about the context of the recovered remains. Where and how fish bone remains have been acquired should influence our interpretation of the assemblage. As stated above, several assemblages have low NISP figures, which may be the result of natural deposition, singular fishing events, or, it must be emphasised, a poor level of archaeological recovery. Identifying the excavation and recovery methods for each assemblage is therefore considered important. Fish bone assemblages are often recovered via wet-sieved samples, sub-sample residues, or hand-collected. These criteria are included in Appendix C, Part 4. A more in-depth assessment of sampling strategies, the various features from which samples are taken, and their impact on the data, is provided in Chapter 9.

3.3.4 Targeted Species

The applications of species identification and quantification are limited in comparison to extensive ichthyofaunal assessments, nevertheless, various approaches can prove fruitful in identifying patterns of aquatic exploitation. In Chapter 9, the data is presented in various formats and with various objectives:

1. To identify dominant species, both at a regional and country-wide scale. This encompasses NISP and Number of Occurrences to distinguish between largest volume and most frequently recovered.
2. To determine the predominant aquatic environments at which assemblages are recovered. The allochthonous nature of traded fish products means the environment of recovery should not be considered the location of the fishery; however, the species habitat (marine, brackish, or freshwater), is included to determine patterns of transportation and deposition of goods.
3. To identify species dominance in relation to cultural context. Distinguishing military, urban, and rural settlements.
4. To identify chronological shifts of species dominance, and regional variations in fishing intensity.

In order to categorise and contextualise both the ichthyofaunal and artefactual data, it has been necessary to identify criteria for dividing Britain into environmental, cultural, and geographic classifications. The methods and criteria for doing so are discussed here.

3.4 Aquatic Environment

The aquatic ecosystems of Britain consist primarily of rivers, estuaries, and the coast. There is an absence of evidence for fishing in open water and the few inland lakes restricted to the Welsh and Scottish Highlands. Wetland exploitation is also unclear, primarily as a result of post-Roman land-reclamation, to the extent that many brackish water environments have disappeared and can only be traced with adequate geoarchaeological interventions (e.g. Cowan et al. 2009; Chadwick and Catchpole 2012), but also due to an absence of evidence from wetland zones, most notably the Wash (Jones and Mattingly 2002) and the tidal flats of the Severn (Crowther and Dickson 2008). All the material that is assessed has been attributed to either riverine, estuarine, or coastal environments; also referred to as freshwater, brackish-water, and marine, respectively, where the exact nature of the aquatic ecosystem is uncertain. The identification of the aquatic environment is considered a significant datum in a region wide assessment for identifying patterns of tool and species distribution. This is especially significant where water level changes and land-reclamation has transformed the Roman aquatic environment, as has been identified in London (Cowan et al. 2009, 11-15), the Wash (Mattingly 2007, 390-392), the Norfolk Broad (Silcock 1905), the Kent coast (Jones and Mattingly 2002, 10), and the Severn Estuary (Chadwick and Catchpole 2012).

Most of the evidence discussed in the thesis derives from inland sites, primarily military and civilian settlements, which are traditionally located by navigable rivers to ensure contact and trade links, and to supply the settlements with freshwater (Mattingly 2007, 511-512). The absence of lakes throughout much of Britain highlights a reliance on migratory species for acquiring significant numbers of fish; otherwise, freshwater species are generally limited off season, both in number of species and number of individuals. Estuaries are complex ecosystems with fluctuating levels of salinity, temperature, and oxygen, a consequence of the interaction of freshwater and marine environments (Graham and Harrod 2009). These zones of interaction are numerous throughout Britain, with the largest examples found in the Medway, Thames, Blackwater, Humber, Esk, Mersey, Severn, and Solent. Most of the large fish bone assemblages that represent fish processing appear to relate to estuarine environments. It is also important to note that estuaries in Britain are the primary outflow for a majority of rivers. All diadromous species must traverse these estuaries to reach inland spawning grounds, while they also become spawning and feeding grounds for various marine species, especially clupeids, flatfish, seabass, and various gadids (Miles et al. 2001, 170). Finally, coasts are, for most of Britain, shallow environments in which a limited range of marine species exist (Burnley 2006, 38). As with the interaction of rivers and estuaries, a significant stretch of the British coast funnels into estuarine environments, presenting a rich mediator for migrating shoals of pelagic fish and diadromous species (Miles et al. 2001, 126-127); however, unless large shoals are targeted with nets or traps, coastal fishing, also termed surf fishing, is considered a low-yield activity (Burnley 2006, 1).

How the species identified in the ichthyofaunal record coincide with the different aquatic environments is discussed in Chapters 9 and 10. It is also important to ensure the discrepant habits of fish are identified, for which Appendix B, Part 2, is dedicated to cataloguing the species identified in the archaeological record and the aquatic environments which they frequent within Britain. The distinction of river, estuary, or coast is a datum that is also assigned to the tool remains and therefore included in the catalogues and tables provided throughout Appendices A, B and C.

3.5 Cultural Context

As previously discussed, issues of equifinality and allochthonisation highlight various potential processes of capture, transportation, and deposition of remains that must be considered during the assessment of both ecofacts and artefacts. The site of recovery should not immediately be considered the location of a fishery, unless structural elements are present; nevertheless, with further evidence, the site location may indicate the intended market or distributor of the captured fish. Determining this connection is reliant on the interdisciplinary study of both the artefacts and ecofacts, as is proposed here, but may be impossible without an adequate amount of data. The thesis therefore includes the cultural context of the remains to determine if such distribution patterns emerge. The divisions are currently broad due to the limited evidence available, divided by the general function of the site, which is considered as one of three options: military, urban, or rural.

Military sites pertain to fortifications only. Urban sites relate to civilian settlements, namely towns and colonies, but may also include fort-side communities known as *vici* and *canabae*. The fortification and re-fortification of several towns took place from the 2nd century up to the late 4th century (Jones and Mattingly 2002, 161), which would provide a military context to various structures surrounding urban settlements; however, some sites may not provide sufficient archaeological evidence with which to differentiate between urban and military contexts (e.g. Wroxeter: Bushe-Fox 1916; Colchester: Locker 1992; Catterick Bridge: Stalibrass 2002) for which they are labelled as ‘urban/military’ and cautiously used in the interpretation. Of equal uncertainty are sites where Roman fortifications later became colonies and civilian settlements (e.g. Gloucester, Wroxeter, Colchester, Dorchester, etc.; see Jones and Mattingly

2002, 158-161). To determine the context of these sites, accurate dating is essential, but also often absent; these examples are also considered 'urban/military' for the time being. Finally, rural contexts largely relate to artefacts recovered from villa sites, but also include artefacts with no structural affiliation, as has been the case for several collections of fishing tool remains (e.g. the sites of Dickson's Corner and Lydd Quarry in Kent; see Priestley-Bell 2013). The cultural context is another datum that is included in the catalogues of fishing tools and fish bone assemblages, in Appendices A and C.

3.6 Chronology

In an ideal setting, dating would facilitate the assessment of data by ensuring an accurate identification of cultural context where multiple phases of occupation were present, by demonstrating a connection between tools and fish bone remains found in close proximity, and by demonstrating transitions of fishing practices and dietary trends; however, dating halieutic remains is relatively complex. The sparsity of fishing tool typologies is reflected in the absence of confirmed morphological transitions throughout the Roman occupation for both hooks and net weights, as has been highlighted to be the case elsewhere (Bernal et al. 2010, 338). In addition, as previously discussed, various artefacts are the result of chance finds by detectorists at archaeological sites with unknown or multiple phases of occupation, leading to general suggestions of dates as 'Roman', or worse still, 'Roman to Medieval' (see Appendix A, Part 2). Fish bone remains are more likely to be dated due to the recording strategies which supplement their excavation and recovery; nevertheless, many of the assemblages precede such systems (Locker 2007, 144). Examples exist where dating has been impossible due to the nature of the site and the restrictions of excavation (as is the case with the significant assemblage from St Mary Bishopshill Junior, York: see Jones 1988).

Many of the artefacts and ecofacts in the thesis lack an accurate chronology. A 'Roman' date (AD43 to 410) is proposed for several published finds and assemblages (e.g. Nicholson 1993; Crummy 1995; Howard-Davis and Witworth 2000; Locker 2002; Atkinson and Preston 2015), while the majority have estimated date ranges between 10 and 200 years, the broader of which are often described as early, mid, and late Roman (e.g. Miles 1984; Sutton 1998; Locker 2015). A 'Roman' date has been considered sufficient with which to include the data in this assessment, although restricted to a broader observation of artefact and ecofact distribution. Where dates are available, they are first used to distinguish individual assemblages of fish bone remains from the same sites, and second, to determine the relationship of tool and faunal remains (see Chapter 10). All available dates are provided in Appendix A, Parts 1 to 3, and Appendix C, Parts 1 to 4.

3.7 Geographical Categorisation and Subdivision

A country-wide interpretation of the halieutic evidence is provided in Chapter 10 in order to approach the research questions and outline preliminary observations of fishing in Roman Britain. At the same time, it is considered necessary to provide a regional approach to the data in order to determine variations of artefact and ecofact distributions, as well as local patterns of species distribution. This approach requires the division of the territory into regions that relate to the practice of fishing, rather than the socio-political criteria (both ancient and modern) that have long dominated the partition of British territories in past assessments (e.g. Salway 1981, 624; Locker 2007). Some environmental factors have been highlighted as influential, most notably the divide between lowland and highland zones (Salway 1981, 553; Jones and Mattingly 2002, 3; Figure 28), which notably coincide with the distribution of civilian and military settlements after the initial conquest of Britain (Mattingly 2007, 132-134; see Figure 29). Aquatic environments have only briefly been considered in the work of Jones and Mattingly (2002, 3), as pertaining to a latitudinal division of the country, whereby two major watersheds exist with eastward and westward waterflow.

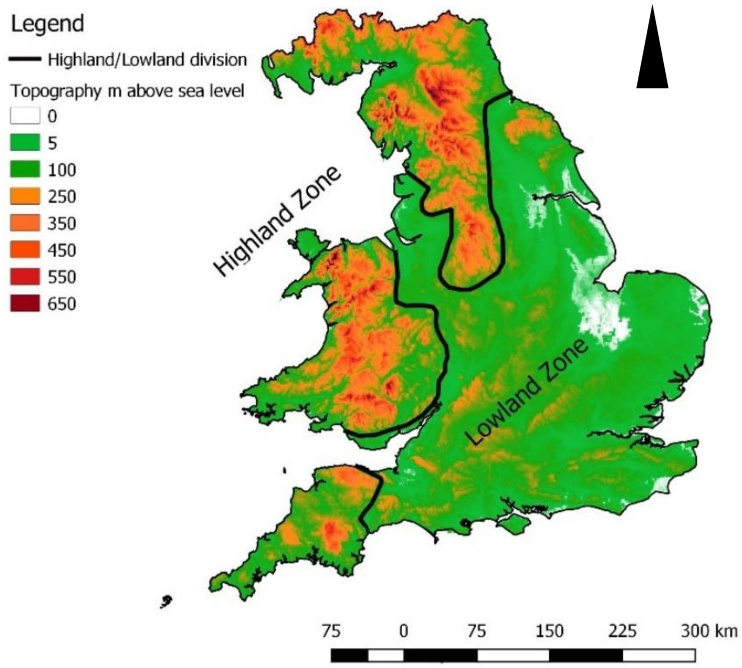


Figure 28: Highland and lowland zones defined in Jones and Mattingly 2002, 3 (Illustration by L. Graña).

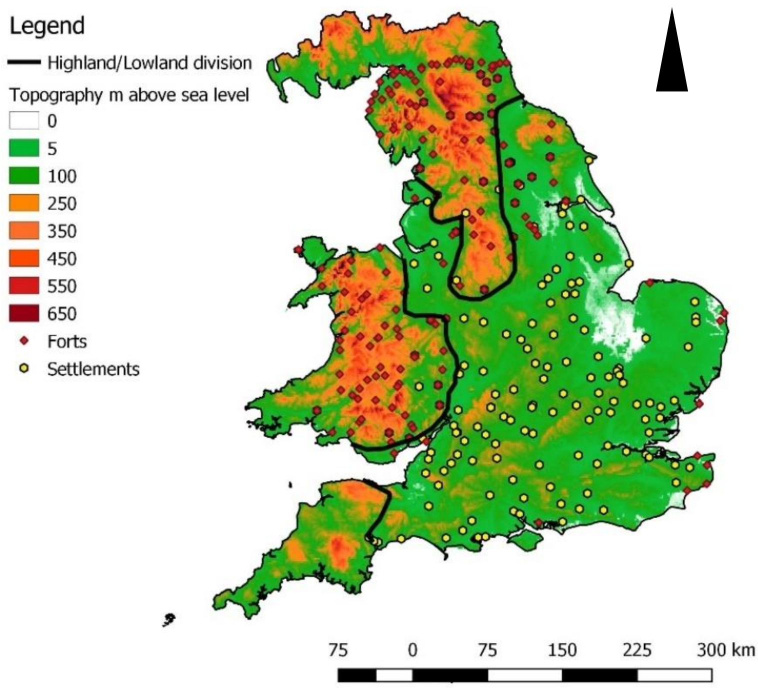


Figure 29: Highland/Lowalnd division including distribution of late 1st to early 4th century fortification and civilian settlement distribution (Illustration by L. Graña).

A more recent study of the rural economy has divided England and Wales into eight case study areas based on a wider range of archaeological sites (Figure 30), including rural villas and farmsteads, but more importantly, influenced by 'Natural Areas' as defined by *Natural England* (Fulford and Brindle 2016, 15). According to Fulford and Brindle (2016), these areas should be viewed as convenient units for the purposes of inter-regional comparisons of settlement distribution and economic practices (not including fishing). The success of this method is confirmed by further archaeobotanical studies of the region, concerning the distribution of floral species and evidence of intense farming (Lodwick 2017, 34). There remain notable influences by topography, although the regions have overlapping environments and remain heterogeneous in terms of natural resources (Fulford and Brindle 2016, 15). Rivers are a noted criterion in the inclusion of the national nature census (Natural England 2014, as referenced by Fulford and Brindle 2016, 15-16) but they are not influential of the chosen boundaries, nor are the discrepant coastal zones.

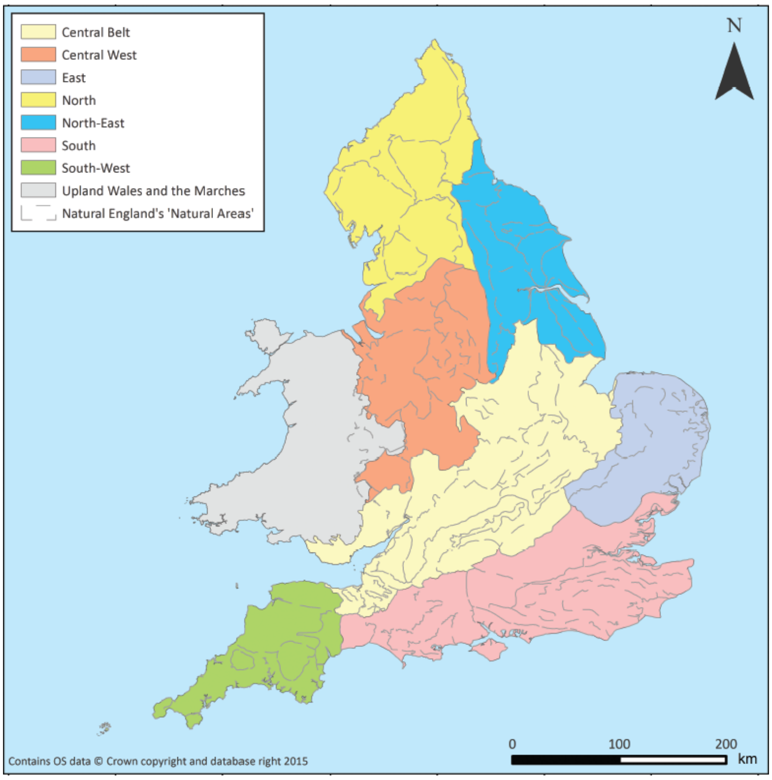


Figure 30: Definition of the eight case study areas identified by Fulford and Brindle (2016, 16).

Several criteria used by Fulford and Brindle (2016) are considered signficant for the division of the halieutic data used in this thesis: major estuarine environments are not used as boundaries but are central to the discrepant regions; topography remains a key component in the definition of borders; and there is no north/south devide atributed to the modern political boundaries of the midlands; neverthless, greater emphasis is needed on the aquatic environments within, in order to ensure that potentially linked fisheries and aquatic resources are not divided. A closer examination of topographical data, produced by the Ordnance Survey (ttps://www.ordnancesurvey.co.uk) has facilitated the mapping of major watersheds (Figure 31), adding to the east/west divisions proposed by Jones and Mattingly (2002, 3). Rivers are distinguishable into groups, based on the direction of waterflow and funeled outflow into the same estuarine systems. This is considered a crucial criterion for the division of Britain into regions, as the three aquatic environments (marine, brackish and freshwater) are connected, providing navigable links for both diadromous species and fishermen, as well as navigable trade routes for fish products.

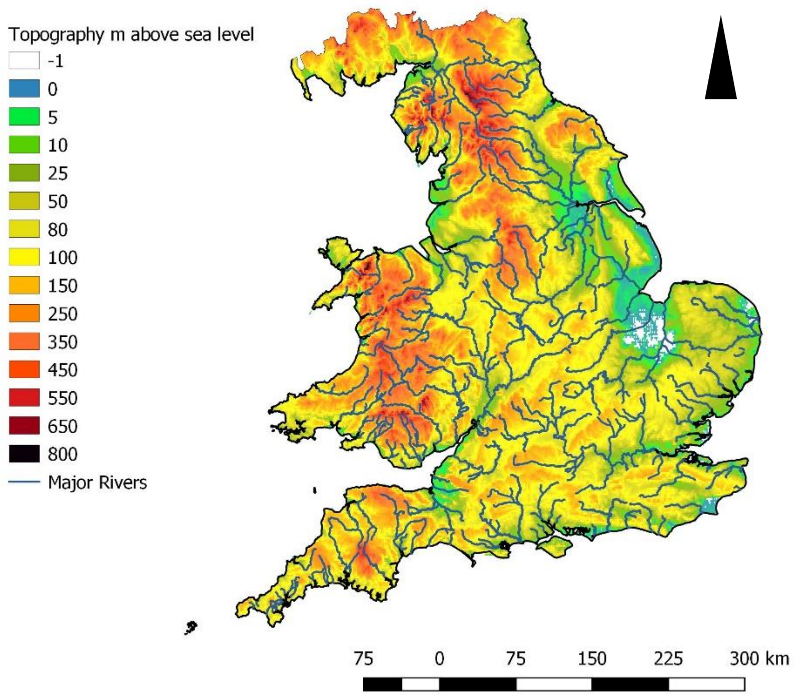


Figure 31: Major rivers and tributaries in relation to the topography of Britain (Illustration by L. Graña)

Britain has therefore been divided into six regions for the purposes of this thesis (Figure 32): North, North-East, North-West, South-East, South-West and South. The regional borders have been chosen following three criteria: high altitude, watercourse direction and outflow, and isolated coastal stretches. A similar structure was used by the National River Authorities in the 1970s and prior to the formation of the Environment Agency (Jenkins 1974, 21), though greatly influenced by political boundaries. Further divisions are theoretically viable at this stage, including the isolated Cornish peninsula (categorised as the South-West region in Fulford and Brindle 2016, 16) and Wales; however, this has been avoided in the thesis due to the absence of data from these areas. It is probable that a greater collection of data and adequate interpretations will facilitate further subdivisions of notable fishery regions to replace these preliminary observations.

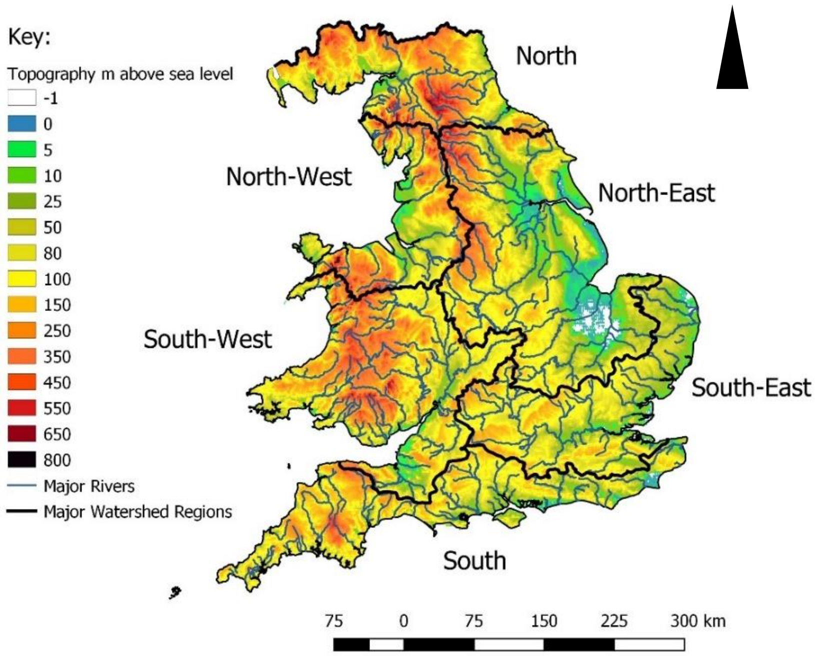


Figure 32: Division of Britain into six major watersheds (Illustration by L. Graña).

3.7.1 Geographic Data Management

The maps used in this thesis have been produced by the author using the open sourced geographic information system *QGIS version 3.0.1-Girona* (www.qgis.org). The archaeological evidence has been introduced as geographic data for this study based on coordinates provided in published reports or, where absent, estimated coordinates (such differentiations are made in Appendix C). The topographic data has been acquired from the *Consortium for Spatial Information CGIAR CSI* (www.cgiarcsi.community), using the *SRTM 90 m Digital Elevation Database v4.1*, produced by NASA for supporting geospatial research. The display formats have been altered for this thesis to suit the British landscape and accompanying archaeological evidence.

Limnological data could not be applied directly to the QGIS software but has been input manually based on research by the Joint Nature Conservation Committee, a government advisory body collecting environmental and faunal data from British ecosystems (www.jncc.defra.gov.uk). As a result, the illustrated rivers are restricted to major water systems and tributaries and minor rivers that are associated with evidence of Roman occupation. This data has also been input manually, acquired from the Ordnance Survery, OS, open data products (https://osdatahub.os.uk/), which includes a map of Roman Britain, coordinated by English Heritage (copyright 2001, www.ordnancesurvey.co.uk).

3.7.2 Proposed Zones

The proposed six regional zones for Roman Britain are described and illustrated below (Figures 33-38). Topographical data are included to accentuate the distribution of freshwater systems and the extent of estuarine zones of interchange. The blue zones represent shallow environments under 1 m above sea level. The uncertain extent of land-reclamation or erosion, alongside noted changes of water level, highlight these areas as potential flood zones or formerly submerged coastlines during the Roman period (Waddelove and Waddelove 1990; Jones and Mattingly 2002, 8). As previously stated, further geoarchaeological studies are necessary to determine the extent of coastal transformation; nevertheless, for the time being, the interchange of freshwater and marine environments are unconfirmed for several areas, emphasising the need to include the interconnected aquatic environments under the identified regional divisions.

The North region (Figure 33) is the only region to branch between east and west coastal zones, encompassing the marine and brackish environments of the Solway Firth and the Tyne. This is the narrowest east to west point in England and represented by river zones at the northern limit of the Pennines and southern limit of the Southern Uplands. One additional East/West sub-division is possible due to the obvious discrepancies between the North Sea and Irish Sea and the watershed division highlighted by Jones and Mattingly (2002). The choice to combine them for this study is influenced by Hadrian's Wall and the military dominance of this terrain, which reflects a close relationship between the eastern and western military settlements from which the halieutic evidence has been collected. There is a general scarcity of both fishing tools and fish bone remains with which to infer a greater divide; meanwhile, there are no large urban settlements with which to suggest the potential for large-scale fishing events. The site of Edinburgh, where fish bone remains have been recovered (Locker 2007), is excluded from the region due to its clear geographical isolation, though it is included in the assessment.

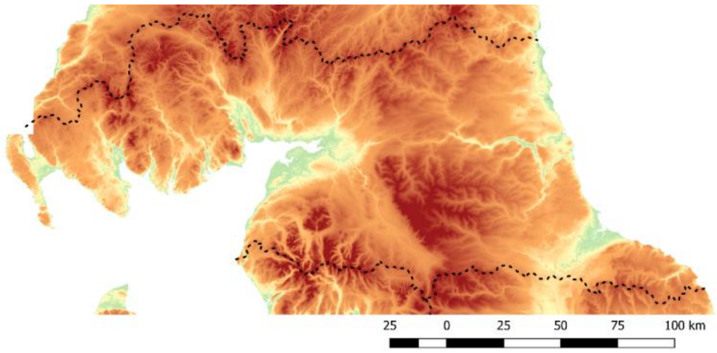


Figure 33: The North region. The narrowest point is formed by the river valleys of the Solway (west) and Tyne (east), which is followed by Hadrian's Wall (Illustration by L. Graña).

The North-West region (Figure 34) is demarcated by the northern reaches of the Cambrian Mountains in Cheshire and Wales, the Pennines to the east, and the Cumbrian Mountains to the north. The low-lying territory is composed of several rivers that flow into estuaries and, subsequently, the Irish Sea, primarily the rivers Duddon, Kent, Ribble, Mersey, and Dee. Several relatively small estuarine systems follow the coast, the largest of which are Morecambe Bay and the Ribble Estuary. Their proximity to each other and contact, via the inland rivers, differentiates them from the more isolated Solway in the North and from the west coast of Wales.

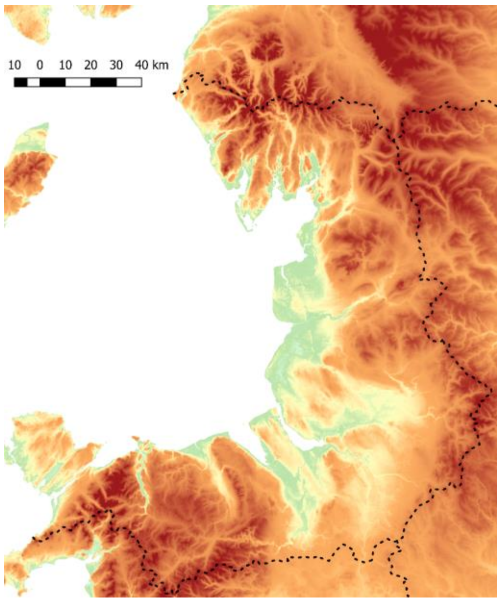


Figure 34:The North-West region (Illustration by L. Graña).

The North-East region (Figure 35) is the largest and extends further south than the North-West region, distinguishable by the low-lying flood zones surrounding the Humber Estuary and the Wash, and the various river systems that connect the entire territory. Several rivers follow the topography of the Eastern Pennines and reach the North Sea coast. Much of the territory surrounding the Wash, known as the Fenland, was marshland prone to tidal floods and thereby sparsely occupied by the Romans among tidal islands (Jones and Mattingly 2002, 11-12); it continues to be susceptible to floods, prevented only by intensive drainage systems and modern sea banks (Waddelove and Waddelove 1990, 256). The York Moors stand out as an elevated territory to the north, as do the more inland regions of Nottinghamshire, Leicestershire, Northamptonshire, and Cambridgeshire. A further subdivision of inland/coastal zones may be possible, but migrating diadromous species, such as salmon and eels, would have traversed the wide area. Further geoarchaeological interventions are required to determine the extent of the tidal reach of the Humber Estuary and the subsequent shoaling clupeids which frequent this environment. As is discussed in Chapter 9, this region alludes to potential large-scale fishing events for the production of processed fish products that have been recorded further inland than expected for the Roman period in relation to the modern coastline and tidal waters.

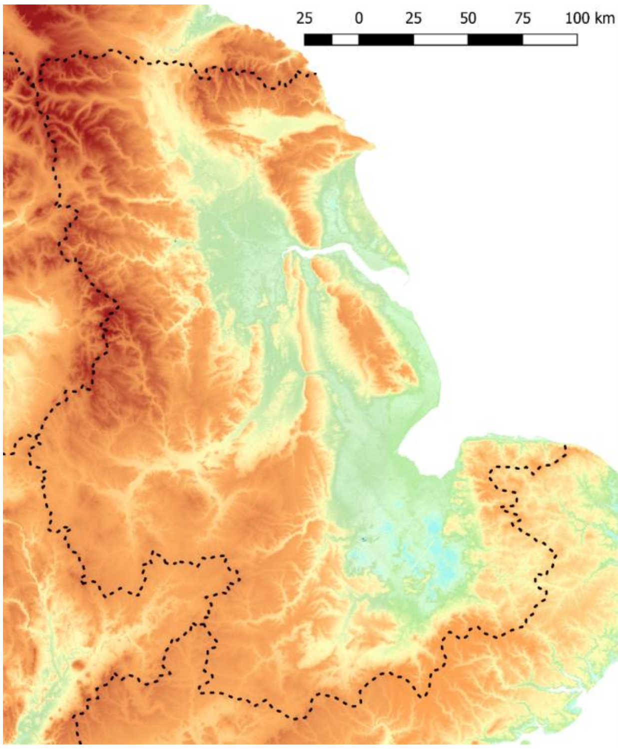


Figure 35: The Northeast. All of the inland river systems flow into the Humber or the Wash (Illustration by L. Graña).

The South-East region (Figure 36) encompasses Greater London, the Thames Estuary and the similar tidal habitats of the rivers Crouch, Blackwater, Colne, Stour, and Orwell, found along the Essex, Suffolk and Norfolk coast. Though the chalk and sandstone hills of Essex and Sussex do not present an elevated topography comparable to the mountains and hills of northern and western Britain, there is still a clear division between waterflow; the resulting aquatic environments are different. On the one hand, the Wash to the north of this barrier is a low-lying marshland, with various flood zones and fens (more so in the Roman period than today: Mattingly 2007); on the other, the Southeast coast has a series of shallows and estuaries, from Great Yarmouth, to the Medway. These coastal habitats are quite distinct and intricately linked by their biota, namely the influx of large shoals of clupeids. A further addition is the Thames Valley, which is fed by several river systems in the low-lying flood zones of Oxfordshire, Berkshire, and Cambridgeshire. A further subdivision at a later date may be able to separate this inland zone, which is comparatively isolated if compared to other freshwater zones, but which is greatly impacted by the Thames river and subsequent estuary.

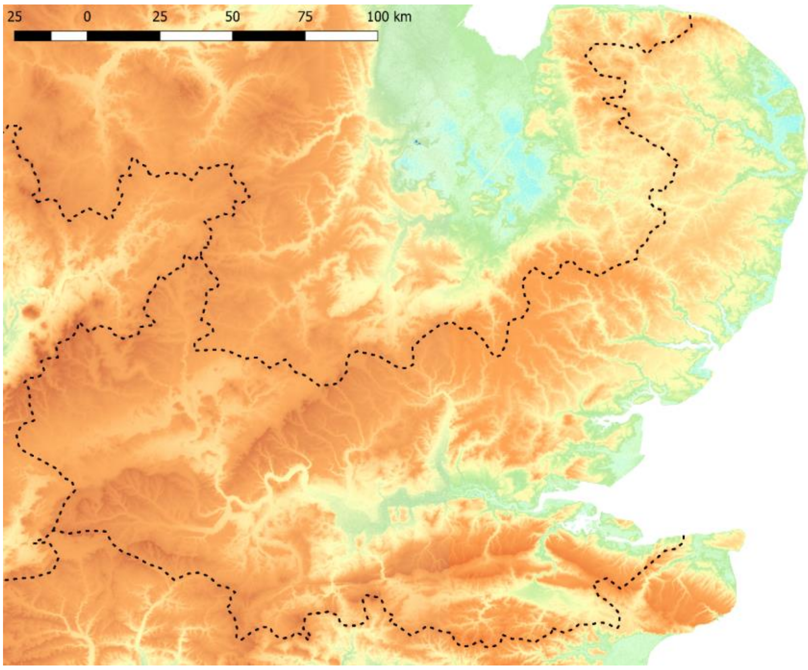


Figure 36: The South-East Region. This includes London, though the city may be studied separately due to the density of archaeological evidence (Illustration by L. Graña).

The South-West region (Figure 37) is predominantly composed of the Severn Estuary and the Severn Valley of Gloucestershire. It includes the dozens of rivers and hundreds of tributaries originating from the Cotswolds and the Cambrian Mountains. The Mendip Hills, along the southern bank of the Severn are isolated from the South by a series of north-flowing rivers and low-lying valleys. The rivers Parrett, Avon, Severn, Wye, Usk, and Taff are the primary outflows and with direct ties to Roman settlements. Meanwhile, Wales produces a complex environment that is primarily included due to the extent of linked river systems reaching the estuaries of the southern coast. A further subdivision is possible for the west coast of Wales and the west-flowing rivers of the Cambrians, but there is no archaeological evidence for this region to warrant a partition currently. The data bias has been attributed to a regional concentration on prehistoric sites (Brown 2013, 250), although studies along the Welsh Severn have suggested a lower yield of Roman remains (Ibid.).

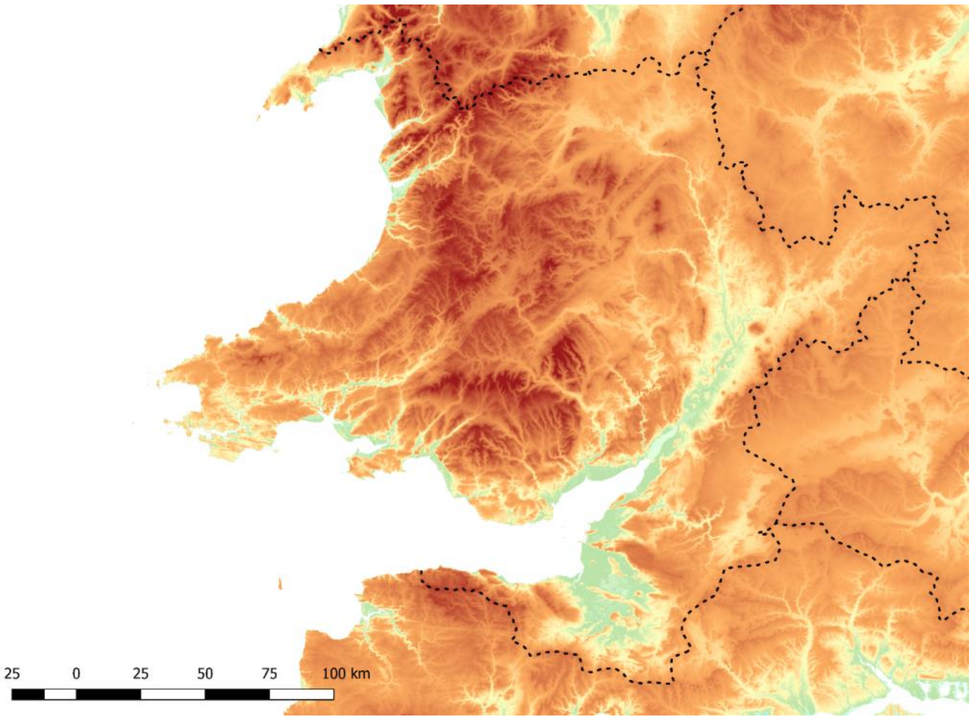


Figure 37: The South-West region. Including central and western Wales (Illustration by L. Graña).

The South region (Figure 38) is broad but encapsulates the continuous rocky coastline that stretches from Cornwall to Kent, including the Isle of White and the Isles of Scilly. This area is also consistent in the coastal conditions affected by the English Channel and influenced by the northern migration of more temperate species. Some river systems produce brackish wetlands and estuarine outflows of significance, such as the rivers Tamar, Plym, Exe, Itchen, and Hamble. There are also semi-enclosed water systems that are ideal marine habitats for migrating fishes, such as the mouth of the rivers Tamar and Exe, Poole Bay, Southampton Water, Portsmouth Harbour, Langstone Channel, and the Emsworth Channel. Cornwall and Devon are noticeably distinct in the predominance of elevated terrain and westerly extent of the peninsula, which is an obvious factor influencing Roman occupation; nevertheless, the entirety of the South region shares the predominance of coastal ties and short-river systems. This is reflected in the ichthyofaunal record, as discussed in Chapter 9.

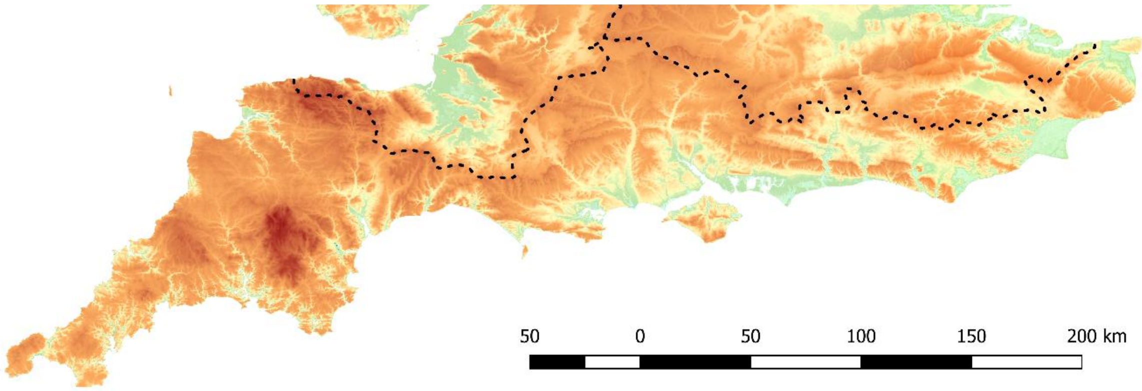


Figure 38: The South region (Illustration by L. Graña).

3.8 Ethnographic Material

The methodology has outlined how and why the historical, artefactual, faunal, and environmental evidence is approached in this thesis, in conjunction with previous halieutic studies (outlined in Chapter 2). One remaining aspect is the resource that has been considered essential for halieutic interpretations to progress (Marzano 2013, 3; Bernal-Casasola 2016, 202): the ethnographic evidence. How fishing in the past worked is largely conditioned by our understanding of the practice, much of which is influenced by more recent methods. An ethnographic assessment promotes a retrospective consideration of traditional fishing methods, outlining physical similarities and promoting the identification of continued technologies and practices. As stated by Hodder (1982, 211), one must ensure that the comparative evidence is consistent in environmental and cultural aspects. To attempt this, the discrepant fishing methods alluded to by the historical and archaeological evidence is judged in relation to traditional fishing practices from Britain, largely restricted to Welsh, Irish, and Scottish fisheries, due to their neglect in England; this is supplemented by Medieval and post-Medieval sources for the entire country, where possible.

The works of Bertram (1891), Hutchinson (1904), Cooper (1934) and Towner et al. (1936) are a few examples of detailed publications, with an individual focus on specific fishing practices that were common in the 19th and early 20th centuries, but with far older roots. Both Cooper (1934) and Bertram (1891) concentrate on the coastal and open sea fisheries of herring and cod on which contemporary markets flourished; while Towner et al. (1936) explain the mechanisms of the freshwater fisheries of salmon and trout that continued to exist in only a few areas of the country following the Freshwater Fisheries Act of 1878. In addition to the legal requirements of both coastal and freshwater fisheries, for which all the authors appear to have substantial knowledge, there are descriptions of predominant species and their seasonal distribution between estuarine and riverine environments (Bertram 1891; Walker 1893; Coward 1910); these include the salmon (*Salmo salar*), trout (*Salmo trutta*), and eel (*Anguilla anguilla*). In Cheshire, these sources predate the rapid industrialisation of the River Dee, which has resulted in a transformation of the biota, namely the disappearance of eels (Harland 2017, 17). The later additions of Jenkins (1974) and, to some extent, Brandt (1984; where British practices are referenced), help expand on the various methods of capture, a result of the more analytical approach conditioned by their own ethnographic investigations. Jenkins' *Nets and Coracles* (1974) is a particularly rich resource, as it provides a first-hand experience of discrepant fishing practices in the estuaries, lowland, and highland rivers of Wales, including the production methods and use of traditional fishing equipment, and the predominant species targeted by those methods (Figure 38).

Figure 39: Wade net fishermen on the River Taf 1970s (Jenkins 1974, 237).

One example is the seine net, the most productive method of capture from shore (Jenkins 1974, 258). Jenkins (1974, 237-240) explains that the standard coastal seine was too large for the brackish shallows of the mouth of the River Taf, where instead a shorter net was used by two individuals wading into the water. The larger seine is more common on deeper stretches of the estuarine and coastal shores and include the use of a boat (Ibid.), similarly used more recently on the River Thurso, in Scotland, until the early 2000s, after which they have ceased (Wigan 2013, 185; Figure 39). Interestingly, the choice to use a shorter seine in shallow stretches of rivers in Wales is for the capture of flatfish rather than the potential migrating salmon (Jenkins 1974, 238). Both techniques bear similarities to the methods depicted on mosaics (see Figure 3) and described by classical authors.

Figure 40: The hauling of a seine or sweep-net at the mouth of the river Thurso, Scotland (1980s), for the capture of salmon (Wigan 2013, 185).

A wide range of fishing methods used throughout the world is provided by the work of Brandt (1984) and Gunda (1984). These sources are a significant contribution and highlight various consistent methods of capture used in disparate corners of the planet, though Britain is by this time a small contributor to the study of traditional methods. The latter work by Gunda (1984) contains two contributions of British case studies (Jenkins 1984; Went 1984). The primary focus is on fishing weirs and the various stone and wooden structures scattered across Britain. Weirs are located in both freshwater and brackish water environments, used into the 20th century (Salisbury 1991). The targeted species, as with the previous nets, appear to have been the salmon and migrating trout (Jenkins, 1984, 239); however, various marine species were also targeted by weirs constructed on coastal environments and using the tide to lure in fish (Went 1969; 1984). At Molona Abbey, Erie (Figure40), the previous wattle structure was replaced by steel mesh in the 1960s (Went 1969), capable of exploiting salmon and flatfish, but also cod, herring, and sprats during spawning seasons (Salisbury 1991, 78).

Figure 41: A modern fishing weir using wire mesh. Located at Molana Abbey, Eire, ireland (Salisbury 1991, 80).

Between the ethnographic sources and the Roman archaeological remains, are a series of partial historical records. The work of Bede the Bard, written in AD 731), describes the predominance of eel fishing throughout the island (Ecc. 1.5), from rivers (Ibid.) and marshlands (Ecc. 19.263). He recalls the work of Bishop Wilfrid, who instructed fishermen to bring their 'eel-nets' to the coast where they were used to catch other 'diverse' fish and feed the starving population (Ecc. 13.247). A few centuries later the Great Charter of 1215 (the *Magna Carta*) dealt with issues that affected both the governing families of the UK and those who were governed, including the many grievances and issues of the working classes. In clause 33, it is stated that:

> *"All fish-weirs shall be removed from the Thames, the Medway and throughout the whole of England, except on the sea coast" (MC. 33).*

No further explanation is provided here, yet there is a proliferation of acts passed to regulate the salmon fisheries of rivers across the island from the 13th century onwards, until the Freshwater Fisheries Act of 1878, likely as a result of the intensity and impact of these fisheries on salmon stocks (Jenkins 1974, 28). This potential link between Saxon to Post-Medieval freshwater fishing practices is partially supported by the consistency of fishing weirs excavated throughout the country (Chadwick and Catchpole 2012); however, no detailed investigation of these features has yet been published and as discussed in Chapter 8, the evidence of fishing traps and weirs for Roman Britain is both sparse and unconfirmed.

Where the historical evidence is useful is in the distinction of salmonid, eel, clupeid, and gadid fisheries as the most productive for the Medieval to Modern periods in Britain. The latter has been shown to derive from the transfer of shore-based to offshore fisheries in the 11th century (Barret et al. 2004), a clear contrast to the evidence for the Roman period; yet the evidence of inland and shore based fisheries exploiting the most prominent migratory species appears consistent with the ichthyofaunal data published by Locker (2007) and alludes to some form of traditionalism among the smaller fishing events supported by the ethnographic studies of 19th-20th century Welsh and Irish fisheries.

These various resources are considered when interpreting the archaeological evidence, however, in the course of studying the various texts it has become apparent that no comprehensive studies of continued (traditionalist) methods exist for Britain, such as those attempted in the Iberian Peninsula (e.g. Garcia-Vargas and Florido 2010). A much large resource of historical texts that allude to the traditional fishing practices recorded in the early 20th century are available throughout the country; following a more comprehensive diachronic study may prove vital for future studies of ancient to modern British fishing practices.

4. Primary Sources

This chapter is a collection of the various texts and pictorial depictions that may relate to the fishing practices evidenced by archaeological remains from Roman Britain. Various Mediterranean texts and mosaics are considered influential to the interpretation of the subsequent artefact and ecofact remains for the Roman period and are therefore highlighted and assessed. The British literary and pictorial evidence, though sparse, is then presented in detail to identify representations of regional fishing practices and targeted species, as well as to compare the aquatic culture of this provincial island to the long established practices of the Roman Empire.

4.1 *Pisces*, The Subject of Fish

The works of Pliny the Elder (Natural History), Oppian (*Halieutica*), Aelian (The Nature of Animals), and Athenaeus (The Deipnosophists), provide rich descriptions of numerous species of fish, several of which have been identified in the ichthyofaunal record of Roman Britain (Locker 2007). These descriptions are representative of a greater depth of knowledge of aquatic fauna by the authors, which, it is argued, may be equally representative of the range and ability of Roman fisheries.

> "Now fishes differ in breed and habit and in their path in the sea, and not all fishes have like range. For some keep by the low shores, feeding on sand…others in the mud and shallows of the sea… where the sweet water ceases from the brine… from the rivers themselves… out of the sea into the estuaries… Others in the deeps under the sea abide in their lairs… in the unmeasured seas far from dry land…"
>
> *(*Oppian, Hal. 1.92-150; Translation by Mair 1928*)*

Not only are aquatic habitats described throughout the various works, but so are the prominent location of certain species that were known to migrate, feed, and shoal. Whether the methods of fishing are related or not, the texts allude to the optimal location of fisheries. The Moselle, a poem by the 4th century poet Ausonius, is a crucial additional resource; although we must be wary of the artistic license, the eponymous work describes the river Moselle in the Belgica province and the various fish species therein. In contrast to the works of Pliny, Athenaeus, and Oppian, Ausonius elucidates on species that are not common or present in the Mediterranean but that are consistent with those identified in comparable British freshwater environments.

4.1.1 The European Eel

The capture of eels (*anguillae*: Pliny *HN* 9.2; *εγχέλες*: Oppian *Hal*. 1.120-121) is attested by the first three authors as occurring largely in freshwater environments, both rivers and lakes. Pliny suggests the optimal season of capture is at the beginning of summer when the rivers are especially rough (*HN* 9.38.74: *ideo circa vergilias maxime capiuntur fluminibus tum praecipue turbidis*), or in the autumn when rivers and lakes are equally rough, which, we are told, is the case for lake Garda in the territory of Verona (Ibid.). This section further highlights an eel fishery via the presence of installations [weirs or traps] set up in the river Mincio, where it meets the lake:

> *"Octobri fere mense, autumnali sidere, ut palam est, hiemato lacu, fluctibus glomeratae volvuntur in tantum mirabilia multitudine ut in excipulis eius fluminis ob hoc ipsum fabricates singulorum milium reperiantur globi."*
>
> *(*Pliny *HN* 9.38.74*)*

> "About the month of October, when the lake is made rough evidently by the autumn star, they [eels] are massed together by the waves and rolled in such a marvellous shoal that masses of fish, a thousand in each, are found in the receptacles constructed in the river for the purpose."
>
> (Trans. Rackham 1967)

Both Aelian and Oppian describe the capture of individual eels using a peculiar method, this involves an inflatable intestine of a lamb; once the eel has swallowed one end, the fisherman must blow into the other end, inflating the organ and thereby preventing the eel from releasing the lure (Aelian *NA* 14.8: *τὸ δὲ ἐκ τοῦ καταρρέοντος πνεύματος πίμπραται καὶ οἰδάνει*; see Oppian *Hal*. 4.450-452 for a similar description). Both texts describe methods that seem purposely strange and entertaining, of exotic locations at the edge of the empire, but one must recognise the description of the locations as evidence of the diadromous nature of eels and the potential capture of adults in both rivers (Aelian *NA* 14.8: ῥεῦμα), and at sea (Oppian *Hal*. 4.450: *θαλάσσης*). The migratory nature of eels is more directly described by Oppian:

> *"ἐγχέλυες δὲ ἐκ ποταμῶν πλαταμῶσιν ἐνιχρίμπτουσι θαλάσσης"*

(Hal. 1.120-121)

"…while the eels come from rivers and draw to the flat reefs of the sea."

(Trans. Mair 1928)

Athenaeus, in his description of the consumption of eels, which "in wholesomeness surpass most [fish]" (*Deip*. 7.52, quoting the author Hicesius: *αἱ ἐγχέλεις εὐχυλότεραι πάντων εἰσὶν καὶ ὅτι εὐστομαχίᾳ διαφέρουσι τῶν πλείστων πλήσμιαι γάρ εἰσι καὶ πολύτροφοι*), not only identifies both freshwater and marine provenance, but emphasises a disparity between the two, stating that the eel caught in lakes is less flavourful but more nutritious than those caught at sea (*Deip*. 8.51: *ἡ δὲ λιμναία ἔγχελυς τῆς θαλασσίας ἐστὶν εὐστομωτέρα καὶ πολυτροφωτέρα*). Athenaeus may further allude to the use of eel farms in the description of "eel keepers" (Deip 7. 52: λέγουσι δὲ οἱ ἐγχελυοτρόφοι καὶ ὡς νυκτὸς), described as "keepers of eel-hatcheries" in an early but unconfirmed translation (Heinemann 1927).

4.1.2 Flatfish

The diversity of flatfish (*planis:* Pliny *HN* 9.97; *πλατέων*: Athenaeus Deip. 7.139) is well represented, often identified alongside the flat cartilaginous rays. Oppian provides the names of a few (*Hal*. 1.97-100), such as the sole (*βούγλωσσα*) and an uncertain pleuronectid (*κίθαρος*); other terms, though references of the body shape, are currently unidentified (e.g. '*πλατύουροι*'). Athenaeus (*Deip*. 7.24) includes the plaice (*ψήττας*) among other names that are also unknown:

"τῶν δὲ πλατέων βούγλωττον, ψῆτταν, ἔσχαρον, ὃν καλοῦσι καὶ κόριν"

*(*Athenaeus *Deip.* 7.139)

"But of flat fish there is the *buglossus*, the sea-sparrow, the *escharus*, which they also call the *coris*."

(Trans. Gulick 1927)

Athenaeus, referencing the author Speusippus, further suggest that the plaice, flounder, sole, and 'ribbon-fish' are alike (7.139: Σπεύσιππος δ᾽ ἐν β᾽Ὁμοίων παραπλήσιά φησιν εἶναι ψῆτταν, βούγλωσσον, ταινίαν); it is unclear which species ribbon-fish refers to, nor whether this is merely a reference to flavour, but it should be stated that the plaice and flounder are related (*Pleuronectidae*) and morphologically alike and, alongside the sole, are all right-eyed fishes. Perhaps this familiarity was recognised by the Romans.

The complexity of assigned terms to such a diverse group of fish prevents us from identifying most flatfish species; nevertheless, we are informed of their habits and locations upon recovery. According to Pliny “flatfish sleep in shallow water, so that they are often taken out by hand” (HN 10.97.212-213: *plani autem piscium in vado, ut manu saepe tollantur*). Oppian further highlights that the shores are their regular habitat as they “feed on sand and things that grow there” (Hal. 1.93-97: *οἱ μὲν γὰρ χθαμαλοῖσι παρ᾽ αἰγιαλοῖσι νέμονται, ψάμμον ἑρεπτόμενοι καὶ ὅσ᾽ ἐν ψαμάθοισι φύονται*). There are no references to the anadromous nature of the flounder, which can be found in freshwater environments.

4.1.3 Miscellaneous Species

Although there are far fewer references to various species that have been identified as significant in Britain, including the Atlantic salmon, the Northern pike, the European seabass, the cyprinids (Cyprinidae), and gadids (Gadidae), the sparse references that do exist highlight the importance of these fish to Romans settled in the northern provinces, namely the work of Ausonius (Mos.). Included in this section are the clupeids such as herring and sprat, which, although a significant resource, are rarely touched upon by Roman historians and naturalists. It appears that the more common descriptions are those of species that could be sold individually and consumed frequently by elite members of society.

The Atlantic salmon (*Salmo salar*) is scarcely mentioned regardless of its significance to later fisheries (Jenkins 1984, 239), which appears to relate to the geographical range of this species, restricted to the north Atlantic and the river systems of northern Iberia, Gaul and the Netherlands in its southern most reaches (Wheeler 1978, 78). Pliny tells us that in Gallia Aquitania, salmon from rivers are preferred to those from the sea (HN 9.32: *In Aquitania salmo fluviatilis marinis omnibus praefertur*). This passage highlights the diadromous nature of the species and implies that riverine fisheries were more popular or successful. Ausonius, further alludes to the seasonal migration of the salmon, stating that it “endures untainted through seasons of long delay” (Mos. 103*: tempora longarum fers incorrupte morarum*).

The Northern pike (*Esox lucius*) has a greater European range, though uncommon throughout most of Italy south of the Po Valley (Wheeler 1978, 92). Its more popular habitats of low-lying rivers and flooded marshlands are attested by Pliny (HN 9.17: *isox in Rheno*), although the term used here (*isox)* remains an unconfirmed translation (Radcliffe 1927, 197), and by the more reliable text by Ausonius (Mos. 122: *obscuras ulva caenoque lacunas obsidet*). Ausonius further discusses the low value of this species as a food source, “not chosen for banquets but fried at shops that smell of the greasy flavour” (Mos. 123-124: *hic nullos mensarum lectys ad usus fervet fumosis olido nidore popinis*). Radcliffe translates this passage as the “coarsest food” (1927, 197).

The seabass is described as always dwelling in the sea where it neighbours rivers, “where the sweet water ceases from the brine” (Oppian Hal. 1.115: ὅθι λαρὸν ὕδωρ μεταπαύεται ἅλμης). This is later reiterated by Athenaeus, who includes their spawning season, occurring twice in the winter (Deip. 7.86: *τίκτουσι δὲ χειμῶνος καὶ τίκτουσι δίς*).

Of the cyprinids, Ausonius alludes to those suited for the masses (Mos. 127: *obsonia plebis*), as is the tench (*Tinca tinca*) and potentially the gudgeon (*Gobio gobio*) and barbel (*Barbus barbus*) (Mos. 125-134: *tincas; gobio; barbi*). It is unclear which species Oppian refers to in his description of a shore-based cyprinid (Hal. 1.101: *κυπρῖνοι*); it is translated as ‘carp’ and may refer to the shores of lakes, rather than the sea (Mair 1928, 209); however, all the accompanying species in this passage are marine fish, for which one must assume that another species of fish is discussed, or that it is a reference to the brackish conditions of estuaries where several cyprinids may be found. This is also alluded to by Pliny when discussing the impact of lightning on a cyprinid at sea (HN 9.25: *hoc et in mari accidere cyprino putant*). The more likely alternative is a marine species that does not relate to the freshwater cyprinids.

Gadids include a large range of cods that are difficult to distinguish in the literary sources. The hake (*Merluccius merluccius*) is often grouped with cods, now assigned to a separate but related family (*Merlucciidae*: see https://www.fishbase.se). Few gadids are present in the Mediterranean (Wheeler 1979, 150-159), which is reflected in the scarcity of historical descriptions. Athenaeus refers to the ‘*onus’* or ‘*oniscus’* when comparing its single spiny fin to other fish (Deip. 7.90: *ὁμοίαν τῷ ὀνίσκῳ τῷ καλουμένῳ γαλλαρίᾳ*). This *onus* may refer to the hake, which, Aelian tells us, is a solitary fish, found alone in its den where other fish only winter (NA 6.30: [*ὁ ὄνος*] *τῶν ἄλλων ἐν ταῖς κρυμωδεστάταις φωλεύειν εἰθισμένων*). There are no further references to the remaining cods that would become a primary target of medieval offshore fisheries in the North Sea.

The identification of clupeid species can be just as complex. Pliny mentions the '*chalcis'* (HN 9.71;9.74), which has been translated as herring (Rackham 1967 269; 273) but is more likely the pilchard (*Sardina pilchardus*), as is suggested for its description by Athenaeus (Epi. 7.137: *χαλκίδας, ἃς καλοῦσι καὶ σαρδίνους*) and by Oppian (Hal. 1.244: *Χαλκίδες αὖ θρίσσαι τε καὶ ἀβραμίδες φορέονται ἀθρόαι*), as herring are not found in the Mediterranean (Wheeler 1978, 66). Of the *chalcis* we are told that "they move in shoals and run to the shores" (Hal. 1.247: *ἀθρόαι… ἐπέδραμον αἰγιαλοῖσιν*). The additional species in this passage, the *ἀβραμίδες* has been translated as the shad (Mair 1928, 231); although highly speculative, the shad is known to frequent shorelines in large shoals and is a potential candidate.

4.2 Fish, Fishing, and Social Class

Fishing activities as direct reflections of wealth or class is alluded to in various sources. Angling, on the one hand, has been indirectly related to the activity of poor citizens (e.g. Plautus, Ru. 2.2), while on the other hand, as the leisure activity of a wealthy individual (Pliny the Younger Ep. 9.7.4; Martial Ep. 10.30), or at the very least, "the most suitable for free men" (Aelian 12.43: *ἡ δὲ ἀγκιστρεία σοφωτάτη ἐστὶ καὶ τοῖς ἐλευθέροις πρεπωδεστάτη*). Aelian's consideration of social standing is more complex and he identifies alternative fishing methods that are "unsuitable for free men*"*, such as the use of a fish trap (Aelian 12.43: ἡ δὲ κυρτεία δολερωτάτη θήρα καὶ ἐπιβουλοτάτη δεινῶς ἐστι, καὶ ἐλευθέροις πρέπειν δοκεῖ ἥκιστα). The term 'free' (ἐλευθέροις) may indicate a class distinction, in which Aelian alludes to practices that are professional and marketable (such as traps), as conducted by a workforce of uncertain but likely low social standing, to those that are generally accepted to be conducted by Roman citizens. It appears that what is defined as a suitable activity for leisure is conditioned by the contemporary values of Roman citizens; this is further highlighted in the noble attributes of fishing practices described by Oppian in his *Halieutika,* where, it has been argued the author reflects the philosophy advocated by the emperor of that time, Marcus Aurelius (Marzano 2013, 49), to whom the poem is dedicated. The alternative description by Plautus suggests fishing has a mixed reception depending on the period, or, just as significantly, the geographical location.

Evidence of geographical discrepancies is indirectly observed in the criticism of the value assigned to fish based on their provenance. Examples include the comparison of mullet sales at Italian and Egyptian markets, with highly inflated values in the former (Pliny H.N. 9.31); or in the sale of unspecified 'small fish' between the cities of Rome and Antium (Athenaeus Dei. 6.224), only 50 km apart. Observations of the flamboyance and scale of fish and seafood consumption is indeed criticised (e.g. Quintilian, Inst. Or. 8.3.66; Seneca Ep. 95.25; Martial 11.27.1-2; Pliny H.N. 9.30.66-67) ascribed by Ovid (Fast. 6.173-174) to a consequence of the extreme wealth and prosperity of the 1st century AD and the political transformation of the Empire. Ovid (Ibid.) infers that earlier Romans were not as concerned with aquatic resources as were his contemporaries. By the 4th century AD, the edict of Diocletian (AD 301) attempted an empire-wide implementation of a maximum price on goods, including the most expensive fish. This has been considered an attempt to cap the hitherto inflation of prices of aquatic resources (Curtis 2005, 43; Marzano 2013, 290), demonstrating the linear progression and success of fish products throughout the Roman empire. Nevertheless, this restriction on price may have targeted those locations and/or species that were so highly priced, with cheaper options available elsewhere; this is alluded to by Ausonius, also writing in the 4th century, who mentions the value of a few riverine fish as suitable for the masses (Mos. 127: *obsonia plebis*), rather than the luxurious diets of the elite. Whether this is due to the species in question, which include cyprinids and the Northern pike, or an example of the geographical disparity of prices between those in Rome and those in Belgica (of which he writes), or indeed both factors, one may infer that Britain too may have been isolated from the eccentricities of Mediterranean marine diets and marketed goods.

4.3 *Halieutica*, the Subject of Fishing

The naturalist Aelian (NA 12.43) summarises the principle strategies of capture into "*four basic fishing methods: with nets, with a pole, with a weel [trap] and with a hook"*. (Aelian NA 12.43: "ἐνύδρου δὲ θήρας διαφοραὶ τέτταρες, φασί, δικτυεία καὶ κόντωσις καὶ κυρτεία καὶ ἀγκιστρεία προσέτι"). Aelian further lists the materials and tools employed for the various fishing methods: "*One needs horse-hair, white, black, red, and grey in colour… and a quantity of bronze and lead, cords of esparto, feathers… corks, and pieces of wood. Iron and other* *material are needed; among them reeds… club rushes… stalks of fennel rubbed smooth, a fishing rod of cornel wood, the horns and hide of a goat. Some fish are caught by one device, others by another*."

> *"δεῖται δὲ ἄρα ἱππείων τριχῶν, τὰς χρόας καὶ λευκὰς καὶ μελαίνας καὶ πυρρὰς καὶ μεσαιπολίους: τῶν δὲ βαπτομένων ἐγκρίνουσι τὰς γλαυκὰς καὶ τὰς ἁλιπορφύρους : αἱ γὰρ ἄλλαι πᾶσαι πονηραί, φασίν. χρῶνται δὲ καὶ τῶν ἀγρίων συῶν ταῖς θριξὶ τ αῖς ὀρθαῖς καὶ τερμίνθῳ δέ, καὶ χαλκῷ πλείστῳ καὶ μολίβῳ καὶ σπαρτίναις καὶ πτε ροῖς, μάλιστα μὲν λευκοῖς καὶ μέλασιν καὶ ποικίλοις. χρῶνταί γε μὴν οἱ ἁλιεῖς καὶ φοινικοῖς ἐρίοις καὶ ἁλουργέσι καὶ φελλοῖς καὶ ξύλοις: καὶ σιδήρου καὶ ἄλλων δέο νται, ἐν δὲ τοῖς καὶ καλάμων εὐφυῶν καὶ ἀβρόχων καὶ ὁλοσχοίνων βεβρεγμένων κ αὶ νάρθηκος ἐξεσμένου καὶ ῥάβδου κρανείας καὶ χιμαίρας κεράτων καὶ δέρματος. ἄλλος δὲ ἄλλῳ τούτων ἰχθὺς αἱρεῖται, καὶ τάς γε θήρας ἤδη εἶπον αὐτῶν."*
>
> (Aelian NA 12.43)

Most of the mentioned materials are organic, which makes their archaeological recovery highly unlikely, especially the described methods of colouring or treatment of hair and plant fibres. In this case the text is an invaluable insight; nevertheless, the artefacts that do survive archaeologically receive limited attention throughout the text, such as hooks and weights. Aelian does not elucidate on the purpose of the individual materials, how they are applied, and which species they may target. Oppian's *Halieutika,* as previously discussed, is controversial due to the poetic license that may have influenced his use of terminology and range of descriptions (Bekker 2005, 84; Marzano 2013, 17). As with Aelian, various terms and references to a multitude of net types and fishing methods are provided, but anecdotal at best and with few descriptions of the materials and methods of application. The complexity of the industry they are attempting to summarise is an aspect that is alluded to by the Roman historians themselves, in the evocative warning that: "A thousand names a fisher might rehearse, of nets, intractable in smoother verse" (Oppian Hal. 3.83: *μυρία δ᾽ αἰόλα τοῖα δολορραφέων λίνακό λπων*; as translated by Radcliffe 1921). As such, extrapolating fishing methods from the literary sources requires the dissection of short descriptions and their association to the archaeological evidence. Of these there are numerous examples.

Figure 42: Cast-net fishing at night. Illustration on a Byzantine copy of Oppian's Halieutika, c.11th century.

In the case of fishing hooks, throughout book three of Oppian's *Halieutika*, several types are referenced: leaded-hooks for catching flat-fish (*Hal.* 138-139), double-barbed hooks for swordfish (*Hal.* 3.529-533), long-shanked hooks for sharks (*Hal.* 147-148), light-hooks for wrasse (*Hal.* 465-467) and narrow hooks for the small mouths of grey mullet (*Hal.* 3.482-483). The author also describes the use of lines with multiple hooks (*Hal.* 3.77-78) and the use of both bronze and iron for the production of hooks (*Hal.* 3.292-294). Not only are these descriptions potential indicators of specialist equipment, but they also coincide with some identified archaeological examples (light hooks: Vargas 1981; leaded lines: Bernal 2010, 91; and long/multiple hook-lines: Thomas 2010, 150; Bernal 2016, 202).

Further inferences may be made on the strength of the fishing hooks that were used in antiquity based on material discrepancies outlined by Aelian and Oppian. Aelian insists that the hooks used for the capture of tuna "must be made of iron" (NA 13.16: *εἴη δ΄ ἂν ταῦτα έκ σιδήρου μὲν πεποιημένα*); meanwhile Oppian describes the required hooks for the capture of the large '*Anthias*' as "hard bronze or iron" (*Hal.* 3.293-295: *χαλκοῦ μὲν σκληροῖο τετυγμένον ήὲ σιδήρουἄγκιστρον πέλεται*). The former is especially interesting if we acknowledge the range of copper-based materials and the distinguishable discrepancies of bronze, to which Oppian may be alluding to in the text.

Coloured hooks, used by modern fishermen to lure particular species or camouflage hooks in the water (Hurum 1977, 78) is a subject that is prompted by the discrepancy of copper and iron examples. Oppian may be referring to intentional colour in his description of the use of 'dark' double-hooks in the capture of whales (*Hal.* 5.140). Notable references to bare hooks not requiring bait (*Hal.* 3.172-176) and hooks of bronze (Cyn. 2.166; *Hal.* 1.54-55; 66-68) may allude to this value.

One aspect that is not touched upon by Oppian in his Halieutika, although describing various methods of capture, is the relationship of individual fishing methods to a specific fisherperson or fishery; it is not clarified whether the various hooks and nets were used by the same person or related to specific fisheries with subsequent geographical or environmental conditions. Lucian (Pisc. 51) only briefly alludes to this in his description of a fisherman who is aware of the optimal method of capture for the identified shoal of fish, but whom must be content with the hook and line that is available to him at that time:

"πετρῶν. ἀλλ᾽ ἢν ἰδού, πολλούς που τοὺς ἰχθῦς ὁρῶ κατὰ ταὐτὸν ὁμόχροας, ἄκαν θώδεις καὶ τὴν ἐπιφάνειαν ἐκτετραχυσμένους, ἐχίνων δυσληπτοτέρους. ῆ̄ που σα γήνης ἐπ᾽ αὐτοὺς δεήσει; "

(Lucian Pisc.51)

"Hullo! I see a whole school of them together, all one colour, and covered with spines and horny scales, as tempting to handle as a hedgehog. We want a net for these; but we have not got one. Well, it will do if we pull up one out of the lot. The boldest of them will no doubt try the hook."

(Translation by Harmon 1921)

Alternatively, Ausonius (Mos.), from the position of a spectator, identifies a range of fishing activities occurring in the river Moselle, although by different people, perhaps simultaneously and within the same location. Once again hooks and nets are the primary methods applied and, unlike previous authors, Ausonius provides a rich description of the fishing method as it occurs:

"hic medio procul amne trahens umentia lina
nodosis decepta plagis examina verrit;
ast hic, tranquillo qua labitur agmine flumen,
ducit corticeis fluitantia retia signis;
ille autem scopulis deiectas pronus in undas
inclinat lentae convexa cacumina virgae,
inductos escis iaciens letalibus hamos."

(Ausonius Mos. 243-249)

"This man far out in mid-stream trails dripping nets and sweeps up shoals of fish, snared in the knotty folds; but this where the river glides with peaceful flood, draws his seines, buoyed up with floats of cork; while yonder on the rocks one leans over the waters which flow beneath, and lets droop the curved tip of his plaint rod, casting hooks baited with deadly food."

(Translation by White 1919)

In reference to fishing hooks, Ausonius, in two separate occasions, alludes to fishing with hook and line as an activity conducted by children (Moes 125: "*puerilibus hamis"*; 256: "*raptat puer"*). The previous passage (Moes. 243-249) suggests this is in addition to the more significant captures by adults using both hooks and nets, but it is nonetheless interesting that fishing as a leisure activity was not solely conducted by wealthy adult men.

As the progression of archaeological recovery has resulted in larger collections of fish bone remains and fishing tools alike, rather than identifying further parallels with the literary sources, greater discrepancies have begun to emerge (Van Neer et al. 2010, 1622; Bombico 2015, 23). It should be noted that such discrepancies are present beyond the Mediterranean and Italian centre from where most texts originate and may therefore highlight regional discrepancies of Roman fishing in the outer provinces. One example of this disparity is only now coming to light, concerning the inclusion of fishing within the Roman army. The Digest of Justinian describes the regard for fishing and hunting as an activity not to be promoted among the soldiers who are off duty:

Paternus quoque scripsit debere eum, qui se meminerit armato praeesse, parcissime commeatum dare, equum militarem extra provinciam duci non permittere, ad opus privatum piscatum venatum militem non mittere. nam in disciplina augusti ita cavetur.

(Digest of Justinian, 49.16.12 (1))

Paternus says that he who commands an army should remember to grant furloughs very sparingly… and not to send a soldier to perform any private labour, or to fish or hunt; for this is laid down in the rules of discipline prescribed by Augustus.

(Translation by Scott 1932)

In the Mediterranean, where the ichthyofaunal evidence of fish consumption among soldiers is dominated by imported fish-sauce and other salted goods, there is little evidence that this policy was ignored; however, in the outer provinces there is substantial evidence for petitions by soldiers to bypass these rules (Walas 2016, 129). The fact that such criteria were deemed necessary to enforce may reflect the frequency of such activities among soldiers, further supported by the strict reprimands inflicted by the more obedient authorities, as is the case for the emperor Tiberius (Tacitus Tiberius, 19). It is in the northern provinces where evidence is emerging of a general neglect of policies condemning fishing. In the Netherlands, there is substantial archaeological evidence for fishing at military fortifications (Dütting and Hoss 2014; Dütting 2016), including the use of traps, nets, and hooks (Dutting 2016, 393-395). Similar evidence from Britain involves the recovery of tools at military sites (e.g. Bushe-Fox 1926; Atkinson 1942; Allason-Jones and Miket 1984; Barker et al. 1997), and by the Vindolanda tablet requesting a fishing net (Bowman 2008; see below for British evidence). In Britain this is also supported by the numerous requests for leave by soldiers serving at Vindolanda and neighbouring castle-forts, also on tablets, which may highlight the popularity of non-regulation activities (Bowman and Thomas 1994, 77; Walas 2016, 129). Little is known about fishing as a supplementary food source for the Roman army, but there is a clear disparity between the literary and archaeological evidence that requires further assessment.

4.4 Revisiting Roman Mosaics

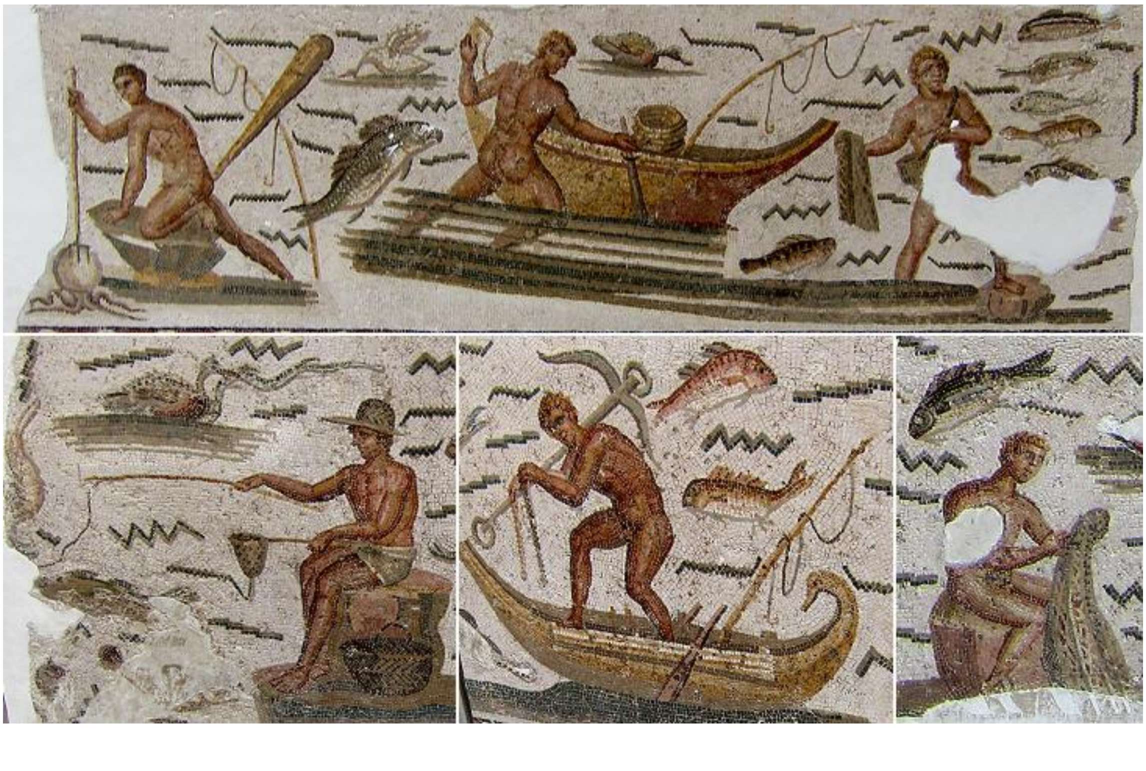


Figure 43: Coastal fishing scene, Odysseus mosaic, Tunis, Tunisia (©Bardo Museum)

Some consistencies should be highlighted where mosaics reveal similarities with each other, with the literary sources, and with the archaeological remains recovered. Hook and line fishing is represented as occurring from both fishing craft and the shore (Figures 26, 27, and 28). The same can be said about the use of seine or surround nets, and casting nets (Figures 26 and 28). Interestingly, the contrasting roles of pronged spears such as tridents and leisters, as described by classical authors in the capture of large fish or cetaceans at sea (Oppian *Hal.* 4.535-538), or cephalopods (Aelian NA. 12.43) from the shore, are illustrated in mosaics; the former is alluded to in the Nile mosaic from Leptis Magna (Figure 3), which depicts a large fishing vessel with three or more fishermen heading out to sea with a five-pronged and long handled leister resting on the bow of the ship; the former is illustrated in a coastal fishing scene from Tunis (Figure 40), where an individual uses a shorter handled trident to catch what appears to be an octopus at the base of a large coastal boulder.

Figure 44: Fishermen at Sea Mosaic, from the Catacomb of Hermes in Hardumetum (©Bardo Museum)

The Fishermen at Sea mosaic from the Catacomb of Hermes in Hardumetum, Sousse, Tunisia (Figure 41) depicts three of the four methods of fishing described by Aelian (N.A. 12.43), one of which is the use of traps, represented here by *nassae* (basket traps) cast from a fishing vessel. This is the only method that is not depicted as occurring from shore on mosaics, which may highlight the authentic depiction of a fishing method that requires a certain depth to function. Further accurate representations include the depiction of weights along the base of the cast net, barely visible as dark circular objects on an otherwise grey net. This example may be the only Roman pictorial depiction of these tools. Similarly, in the coastal fishing scene from Tunis (Figure 40), there is a rare depiction of a needle being used to mend a net; however, this example is too small and the detail too ambiguous to determine whether a bifurcated shuttle (the Mediterranean type needle) is being used. The most convincing aspect of these mosaics are the detailed depictions of fishes, to the extent that various species are identifiable (Kankeleit 2000). Britain, however, presents a more complex collection of abstract and partial depictions.

4.5 The Romano-British Primary Sources

Britain has substantially fewer primary sources with which to elucidate on the reception of fish and fishing by Romano-Britons; nonetheless, the few literary and pictorial representations that do exist are insights into how and where aquatic resources were represented by the local population, and telling of the Mediterranean cultural aspects that were transported over to the island.

4.5.1 The Vindolanda Tablets

The written record for Roman Britain is primarily represented by personal letters and requests written in ink on wooden tablets. Most of the translated tablets have been recovered from the anaerobic conditions at the site of Vindolanda, dated between AD 97 and 105. In addition to the description of various tools, clothing items and food (Bowman 2008; Grønlund 2011), there is one confirmed description of a fishing net (Tab. Vindol. 593), and another potential example (Tab. Vindol. 596). Both examples are the extent of literary sources for fishing in Roman Britain (Figures 42 and 43). The other significant literary resource, the curse tablets, have not revealed any mention of fishing implements or fishermen, to date.

Figure 45: Vindolanda Tablet 593. Image from Roman Inscriptions of Britain (©https://romaninscriptionsofbritain.org/inscriptions/TabVindol593 accessed March 2020)

The Vindolanda tablet III593i, a request to a *Veteranus* for various nets includes the following description:

Retes quas reliquimus
Retem turdarem
Retem anatarem
Evericulum piscatori[um]
(Tab. Vindol. 593)

Nets which we have left.
A net for thrushes
A net for ducks
A drag-net for fishing
(Translation by Bowman 2008)

It is suggested that the tablet was likely a request to the manufacturer for more examples of these types of nets (Ibid.). The source infers a correlation between the acquisition and, perhaps, production of nets with discrepant functions, at least among the military personnel along Hadrian's Wall. It is unclear if *Veteranus* is the name of an individual, or an indication of a retired soldier. One must not overlook the possibility of a civilian connection to the production or commerce of such nets. A significant factor is the inland location of the fortification and the net's association to freshwater fisheries. At the same time, the fishing net is the only example that has a specific name, rather than the generic term of *retem*; the chosen nomenclature may be indicative of a specific type of net, described by Bowman (2008) as a ‘drag-net’, which alludes to a differentiation from other types that may also have been produced and used in the northern frontier.

A second tablet (Tab. Vindol. 596; Figure 43) lists various requested supplies on the front, most of which relate to fabric or raw fibres with various uses, including leather, cork, fabric curtains of various colours, and hair. On the back of the tablet, highly fragmented words are visible that appear to continue the list, among them are the letters *]riclum*, which have been suggested to be a reference to either a javelin (*uericlum*) or a net (*euericlum*) (Recorded in the Roman Inscriptions of Britain: https://romaninscriptionsofbritain.org/inscriptions/TabVindol596). The various fabric objects listed above, alongside the absence of other hunting or military equipment suggest the latter option is more likely; however, these are scarce remains on which to base an interpretation of fishing practices.

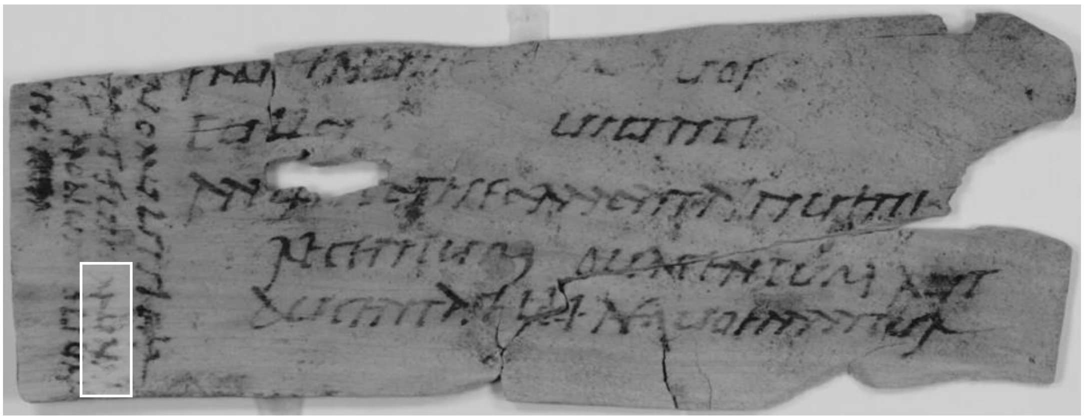


Figure 46: Vindolanda Tablet 302. Highlighted section of potential term [...riclum]. Image from Roman Inscriptions of Britain (© https://romaninscriptionsofbritain.org/inscriptions/TabVindol302, accessed March 2020)

In addition to the nets, there are a few tablets that highlight the significance of fish to the Romans settled in the frontier via the request for fish by-products from further afield. Fish sauce is referenced in four tablets, specifically the sauce known as *muria* (Tab. Vindol. 190; 202; 302; 594). The scarcity of these descriptions suggests that it was a commodity that was acquired by a minority of the military personnel; nevertheless, it was an available resource from a potential market for such goods at larger urban settlements.

4.5.2 Romano-British Mosaics

Research by Neal (1981) provides a comparison of what he described as “the grandest mosaics from Britain”, eight of which have an aquatic theme. Of these, five at Lullingstone, Caerwent, Kingscote, Fishbourne, and Verulamium, depict dolphins (Ibid. 16,63,73), following a highly stylised representation reminiscent of the Mediterranean examples. The remaining three show fish: the example from Cirencester has two dolphins and an unclear species of large fish, with more suggested to have been present in the absent sections (Ibid. 34); at Fishbourne there is an additional mosaic with a fish next to an amphora, also likely to have included several more examples, now destroyed (Ibid. 44); and at Rudston, a clam and nine fish (only a third of the faunal depiction survives) are deemed undiagnostic as a result of the 'poor quality' of the artist's rendition (Ibid. 67; Figure 47). Alcock (2001) argues that the British evidence reveals an attempt to adhere to the formulaic cultural practices of Rome. This, she argues, is visible in the decorative mosaics at Witcombe and Lufton villas, where fish species are barely discernible but iconographically related to several Mediterranean examples (Ibid. 52; see Figures 44 and 45).

Figure 47: (Left) The Great Witcombe Villa Mosaic. The abstract depiction of sea creatures and fish has some parallels with the Neptune Mosaic from Italica, such as sagitarii, a bivalve, and snail shell (Image from Lysons 1976, 11).

Figure 48: (Right) The Neptune Mosaic from Italica, Spain. Neptune stands out as the only colour depiction, while the other sea creatures are depicted in a simpler black monotone and contrasted with white shapes (Image from Monteagudo 2010).

In addition to the previous mosaics, dolphins are sometimes accompanied by fish, such as at Hemsworthy and Fifehead, in Dorset; nevertheless, these fish are not generally identifiable to species level (Alcock 1998), and may therefore be considered purely ornamental rather than depictions of local species. At Lydney villa, a mosaic depicts undiagnostic fish among unknown sea monsters (Wheeler 1932). The fish from Lydney were described in the original report as salmon (Bathurst 1879: see Figure 46); however, there is little within the abstract depiction to support this interpretation. Of interest is the surviving dedication to Nodons, who may be a

Celtic hybridization of the god Neptune, considered the fish god (Radcliffe 1921, 195), which suggests a deeper connection to the aquatic fauna depicted, but a religious objective in the chosen art-style.

Figure 49: Lydeny mosaic with dedication to the God Nodons (Image from Bathurst 1879, Plate 8).

Figure 50: Rudston villa, Yorkshire, Oceanus or Pontus mosaic. The deity figure is missing from the centre, but the various fish depictions remain (Image from Hull Museum online collections http://museumcollections.hullcc.gov.uk/).

Of the hundreds of mosaics discovered since the 18th century (Mattingly 2007, 463), twelve depict aquatic creatures, from these twelve only eight include fish (as opposed to dolphins only), and of these eight, three include diagnostic species in the form of the iconic European eel (*Anguila anguila*), and a cephalopod consisting of a cuttlefish (Figure 47). The identification of eels is a result of their unique elongated shape and pectoral fins (see Figure 43), rather than a clear depiction of the species, which strengthens the likelihood of highly stylised renditions, as opposed to a representation of the local fauna. Eels are depicted alongside the cephalopod at the bath house mosaic at Lufton villa (Neal and Cosh 2006), where they are attacking other fish by encircling them (not depicted on Figure 47). This is the only potential example of a British mosaic depicting the behavioural patterns of a fish and one that may be the result of an artistic rendition.

Figure 51: The Lufton Villa Bath House Mosaic, depicting an uncertain species of fish and a cephalopod, likely a cuttlefish (Image from University of Newcastle excavation blog: https://blogs.ncl.ac.uk/luftonarchaeology/).

Where some inferences can be made are in the geographical distribution of the mosaics. All are found in rural villas located near aquatic resources. The Rudstone, Fishbourne, Lullingstone, and Verulamium villas are comparatively isolated case studies; the former two are on the coast and it is therefore noteworthy that they include more detailed species (Neal 1981), if compared to other examples; in contrast, Verulamium is located the furthest inland, on the River Ver, and is composed of two abstract dolphins only. The remaining villas are all within a 40 km radius of the southern bank of the Severn Estuary. On the one hand, this is viewed as the result of the potential mosaicist school at Cirencester, which saw a concentration of mosaics constructed in this area (Mattingly 2007, 398), in which case the subsequent production of mosaics, aquatic-themed or not, would have been common; on the other hand, one cannot ignore the proximity of the mentioned mosaics to the Severn Estuary and the aquatic resources therein as a potential incentive for the themes depicted. In such a case, the mosaics would represent the interests of the local clientele.

One site that bears mentioning is the Roman villa at Bancroft, Buckinghamshire (Williams and Zeepvat 1994). There are no mosaic depictions of fishes, but a wall fresco depicting at least thirteen fish and iconographic dolphins have been recovered in fragments alongside a fishpond at the centre of the private garden (Ibid. 247). The fish have been described as unconfirmed species (Ibid.), however, they include colours and circular patterns that are absent from mosaic depictions and, alongside the body shape, that appear to resemble the locally available brown trout (*Salmo trutta*) (Figure 48). One further potential example of fish depicted on wall plaster are fragments excavated in St Albans, but which have not been published or included in the museum collection (information courtesy of David Thorold, Verulamium Museum).

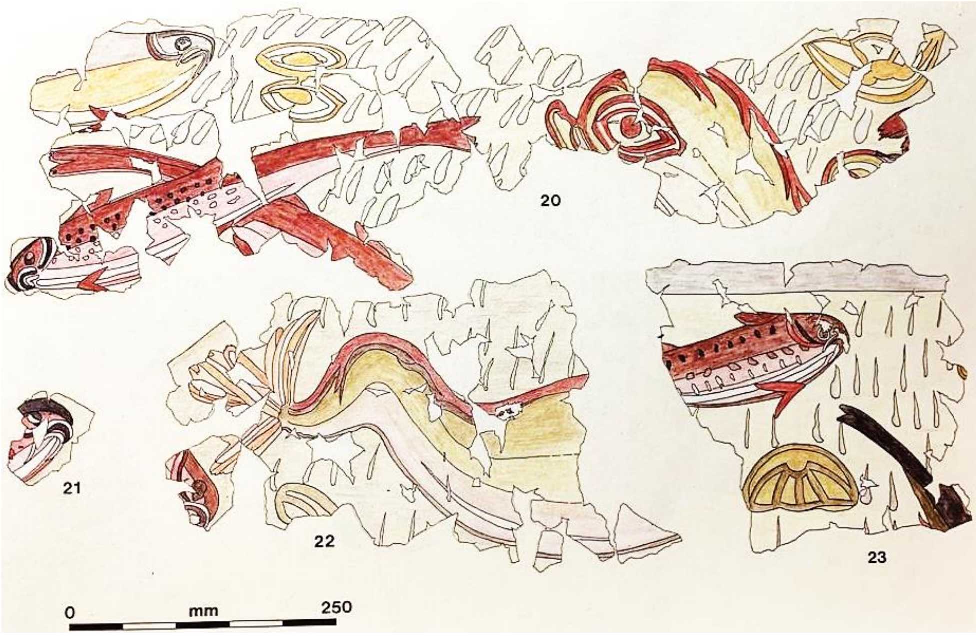


Figure 52: Section of wall plaster from the fishpond at Bancroft Roman villa (Willias and Zeepvat 1994, 264).

4.5.3 Additional Halieutic and Zoomorphic Representations

In addition to the mosaics there are a few representations in the form of stone and bronze reliefs and zoomorphic jewellery. A relief in stone of a winged amorino/*putto* catching a fish was recovered at Chester. (Wright 1955; Figure 36). This potential tombstone of unspecified Roman date is the only recorded example from Britain of an otherwise common classical depiction of amorini doing a range of activities (Aclock 1998, 25). There are no direct associations of fishing amorini to local fisheries or fishing activities, yet such a relationship cannot be ignored, especially considering the substantial ichthyofaunal remains recovered at Chester (see Chapter 9).

Figure 53: Winged amorino angling with a fish on the line and a dolphin in front. From the North Wall of Chester. 33 x 63.5 x 71.1 cm (Image Courtesy of Elizabeth Montgomery, West Cheshire Museums)

A copper plate from Lydney depicts a sitting man catching a fish with a pole and line (Wheeler 1932; Figure 50). The religious connotations of the accompanying figures of the Lydney copper plate have been interpreted as deities, protectors of the rivers and its fish, which is taken as evidence of the significance of fishing to the local population or a local individual (Alcock 2001, 51). At the same time, though dating the Lydney plate has been stunted by the early excavation methods employed by Sir Mortimer Wheeler, a later re-examination has concluded a mid-3rd century date (Casey et al. 2011); one must therefore emphasise the potential link to Christianity rather than a rendition of a leisure or economic practice.

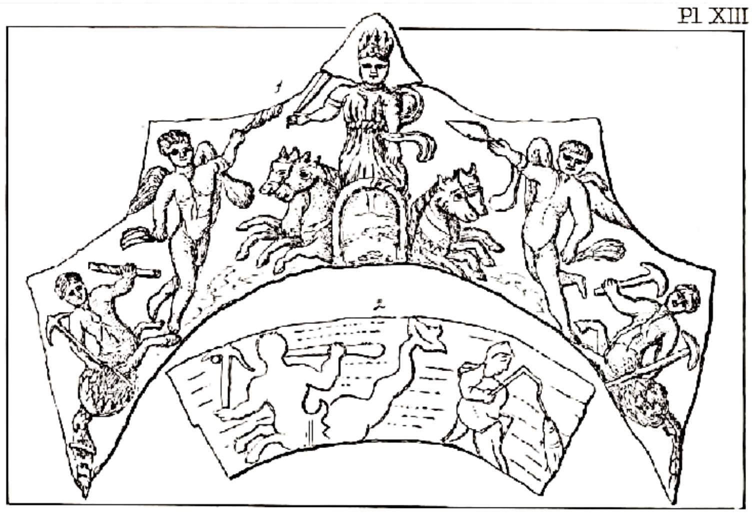


Figure 54: Lydney copper plate depicting a religious scene and a seated man fishing (image from Wheeler 1932).

Additional iconography on artefacts depicts fish, rather than fishing; these include the numerous depictions of fish on spoons (Casey et al. 2011), an unknown fish on a grooming utensil from Beadlam villa (Neal 1996, 45-46), depictions of eagles with caught fish in their talons (e.g. a bronze disc from Wroxeter, Figure 14), and abstract fish from pewter dishes at Icklingham and Appleshaw, of uncertain dates (Liversidge 1973,207). A carved stone, perhaps a voussoir used for an archway (Wright and Hassall 1973, 335), has been recovered at Great Witcombe villa and depicts an abstract fish with scales (Figure 51). At first glance, a depiction of a fish on a structural element may be interpreted as Christian iconography; however, the unstratified discovery within the backfill of an earlier 19th century excavation, has prompted Wright (Ibid.) to interpret the image as an addition by a modern enthusiast, which remains unconfirmed. Backfilled Victorian trenches with unrecorded artefacts is not uncommon (Fulford et al. 2002).

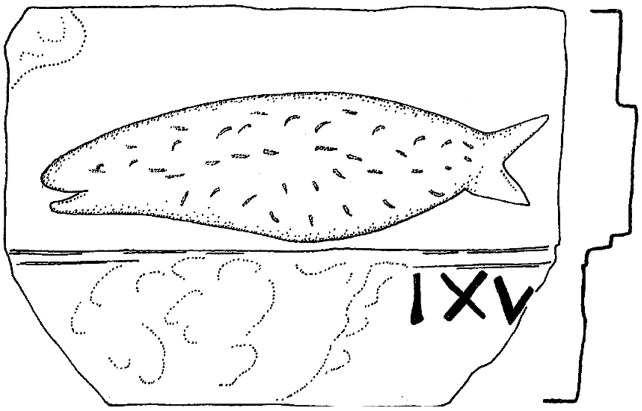


Figure 55: Fish relief on worked stone, from Great Witcombe villa (Image by Wright and Hassall 1973).

A significant collection of zoomorphic iconography has been recovered in the form of dozens of brooches representing fish and recovered throughout Britain. A total of forty-three fish-themed brooches have been identified from various publications and by the Portable Antiquities Scheme. Some have previously been classified (Mackreth 2011), such as the type 5.a2 (Figure 52), following examples recovered in Gaul (Ibid.), and of which there are nineteen examples for Britain. This type has been consistently dated to the 2nd century (Mackreth 2011) and depicts a fish with a large eye, clearly visible and coloured gills, pectoral and anal fins, and a potential adipose fin, which has prompted a salmonid identification (Ibid.). Other fish species are depicted, such as flatfish and eels, though by comparatively scarce examples.

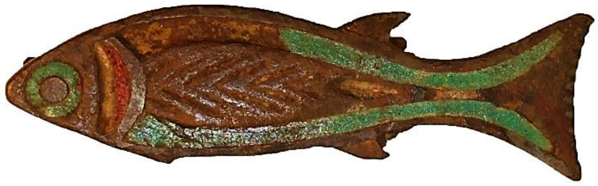


Figure 56: Example of the most common fish brooch. From New Darlington (Image accessed at the Portable Antiquities Scheme).

Widespread Christian iconography, via inscriptions, mosaics, and paintings, has been described as a process of the early 4th century onward within Britain (Liversidge 1973, 455-463; Petts 2016). The incorporation of fish in Christian iconography has an earlier date of the second half of the 2nd century AD, though primarily an abstract rendition of the Greek letters (*IXΘYC*) and originating in the Mediterranean (Rasimus 2012, 327). It is unlikely that the brooches represent Christian symbolism, yet the wide-spread distribution of similar or identical brooches alludes to either a cultural or religious connection, and Christianity should not be ruled out completely. Alternative local deities are also a possible representation, such as the hybridization of

Neptune, the god Nodons, or indeed Neptune himself (Radcliffe 1921, 195), but there are no confirmed cases of these brooches relating to such religious sites. If not a religious symbol, the depiction of local aquatic fauna is a significant reflection of the importance of aquatic resources to the local population.

The various depictions of abstract fish from Roman Britain provide little evidence of fishing practices or a fish-consuming culture. They are evenly distributed throughout the country, which is indicative of fish being present to some degree. If considered Christian iconography, less can be said for their representation of aquatic exploitation, for which a more thorough investigation of the various pictorial sources is required. The mosaics and fresco are indicative of a society with greater ties to aquatic resources, but one that is equally influenced by practices rooted in Mediterranean Roman traditions. The potential depiction of some local species may reflect either the knowledge of the artist or the client but are crucial either way in highlighting desirable species; this too requires a more thorough investigation. While the thesis must focus on the artefact and ecofact remains, there are likely numerous unrecorded pictorial sources that may further our understanding of the fishing culture. In comparison, the primary sources from the Mediterranean provide a rich resource of halieutic practices that, though influenced by regional bias, are contemporary representations of fishing traditions that may have been introduced to Britain alongside the altered artistic renditions.

5. The Fishing Hook

5.1 Defining Romano-British Fishing Hooks

The Romano-British Fishing hooks are composed of six diagnostic elements (shape, size, point, terminal, profile, and material). The definition of these elements has been provided in Chapter 4, based on the available material acquired throughout this investigation, and based on previous definitions from Iberian studies (Bernal 2010; Vargas 2011; 2020). Identifying consistencies is essential for confirming the preliminary classification and for developing a typology, for which the data is first assessed collectively.

5.1.1 Size Ranges

Size is the primary influence on the potential species that may have been targeted. Too large and the hook would only be useful for smaller fish, too small and the hook might be avoided or damaged by larger fish. The Roman ability and intent to regulate size to cater discrepant sizes of fish is an aspect described in the literary sources (see Chapter 4):

> "… the weapons are suited to the prey: smaller the lines, smaller the jaw of the hook, scantier the food that baits the barbs."
>
> (Oppian *Hal.* 5, 350-358)

Such a discrepancy is supported by the diverse sizes of the archaeological evidence for Britain; however, the definition of size ratios is strictly conditioned by the available material. Thirty-eight of the hooks recovered are relatively small at under 50 mm in length, six are above 100 mm, and nineteen of the recovered hooks lack sufficient data to determine size. An attempt to divide the material into distinguishable size ranges has required a broad estimation of small, medium, and large examples, with the exclusion of the 'very-small' category defined by Vargas (2011); this is primarily due to the fewer examples with which to attempt a more refined range. The three size ranges have differing criteria based on the hook shape, though only the J and Elongated-J have sufficient examples with which to propose size ranges. Furthermore, as described in Chapter 3, the length of the shank is a crucial datum in differentiating these two types. The double hook is also examined, but in an attempt to scrutinise various examples that are considered non-fishing hooks in this study, rather than for proposing size guidelines.

Figure 53 illustrates the averages for the 'J' shaped hook. Small hooks appear to cluster around 28 mm in length, while medium hooks cluster around 70 mm; large hooks are represented by only two examples, separated due to their substantial increase in size to 115 and 143 mm lengths. The first notable characteristic are slight discrepancies from the estimates proposed for the Iberian Peninsula by Vargas (2011; see Chapter 2). In the previous classification the length is used to indicate size (Ibid. 211), and divisions are drawn at 40 and 80 mm, between small, medium and large; for this study the width has also been considered to both determine the consistency of the width-to-length ratio and thus, where the length may be undiagnostic due to truncation, to be able to use the width alone for identifying the size-range. It is the width that reveals some consistency in hooks that otherwise have disparate lengths. Five examples are above the 40 mm proposed maximum for the small hooks (Ibid.) and yet have widths that are equal to shorter examples and substantially narrower than the medium average. The same is the case for two medium examples that have lengths above 80 mm, but no further consistencies with larger examples.

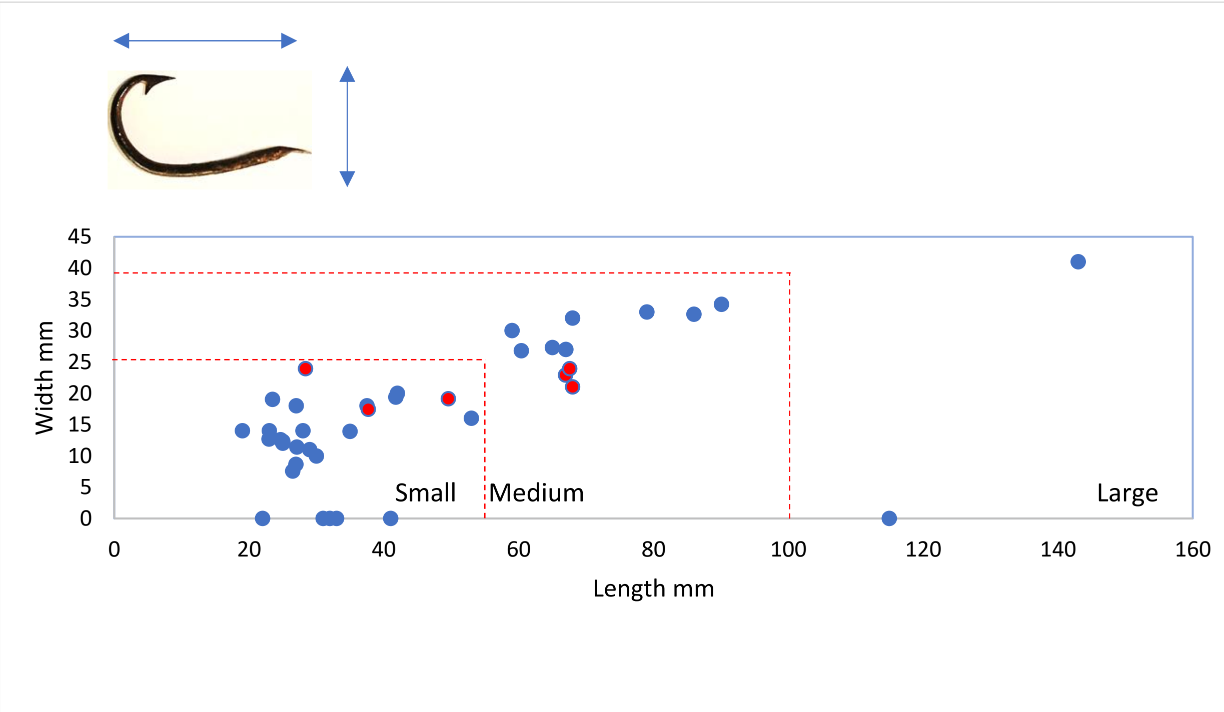


Figure 57: Size groupings among the Simple or 'J' shaped hook. The red markers indicate truncated hooks. The red lines show the suggested average size ranges with which to divide the hooks. The '0' value is assigned to hooks with unknown widths.

Three interpretations are proposed for the long examples of the small and medium sizes: the first is that Roman manufacture was largely arbitrary, resulting in various inconsistencies; the second is that further size divisions may exist beyond the three proposed here, which would imply a greater and intentional control over size; and the third is that these examples represent elongated hooks, though with uncharacteristically shorter shanks than the examples below. Regardless of the reason, the clusters are indicative of a consistent size average that may allude to an intended goal.

The 'very-small' classification included in the Iberian typology (Vargas 2011) has not been adopted here although several examples below 25 mm in length have been identified in Britain. These are far too consistent with examples between 25 and 30 mm in length to distinguish any such division; furthermore, the width is indicative of a more consistent production in which length is secondary. Some hooks above 25 mm have narrower widths than those below the proposed 25 mm threshold. As discussed, additional sizes may have existed, whereby the 'very-small' classification may be present, but with a longer average reaching 30 mm instead.

Width, it appears, is a relevant datum, but with an overlap between sizes that must be considered. Clusters currently suggest an average width of 13 and 25 mm for the small and medium hooks respectively (there are insufficient large examples to determine their average); however, among the medium hooks, three examples fall below the maximum width identified in the small hook range (21 mm being the narrowest example: H49). Theoretically, hooks can have much narrower widths, that is, until they fall under the 'Elongated-J' hook criteria, yet, other than truncated examples, there appear to be no significant overlaps that would negate the latter as a distinct type.

The proposed size ranges in millimetres for the 'J' or 'simple' hook are as follows:

1. Small
    - Length = <55
    - Width = <25
2. Medium
    - Length = 56-100
    - Width = <25-40
3. Large
    - Length = >100
    - Width = <35

While currently only based on six examples the elongated hook is highly characteristic. An elongated shank appears to relate to an intended function, which involves the capture of sharp-toothed species that would otherwise sever the line; an aspect alluded to by Oppian (*Hal.* 147-148). With the 'elongated J' (Figure 54), width is no longer a reliable classification criterion, as there is currently insufficient data with which to determine a relationship. Alternatively, the depth of the 'bite' in relation to the length of the 'shank' reveals a more consistent pattern. Romano-British elongated hooks are characterised by a shank that is at least five-times the length of the bite. The large examples are indeed distinguishable (see Appendix A, Part 1), yet the current size restrictions for 'medium' and 'small' are based on only four examples. Medium is represented by one hook (H11), which, though having a bite equal to the small examples, is over 30 % longer than the longest small hook. It is possible that the medium example was intended for the capture of the same fish, and that the length of the shank was a by-product of the production method or increased caution by the fisherperson/metalworker. Further examples are necessary to confirm a size range, yet elongated hooks are rare throughout the empire (Vargas 2020, 30).

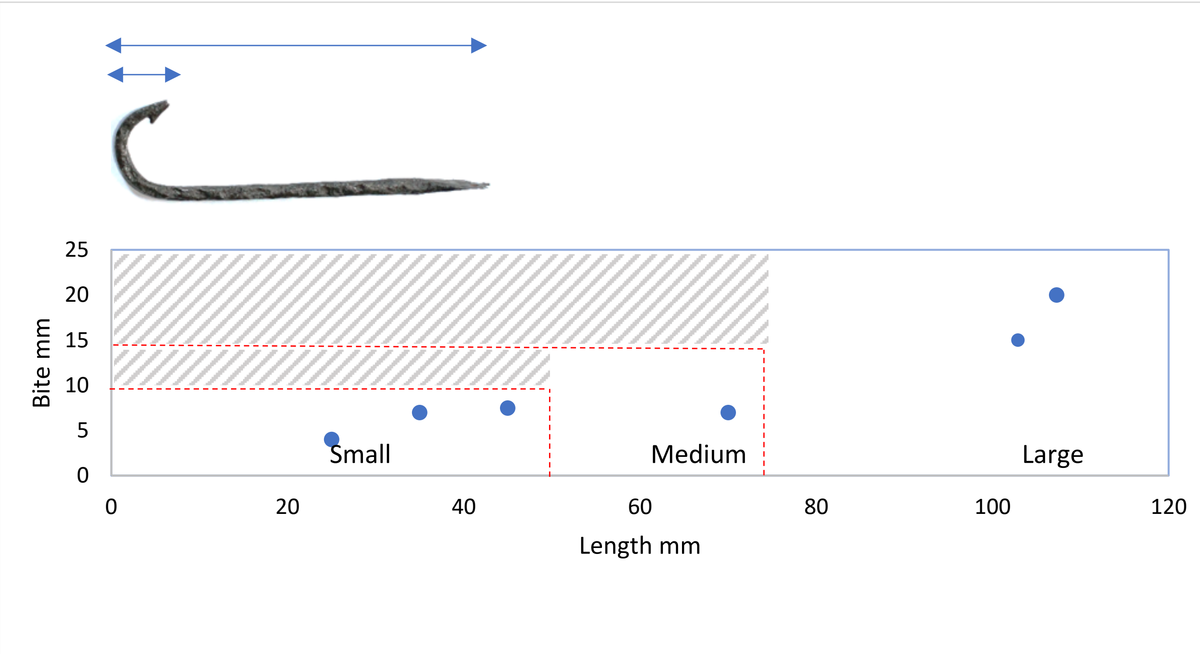


Figure 58: Average length and depth of bite of the Elongated 'J' shaped hook. The areas highlighted in grey represent impossible measurements within the 5-1 ratio suggested.

The proposed size ranges in millimetres for the 'Elongated-J' hook are as follows:

4. Small
    - Length = <50

- Bite = <10 or ≤ 1/5 of the length

5. Medium
    - Length = 50-75
    - Bite = <15 or ≤ 1/5 of the length
6. Large
    - Length = >75
    - Bite = <25 or ≤ 1/5 of the length

The double-hook is problematic when suggesting size averages, not only because there are merely four examples, or because of the peculiar shape, but due to the unlikely role of all but one artefact from Britain as a fishing implement. Only one example is undoubtedly a fishing hook (H51 from London) as it is the only example with barbs (Figure 55). This hook is 30 x 33 mm, with two bends and barbs averaging at 13 mm in width each. Although the overall size may correspond to medium estimates for other hooks, it is considered a small example due to the gape capacity of each face corresponding with the 'small' size of the 'J' hooks. This proposal may need amending as further examples are recovered; however, it is important to note that double hooks are often attributed to the capture of medium to large species (Vargas 2020, 60), for which the combine gapes of H51 are still relative narrow for that purpose.

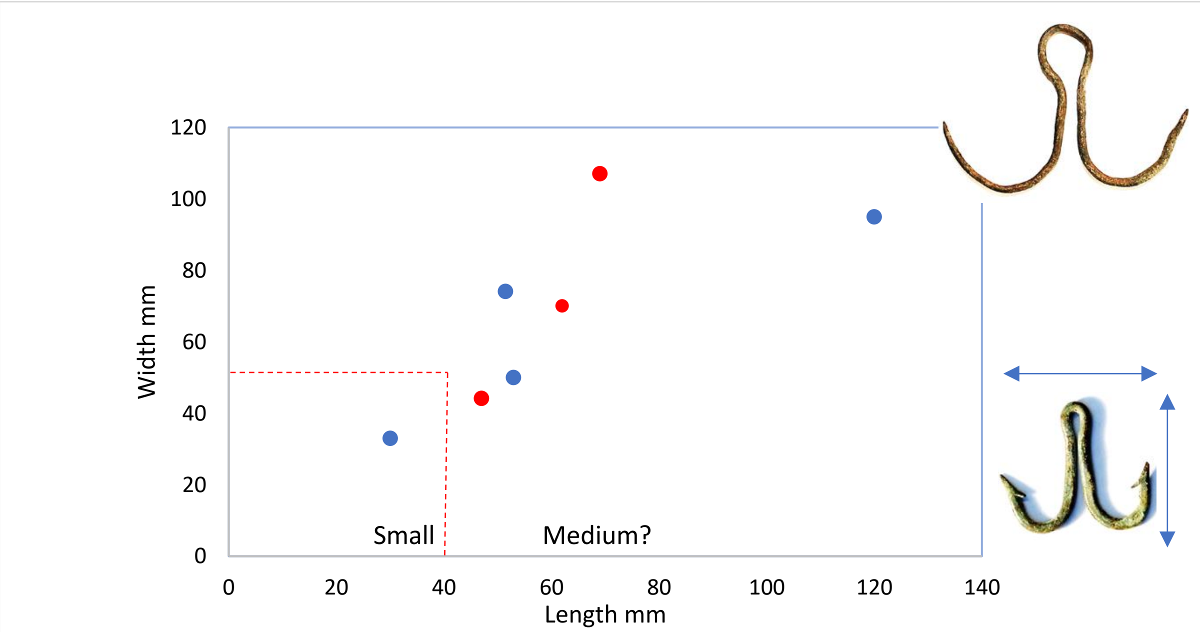


Figure 59: Distinction of length and width of the Double Hooks. The red examples are steelyard hooks that are identical to those described as potential fishing hooks. The images included are H51 (bottom) and H67 (top), see Appendix A, Part 1.

The remaining double hooks have been described as potential fishing implements in archaeological reports (see Appendix C, Part 1 for references), but more closely resemble steelyard hooks in shape and size (Figure 56; also see steelyard examples included in Figure 55, represented by red markers). The double hooks are substantially larger than H51, and are pointed, with a slight outward projection. Additional examples of these hooks have been found articulated with the component parts of the steel-yard scale to which they were attached (e.g. Brailsford 1964; Major 2015). None of the pointed examples included in the catalogue have been recovered from assemblages that suggest a halieutic practice.

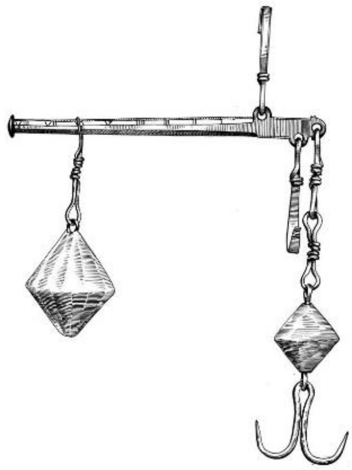


Figure 60: 1st to 2nd century steelyard hook from Wallbrook (Brailsford 1964).

5.1.2 The Barb Types

As discussed in the Methodology, the barb is a significant aspect for the categorisation of modern hooks, with numerous types being formed for the capture of specific species (Hurum 1977). Both Oppian (*Hal.*) and Aelian (NA) describe barbed hooks in reference to the capture of various species, but only one reference to the method of production is available in Aelian's description of fishing in Mysia (*NA*. 14.25), where he simply suggests that the hook "has been well sharpened" (καὶ ἐκεῖνος τῇ μηρίνθῳ κατὰ θάτερα προσῆψεν ἄγκιστρον ἰσχυρὸν καὶ μέντοι καὶ τεθηγμένον δεινῶς). This may refer to an abrasive method of production, with a file or sharpening-stone. Such a method would result in the 'V' shaped profile that is categorised as the 'sharpened barb' or B3, in the proposed classification, which is indeed the most common example from Britain (Table 2). The question that remains is whether the additional types were purposely formed, or if their alternative manufacturing processes relate to non-fishery functions.

Table 2: Table demonstrating the figures of the Point types and the Barb subtypes, as distributed throughout the identified regions of Roman Britain.

		N	NW	NE	SW	SE	S	Total
	Total Hooks:	**7**	**4**	**3**	**15**	**41**	**10**	**80**
B	1 Needle Barb	0	0	0	2	5	2	**9**
Barb	2 Pinched Barb	0	0	1	0	0	1	**2**
	3 Sharpened Barb	2	2	0	2	7	3	**16**
	4 Knife Edge	0	0	1	0	3	0	**4**
	5 Notched	0	0	0	0	4	1	**5**
	6 Outer Death	0	0	1	0	0	0	**1**
	7 Curved/Beaked	0	0	0	0	1	0	**1**
	8 Undiagnostic	1	0	0	2	6	0	**9**
P	Pointed/Barbless	0	1	0	2	9	0	**12**
T	Truncated/ Missing	0	1	0	2	0	0	**3**
TBC	To Be Confirmed	4	0	0	5	6	3	**18**

Subtype 6 (outer-death) has a single and highly questionable example, recovered from South Ferriby, Humber (H13). This appears to be a pointed hook with an alternative function to fishing (perhaps a meat or weight hook) and may therefore have been miss-interpreted. Outer-Death hooks (those with the barb on the anterior edge of the bite) are scarce in modern fisheries and unlikely for the Roman period, as no Mediterranean examples could be identified for comparison (see Vargas Girón 2020), for which reason the subtype, though included, will remain unused for the current assessment.

Similarly, subtype 7 (curved or beaked) is represented by a single example (H50); however, this is a far more likely case study with potential parallels. Like the Outer-Death, the beaked barb is highly distinguishable, composed of a low-lying barb and the inward curving point, but it is also very fragile; modern examples are prone to bending or breaking due to the thin structure of the point.

Additional examples exist without the curve, but including the low-lying barb (H62, H69 and H70). All four examples are from London, made of copper, between 26 and 30 mm in length and with a flattened terminal (Figure 57). It should also be noted that examples H69 and H70 have their points at an outward angle, facing away from the shaft, which may be a characteristic of bending or damage caused by pressure. It is also possible that the beaked barb is itself a consequence of bending. It is therefore a possibility that the four examples all represent a consistent product. Once again, there are no certain dates to verify this hypothesis.

Figure 61:The Curved Barb on H50 (Left) and the potential parallels of hooks H62, H69, and H70 (left to right respectively). See Appendix A, Part 1, for references.

Barb subtype 5, the notched barb, is represented by five examples (H24, H45, H62, H69, and H70), all of which are made of copper. A notch on the underside of the barb has an unclear function and is something that is not reproduced in modern examples (Hurum 1977, 69-71). The closest resemblance is the modern knife-edge profile, which extends from the barb throughout the shank, with the purpose of easing the penetration of flesh to allow the hook to catch on the bone structures of certain species (Ibid.). It is unclear if the notch was intended to facilitate the capture of fish with hard jaw-structures, if it was a decorative addition, or an unintentional by-product of the manufacturing process. Not all barbs include a notch, which lends weight to the former two functions. It is important to note that H50, defined as Subtype 6, includes a notch, adding another element to its resemblance to H62, H69, and H70; however, it was considered important to highlight the curved cusp as a potential subtype for posterity.

As characteristic as the B5, the B1 (needle-barb) is another example of intentional manufacture. As the name implies, this barb resembles a needle, being a conical projection, often with a more horizontal angle than other barb types (see figure 58). With the proliferation of modern technology, barbs have substantially reduced in size, meaning that there are next to no comparisons with this ancient example. The modern 'needle-point' should not be confused with the needle-barb, as the former merely refers to a perfectly conical point/cusp, with or without a barb (Hurum 1977, 70). In contrast, the nine examples from Roman Britain of Needle-barbs (H14, H26, H41, H46, H63, H65, H76, H78, and H80) are visibly characterised by the sometimes-exaggerated projection.

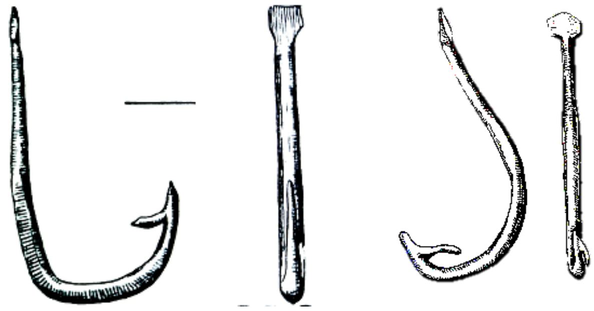


Figure 62: Two examples of the Needle Barb, subtype 1, H27 from Fishbourne Palace, Chichester (Left) and H17 from St Albans, Hertfordshire (Right).

The production of barb subtype 1, as with the former subtypes 5 and 7, appear to be a result of the material, as all of the examples but two (H76 and H78 with needle barbs) are made from copper. The softer material may have influenced the production of more versatile barb types, either intentionally or not. In contrast, the use of iron has resulted in simpler production methods (Figure 59). Of the twenty-nine iron hooks currently included in the study, twelve belong to the three remaining barbs (B2, B3, B4), which is a significant percentile if we consider that nine of the twenty-five iron hooks are undiagnostic due to truncation , oxidation or missing data. The first, B2, is the pinched-barb and is produced by hammering the barb into a sharp edge, which leaves a characteristic 'T' shape profile, as if 'pinched'. This barb is represented by only two examples, one copper (H47) and one iron (H8), and may have been the result of unskilled production or repair, as the resulting barb appears to be fragile (see illustration of H8 in Appendix A, Part 1).

The most common subtype is B3, the sharpened barb, represented by sixteen examples, including five copper hooks. This example remains the most common modern hook (Hurum 1977, 70). The use of abrasion to create a sharp edge would have been ideal when working with iron. This ease of production raises questions about the required skill of the craftsmen and the role of the barb in targeting specific species, as the sharpened barb suggests a basic product.

The B4, the Knife-Edge, is very much like the B3 as it maintains a distinct 'V' shaped profile acquired by sharpening; where it differs is in the continued projection of this sharp edge on the dorsal end, leading to a banana-shaped projection. The result is a barb that is sharp on three sides and this can prove problematic in holding certain species as it will facilitate the widening of the wound and potential release of the fish. There are only four examples for Roman Britain; H25, H28, and H57 are copper examples, while H66 is made of iron.

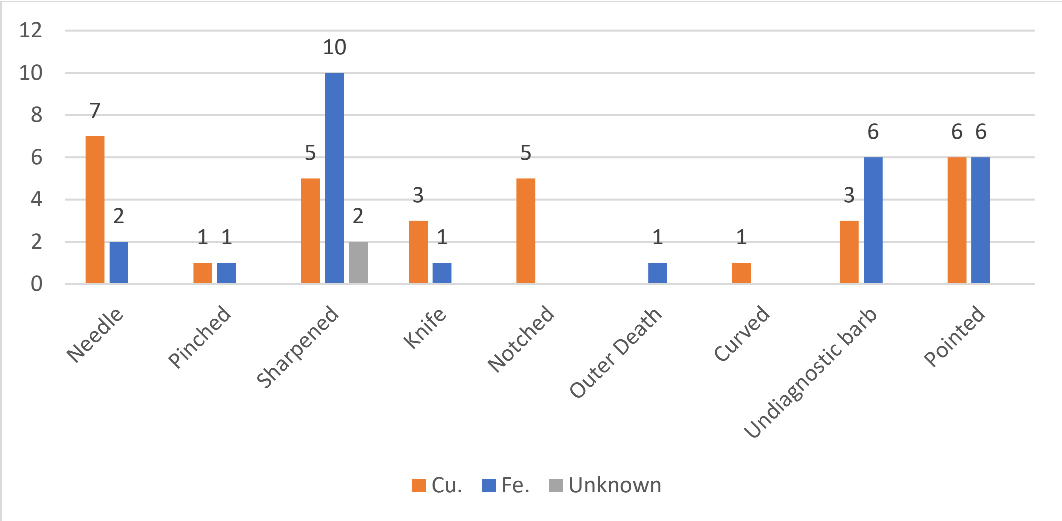


Figure 63: Point types based on material, including the barb subtypes and the pointed type.

With the pointed/barbless hooks, we must consider the several inconsistencies in their classification and, as such, their viability as fishing implements. There is a total of twelve pointed hooks from Roman Britain, six are made of copper and six of iron. The latter includes two similar hooks with a sharp bend forming a 'V' shaped rather than 'J' shaped tool (H29 and H31). Both were recovered in early and mid-20th century excavations and do not resemble any other fishing hooks, Roman or modern. Of the copper examples, three are double-hooks (H30, H39 and H67), which do not resemble fishing hooks due to the absence of an enclose eye (Figure 60) and their similarity in shape and size to hooks with alternative functions, as identified above (Figure 56).

Figure 64: H67, a double hook from Tower Street, London, described as a potential fishing hook (Illustration by L. Graña)

An additional pointed double hook that differs morphologically to the steelyard hooks is H73, which is consistent with the quadruple hooks (Figure 61). These four-pointed hooks are represented by two copper examples from river-side contexts in London (H71 and H72), once again, with no direct link to fishing activities other than their cataloguing as 'fishing equipment' (Frank's House Collection, the British Museum). The two examples are barbless and do not resemble past or modern fishing implements in Britain, which reduces the likelihood of their halieutic function. It is possible that their morphological ambiguity and recovery in proximity to Roman riverine deposits prompted a halieutic interpretation; however, they have no confirmed context or date. The closest resembling artefacts from Britain derive from 15th to 18th century deposits in Norwich (Margeson 1993, 18). These are often copper double hooks of similar dimension and almost identical to H73. They are described as 'fasteners' potentially for leather, which have wire decorations wound around them and often have bone or glass beads attached to them for decorative purposes (Ibid. 19). H73 fits in with this description and this brings to question not only the function but the date of the artefacts. At present, it is advised that these should not be interpreted as evidence of Roman fishing.

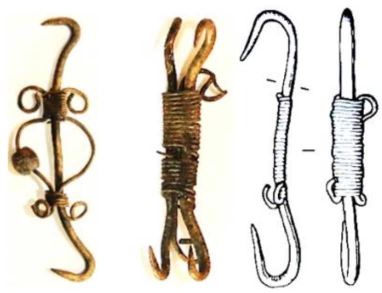


Figure 65: Potential fasteners H73 and H72 (left to right) described as Roman in date (Illustration by L. Graña), and a post-medieval example from Colegate, Norwich (right) (Illustration from Margeson 1993, 18)

Another controversial hook is H74, a Cu. pointed hook from London (Figure 65), which has a perforated flattened terminal and a very shallow bend. A similar example is H27 from Heybridge, made from Cu. and pointed, but with a flattened terminal that is not perforated. This uncharacteristic bend may be the result of damage caused by fishing; however, these tools more closely resemble curved needles used for leatherwork or as surgical equipment, also discovered on other sites (e.g. Andrews 1995, 93). No similar pointed examples have been found with an inward facing point with which to suggest an alteration of the 'J' hook; it is therefore possible that these objects have retained their intentional shape and relate to leather work. It is unclear why the pointed examples discussed have been directly assigned to fishing, but they highlight the difficulty with which pointed hooks are classified.

Figure 66: H74 from London, described as a potential fishing hook (Illustration by L. Graña).

5.1.3 The Terminal Types

Both the eye and flattened terminal have been used with hooks of all sizes and recovered throughout Britain, suggesting the method of production was reliant on either the manufacturer's or client's preference rather than a functional requirement. Modern examples seem to confirm this detail (Hurum 1977, 79-82). The flattened type is however more common, which may be a result of the greater ease of manufacture, rather than a functional role. An illustration of the terminal subtypes (Figure 63) highlights the dominance of the circular (F1) and square (F2) flattened terminals. The only three examples of irregular flattened terminals (F3) suggests that some care was taken in the intended shape, especially with the insurance of quadrangular edges, which, it is also worth noting, are only found among the J shaped hooks.

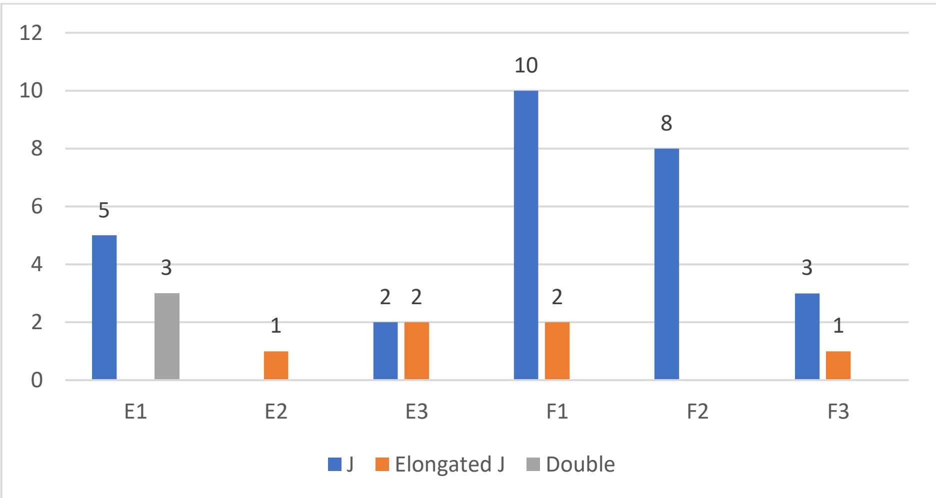


Figure 67: Number of subtypes of the Eye (E) and Flattened (F) terminals according to the three primary shapes.

The eye subtypes are fewer in number, especially if we consider that the double hooks are automatically assigned a looped eye (E1), due to their 'omega-shaped' construction. The needle eye (E2) is represented by one example (H11), which, on further inspection has revealed a partial flattening. It remains a narrow and gradual flattened surface that appears to have been produced with the further perforation in mind and therefore stands out from the remaining E3 examples. Of the flattened and perforated terminals (E3), the examples appear to be irregular and inconsistent, which may allude to alterations of a pre-existing flattened terminals, or personal crafting.

If one compares the consistency of terminals to the previously discussed barbs (Figure 64), further patterns suggest the flattened type was not only more numerous, but more consistent with the dominant barb morphology: the sharpened barb subtype. In fact, if we exclude the double hooks, which are categorised as 'eye' terminals, there is only one example of either the B3 (H11) or pointed types (H31).

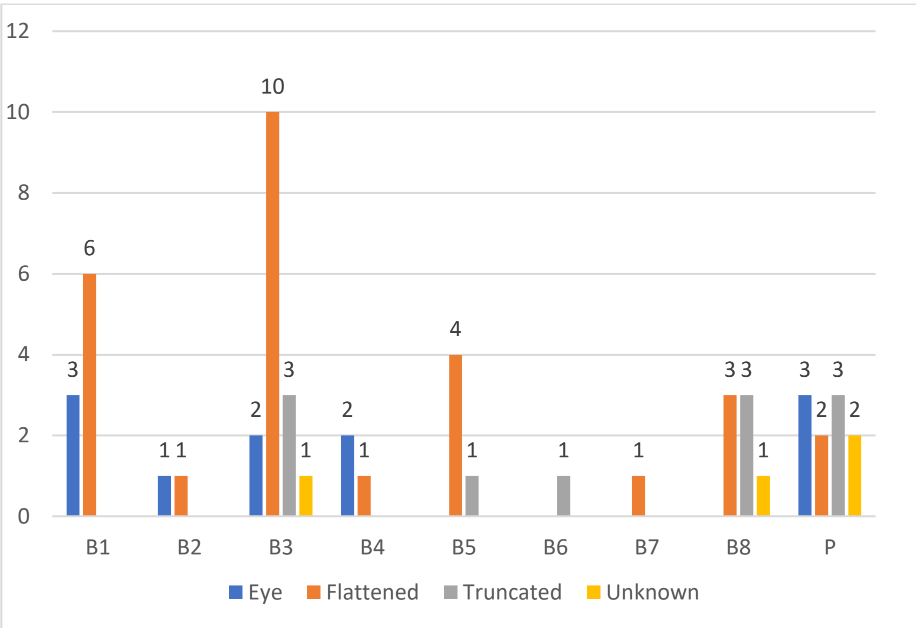


Figure 68: Number of eyes, flattened, and truncated terminals in relation to the barb subtypes.

5.1.4 Material

Iron (Fe.) and copper (Cu.) are the only materials identified among the recovered Romano-British hooks. Of the eighty artefacts, seventy have recorded material type, of which twenty-nine are iron, and forty-one are copper. Future analyses may reveal a more diverse range among the latter, including brass and bronze as subtypes, but no such classifications are available at this time. The choice of material has various implications that can impact the function of the subsequent hooks. Strength and mailability are the primary concerns, as they impact the production method and potential application of the tools. As discussed in the previous chapter, these are qualities that are only alluded to in the literary sources, but which may be discernible in the archaeological remains. The material should therefor be considered in relation to the aforementioned parts of the hook.

The first discernible pattern is in the size of hooks (Figure 65). Iron examples have a substantially larger average, with the largest example, H6, at 143 mm. In contrast, the largest copper hook is H41 at 53 mm. It should be noted that eight of the Fe. hooks are truncated along the shank, increasing their size average above the copper examples, which have only one truncated hook. As implied in the literary record, iron is the likely candidate for capture of large species as it was acknowledged as a stronger metal. The overlap of material based on size is minimal, especially if the truncated iron examples are not included. On the one hand, this may imply that material was chosen based on the intended size and strength of the hook; on the other hand, there are a few iron examples of notably small size that highlight an ability to produce hooks of any size, regardless of material.

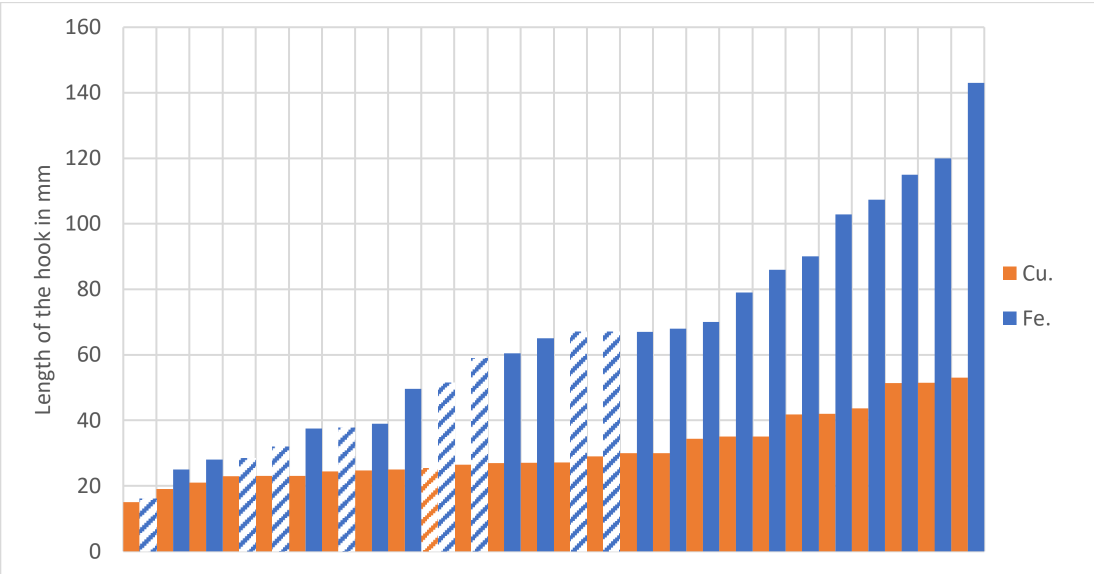


Figure 69:The length of the diagnostic Romano-British hooks divided by material type. The dashed examples represent truncated hooks for which the total length is unknown.

The ability to make small iron hooks does not however suggest that the Romano-Britons were capable of ensuring finer details on other aspects, most notably, the barbed points. As previously discussed, (see Figure 59), the B3 appears to be the simplest form, produced by filing the point into a 'V'shaped sharpened edge. This encompasses the majority of the iron hooks. The copper hooks provide a wider range of barb types, which, regardless of whether they were intended for the capture of particular species, or the result of production or alteration, suggest this was possible due to the softer material.

With the terminal type, it is more difficult to identify a pattern. The eye terminals consist of six copper and iron examples each. The former includes the double hooks, which, it has been argued, are probably steelyard hooks (bar one example: H51). If the double hooks are removed from the equation, the majority of the eye terminals are iron; however, it should be highlighted that there are insufficient examples with which to propose a correlation at this time. Meanwhile, the flattened terminals consist of nine iron and twenty-one copper examples. At first glance, this may be interpreted as a result of the material, suggesting that copper facilitated the production of a flattened type; however, it should be highlighted the majority of iron hooks had a flattened terminal, suggesting this type was intended regardless of material.

Where material may play a more significant role is in the profile of the shank. The profile appears to relate to the original blank bar or wire that was used to produce a hook. Little is known about the metal blanks other than what can be devised from ethnographic sources and a single example from London (H53). This iron blank is missing a terminal and bend but includes the barb, with which it is diagnostic as a potential fishing hook. The shank is square in profile and appears to be consistent in diameter throughout. The implication is that the production of the blank resulted in the shape of the profile that would be adopted by the hook. Interestingly, most of the iron examples are square in profile, while most of the copper examples are circular, although there are examples of either type (Figure 67).

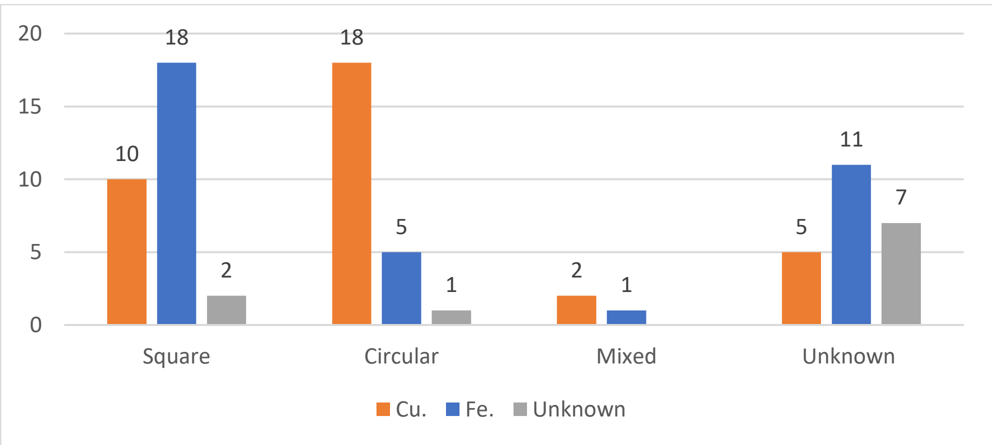


Figure 70: Type of profile shape based on material. The unknown Category represented by twenty-three examples highlights examples with unknown material.

5.2 Hook Shapes and the Predominant J Hook

Of the six shapes identified in Roman Britain, the ring and quadruple types are too few to advance any convincing argument of function. Modern ring hooks are used to facilitate the capture of big-game species often from deep-sea (Hurum 1977, 72), yet the single example recovered inland at Bristol (H37) has no contextual information with which to determine this role. Furthermore, H37 has an angular bend on the shaft which resembles damage or a haphazard inclusion rather than a skilful moulding of a circular bend. It is therefore possible that this example is a damaged large 'J' hook. Two additional examples present significant curves, but which render the hooks untenable and are considered confirmed damage to otherwise J hooks; these include H23 (Figure 67) and H44 (see Appendix A, Part 1 for illustrations). Together with H37, the three examples are likely evidence of post-depositional damage to these artefacts.

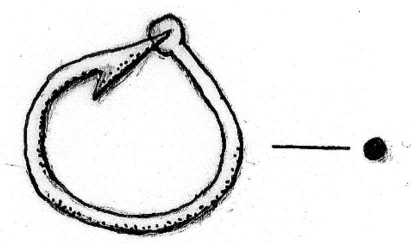


Figure 71: Apparently damaged hook H23 from Wroxeter, undated Roman context (Cool et al. 2014).

As previously discussed, the quadruple hooks (H71 and H72), alongside the similarly shaped and decorated double hook (H73), do not display any consistencies with the remaining fishing hooks and are therefore considered unlikely fishing equipment. All three have been recorded as such (Frank's House collection, British Museum), but with no comparative examples considered fishing equipment. Medieval examples have since been recognised as leather fasteners (Margeson 1993, 18), which has likely ensured the absence of further misinterpretations. The quadruple hooks should therefore be avoided in future.

The double hooks have been scrutinised in relation to their component parts and comparable artefacts with alternative uses; all of which suggests that the barbed H51 from London is the only example of a Romano-British double fishing hook.

The second most frequent hooks are the elongated-J, although represented by six examples only. Modern elongated hooks are used in the capture of sharp-toothed species, such as sharks, in brackish or marine waters (Hurum 1977, 80), a technological initiative alluded to by both Oppian (*Hal.* 147-148) and Aelian (NA 1.5) in the capture of sharp toothed coastal species. Modern examples with narrow gapes and short bites are also used in the capture of flatfish such as flounder (Hurum 1977, 72), which is not supported by the literary sources, but which more closely resembles some of the recovered Roman examples (H11, H52 and H54). With the elongated J all of the examples have been recovered from riverine environments, two in proximity to estuarine environments, which suggests the capture of sharp-toothed freshwater species or brackish water migratory species, potentially including the flounder (*Platichthys flesus*). The sizes vary, with two examples each of small, medium, and large. Both large hooks derive from London, where the brackish-water conditions of the estuarine-riverine transition may have supported the capture of large migratory species. The remaining four medium and small examples have been recovered throughout the country at inland sites, reducing the likely targeted species. Pike (*Esox lucius*) is indeed a prime candidate and strongly supports the intentional function of this shape and its recovery by freshwater environments.

The J hook is the most common hook recovered in Britain. The forty-nine recorded examples constitute the majority-type in all the identified regions and compose 75 % of the diagnostic shapes. Most have been recovered from riverine and estuarine environments, though all three coastal hooks are also of the J type. The ubiquitous nature of this type suggests that it was the most efficient morphology. The numerous examples provide substantial data with which to identify the most frequent typology (Table 3). We can accurately state that the most common Romano-British hook is the small copper 'J' hook, with a barb, a flattened terminal, and a circular profile (Table 3). The profile shape and material show few consistent patterns; if we remove these from the calculation, the small 'J' hook with a barb and flattened terminal is indeed the dominant hook, composing a third of the entire Romano-British 'J' hook collection to date. Size is an additional factor, as small and medium sizes combined would increase the barbed and flattened types to 45 % of the 'J' hooks (twenty-two of the forty-nine examples), noting that seven examples (14 %) have undiagnostic elements. Following an appraisal of the morphological discrepancies and how they correlate with each other, it is important to elaborate on the distribution of the hooks and determine if the relevant environment and cultural context relate to the choice of hook.

Table 3: Dissemination of the 49 'J' shaped hook, following the subsequent morphological parts and the corresponding number of examples. Highlighted in bold are the most numerous progressions.

<table>
<tr><th>Shape</th><th>Size</th><th>Point</th><th>Terminal</th><th>Profile</th><th>Material</th></tr>
<tr><td rowspan="29">‘J’/Simple

49</td><td rowspan="13">Small
26</td><td rowspan="7">Barbed
20</td><td rowspan="2">Eye
2</td><td>Circular
1</td><td rowspan="2">Cu.
2</td></tr>
<tr><td>Square
1</td></tr>
<tr><td rowspan="4">Flattened
16</td><td rowspan="2">Circular
8</td><td>Fe.
1</td></tr>
<tr><td>Cu.
7</td></tr>
<tr><td>Square
4</td><td>Cu.
4</td></tr>
<tr><td>Mixed
2</td><td>Cu.
2</td></tr>
<tr><td>Notched
1</td><td>Unknown
1</td><td>Cu.
1</td></tr>
<tr><td rowspan="4">Pointed
4</td><td rowspan="2">Unknown
2</td><td>Square
1</td><td>Fe.
1</td></tr>
<tr><td>Unknown
1</td><td>Fe.
1</td></tr>
<tr><td rowspan="2">Tr.
2</td><td rowspan="2">Square
2</td><td>Fe.
1</td></tr>
<tr><td>Cu.
1</td></tr>
<tr><td>Truncated
1</td><td>Eye
1</td><td>Square
1</td><td>Unknown
1</td></tr>
<tr><td>Unknown
1</td><td>Unknown
1</td><td>Unknown
1</td><td>Fe.
1</td></tr>
<tr><td rowspan="9">Medium
16</td><td rowspan="7">Barbed
14</td><td>Eye
2</td><td>Circular
2</td><td>Fe.
2</td></tr>
<tr><td rowspan="3">Flattened
6</td><td rowspan="2">Circular
3</td><td>Fe.
2</td></tr>
<tr><td>Cu.
1</td></tr>
<tr><td>Square
3</td><td>Fe.
3</td></tr>
<tr><td rowspan="2">Truncated
5</td><td rowspan="2">Square
5</td><td>Fe.
4</td></tr>
<tr><td>Unknown
1</td></tr>
<tr><td>Unknown
1</td><td>Square
1</td><td>Fe.
1</td></tr>
<tr><td rowspan="2">Pointed
2</td><td>Flattened
1</td><td>Circular
1</td><td>Cu.
1</td></tr>
<tr><td>Truncated
1</td><td>Square
1</td><td>Fe.
1</td></tr>
<tr><td rowspan="2">Large
2</td><td rowspan="2">Barbed
2</td><td>Eye
1</td><td>Square
1</td><td>Fe.
1</td></tr>
<tr><td>Unknown
1</td><td>Unknown
1</td><td>Fe.
1</td></tr>
<tr><td rowspan="5">Unknown
5</td><td rowspan="3">Barbed
3</td><td rowspan="2">Flattened
2</td><td>Circular
1</td><td>Cu.
1</td></tr>
<tr><td>Square
1</td><td>Cu.
1</td></tr>
<tr><td>Truncated
1</td><td>Circular
1</td><td>Cu.
1</td></tr>
<tr><td>Pointed
1</td><td>Eye
1</td><td>Square
1</td><td>Fe.
1</td></tr>
<tr><td>Truncated
1</td><td>Flattened
1</td><td>Square
1</td><td>Cu.
1</td></tr>
</table>

5.3 Distribution of the Fishing Hooks

The eighty Romano-British fishing hooks have been recovered throughout England. Only one example derives from Wales, while none are from Scotland. Half of the fishing hooks are from the South-East region, thirty of which come from London. The remaining examples derive from a range of sites with discrepant cultural contexts and local aquatic environments. Due to the discrepancies of hook preservation, the various parts of the hook are examined individually in relation to the environment and the settlement type; in the case of the cultural context dates are provided where possible.

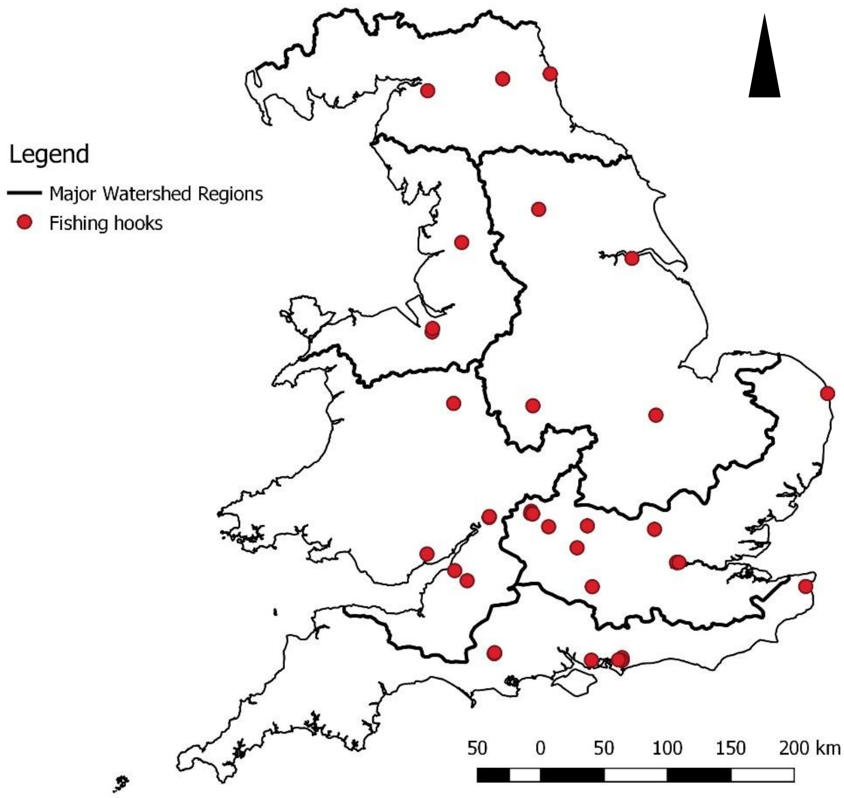


Figure 72: Distribution of Romano-British fishing-hooks by established regions based on major watersheds.

5.3.1 Hook Distribution by Environment

Thirty-six of the eighty Romano-British hooks derive from freshwater riverine environments. This figure may be doubled if we include the thirty artefacts from London; however, comprehensive environmental studies have revealed a tidal and semi-saline environment in London during the Roman occupation, consistent with the greater Thames Estuary (Cowan et al. 2009, 11). This does not dispel the possibility of those hooks pertaining to the capture of freshwater species, but the brackish-water conditions may have also supported the capture of marine fish. This is the case for all estuaries in Britain, as hooks are often recovered in the transitional zone, as opposed to the more saline waters by the coastline (Figure 72). Combined with the remaining riverine hooks, the estuarine and riverine artefacts constitute seventy-three of the eighty hooks recovered. Only three examples have a direct link to coastal fishing all of which are Saxon Shore-forts (H24, H41 and H49), with an additional four hooks from South Shields, Newcastle (H2, H3, H4 and H5), suitably located between both riverine and coastal environments. This assessment is therefore primarily an overview of the riverine and riverine/estuarine sites that encompass 91 % of the Romano-British hooks.

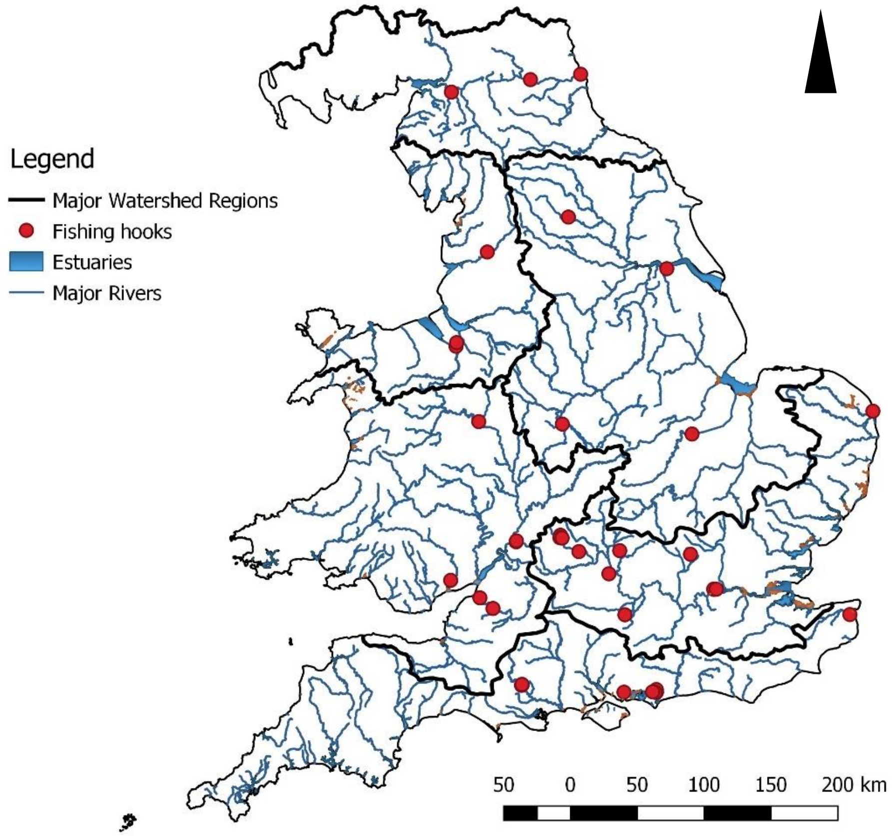


Figure 73: Distribution of Romano-British fishing-hooks in association with major riverine and estuarine environments.

5.3.2 Hook Distribution by Cultural Context

A more complex picture emerges from the cultural context of the artefacts and the nature of the site from which they have been recovered. With such a preliminary study and a limited understanding of many of the poorly recorded artefacts, we can only focus on basic discrepancies, highlighting 'military', 'settlement', or 'rural' contexts. Many of the artefacts cannot be assigned a specific site-type due to an absence of adequate dating and the transformation of several locations from military to urban settlements within the 2nd and 3rd centuries (Jones and Mattingly 2007, 159). A total of fifty-seven hooks (71 %) have been assigned a general 'Roman' date (AD 43 to 410) due to the poor level of recording and/or recovery techniques at the time of their discovery. This inhibits the development of a typology based on morphological discrepancies over time; it also affects our interpretation of whether there was an increased use of these tools over time and how this relates to the military expansion and/or Roman settlement distribution.

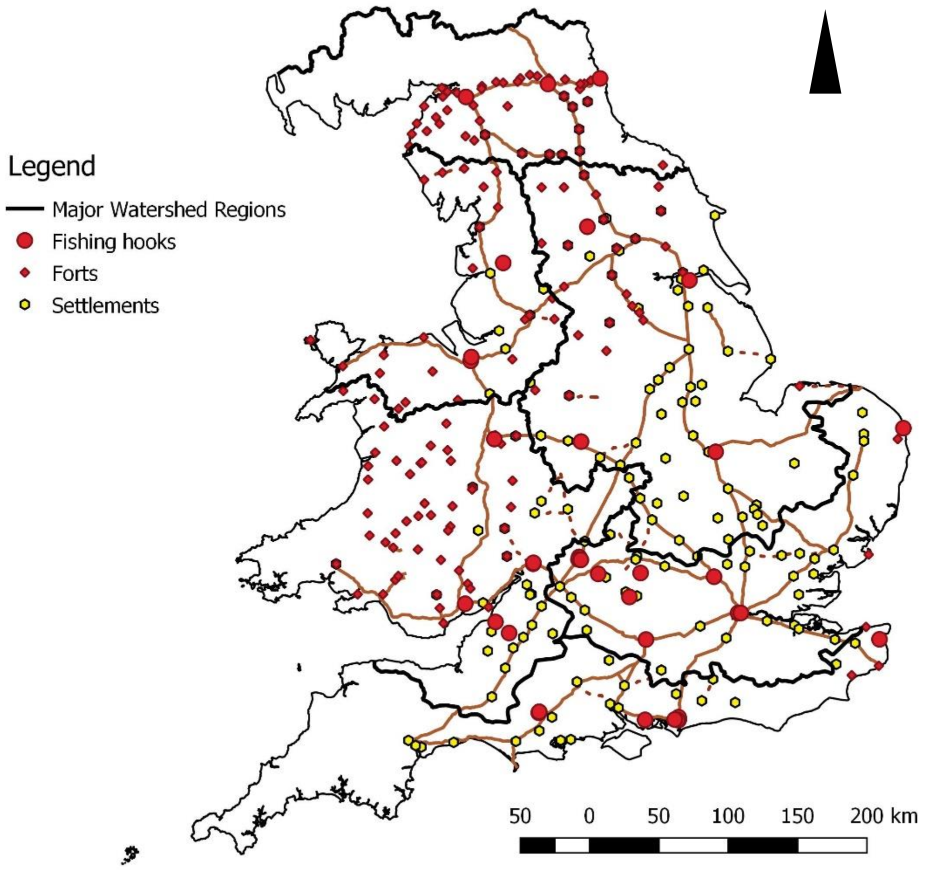


Figure 74:Distribution of Romano-British fishing-hooks in association with forts and settlements.1st century forts from the South East are excluded from the map.

To ensure the various data are well represented, the military, settlement, and rural classifications have been related to the previously discussed aquatic environments and to the major watershed regions (Figures 74 and 75). Where possible dating has also been included (Figure 76), though, as discussed, these figures are unreliable at this time.

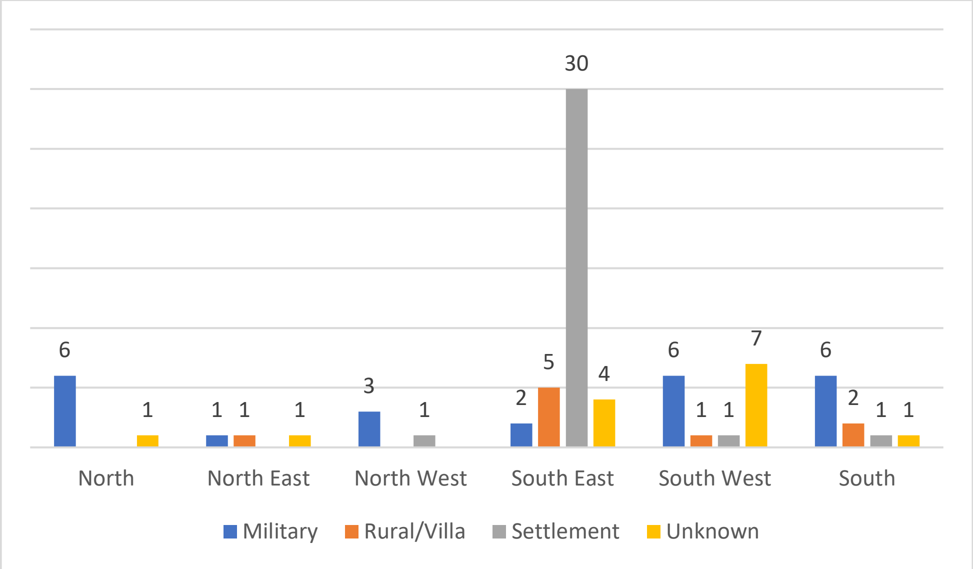


Figure 75: Number of hooks from military, rural, and settlement sites within the major watershed regions.

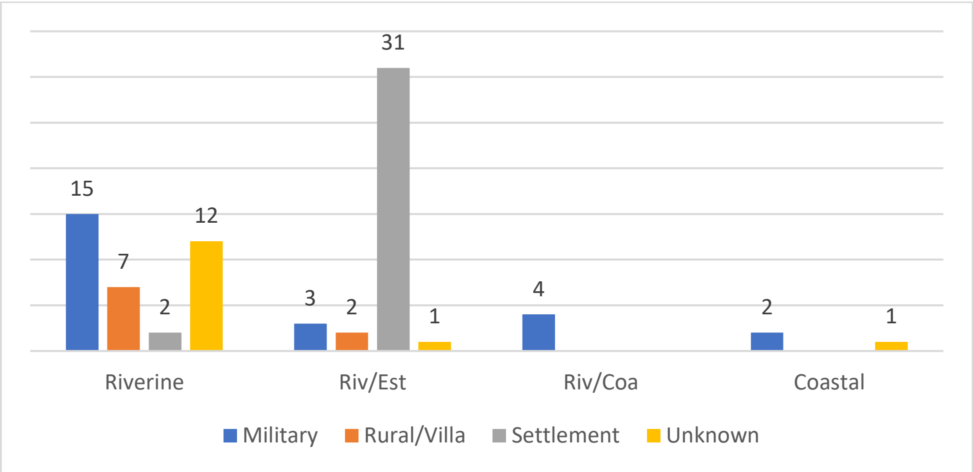


Figure 76:Number of hooks from military, rural, and settlement sites in relation to aquatic environments.

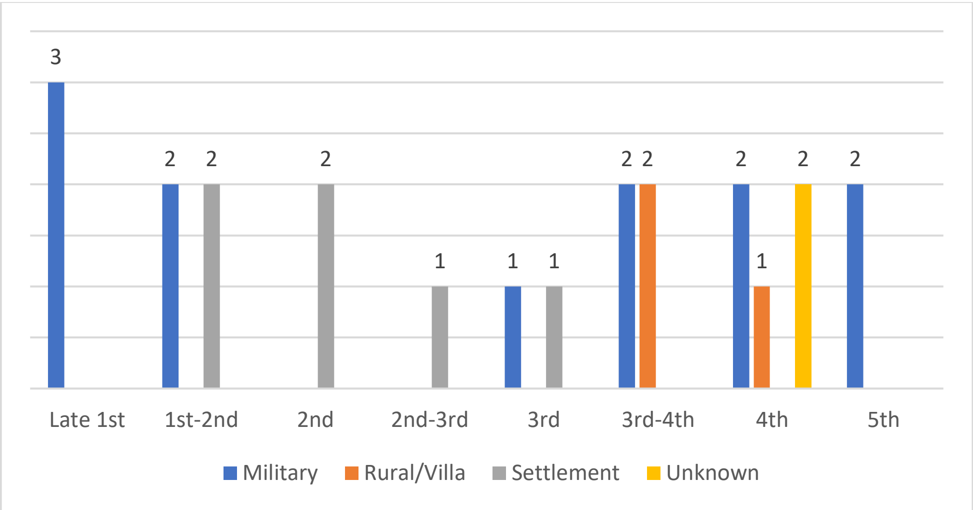


Figure 77: Number of hooks from military, rural, and settlement sites by date.

Military sites are here defined as assemblages from military structures and considered to be linked to the food supply of Roman soldiers. The hooks recovered from the North-East and North-West are predominantly from military sites, or urban sites with a military foundation or association. Of the twenty-four hooks assigned military context, fifteen are from riverine environments (Figure 75), consistent with the strategic distribution of inland fortifications (Mattingly 2007, 132-135). In the North, North-East and North-West regions, four hooks from Newcastle (H2-H5) have direct access to riverine and coastal resources, while the remaining six military hooks are from inland riverine and riverine/estuarine ecosystems at Vindolanda (H1), Carlisle (H7), Ribchester (H9 and H10), Chester (H11), and Longthorpe (H25). Chester and Carlisle have an accurate chronology (late 1st century), ensuring a military context, as does Vindolanda for a later period (4th and 5th century). In the South, South-East and South-West of England fourteen hooks are associated with military contexts at Wroxeter (H14, H21 and H22), Caister-on-Sea (H24), St Albans (H26), Gloucester (H32 and H33), Hod Hill (H39 and H40), Portchester (H41), Chichester (H43, H44 and H45), and Caerleon (H80). The only hook from Wroxeter with a fixed chronology (1st to 2nd century) is H14, associated with the military fortification. Chichester reveals a consistent use of hooks in the 1st (H44) and the 4th (H43) century. Meanwhile, H24 and H26, from Saxon shore-forts, have been dated to the 4th and 5th centuries, respectively, which follows the refortification of British coasts and cities (Mattingly 2007, 326-333). The remaining examples have no fixed chronologies, for which we are reliant on the archaeological interpretations when assigning a military context.

Rural sites are primarily composed of Roman villas, consisting of six hooks from Beadlam (H8), Woodeaton (H28), Worsham (H29), Keynsham (H38), and Fishbourne (H46 and H47). The remaining three hooks are from unstratified and highly questionable deposits with no structural association, two of which were recovered in proximity to the Thames (H50 and H51) and a single find from Appleford, Oxfordshire (H30). Though consisting of only six sites, we should note that the villa-associated hooks are all in proximity to riverine environments. One example (H29) is an Fe. hook, and another is yet unidentified, but there is a noticeable majority of Cu. alloy hooks from these sites. Chronology remains unreliable, with only the Fishbourne examples being dated to the late 3rd to early 4th centuries.

The final site type is the settlement, that is, a civilian urban environment associated with Roman towns, colonies, and cities. Of the thirty-three hooks recovered, twenty-eight are from

London alone, only two of which have been dated, H77 (mid-1st to mid-2nd centuries) and H78 (mid-3rd century). All of the London examples are considered riverine and estuarine, due to the tidal and saline nature of the Thames during the Roman occupation. Meanwhile, there is an almost even number of Cu. (fifteen) and Fe. (thirteen) hooks. Only one example from the North-East region has been recovered at Chester, Cu. hook H12, which has no further details on the cultural context. The remaining three hooks were recovered in riverine environments at Chichester (H48), Silchester (H42), and Sea Mills (H37), the latter of which is the only Fe. example. Silchester represents a curious example due to the absence of immediate or significant aquatic environments in the vicinity. Both H42 and H48 have been dated to the mid-2nd century, while H37 has an earlier date of 1st to 2nd century.

5.4 Interpretation

The assessment of the Romano British hooks has outlined the predominant type, the barbed J, consisting of thirty-nine examples. The most numerous are under 55 x 25 mm, considered 'small' by the current classification. The medium examples are also numerous, while large hooks, those above 100 mm, consist of two examples only. Other shaped hooks are also sparse, and it is proposed that the ring and quadruple hooks (included to represent recorded finds) are probably not Roman fishing equipment. The double hooks appear to be impacted by misinterpretations also, however, a single convincing artefact from London (H53) is representative of the use of this type in Britain. The Elongated J is also represented by few examples, though characteristically distinct from the J hook in the length of the shank. The division of the hook into diagnostic parts has highlighted further consistencies, in the dominance of flattened terminals and the sharpened barb (Type 3). There are examples of barbs that may be singular occurrences caused by unskilled production, alteration, or damage, yet, the needle, notched, and knife-edge include several examples supporting their intentional production. While little can be said as to their function until further examples are recovered, such characteristics are important for defining morphological discrepancies among further artefacts. The pointed hooks are represented by various examples with morphologies that indicate alternative functions, leaving only one example (H64) that resembles barbed fishing hooks in shape and size. In the case of the needle barb, all but two examples (H76 and H78) are made from copper alloy, which is indicative of the influence of material on the production method. There is a noted discrepancy between size averages for iron and copper hooks, with iron examples being the largest hooks recovered in Britain. Copper hooks are notably small, bellow 59 mm in length; it is unclear if this is a consequence of the cost of material, the perceived reduced strength in relation to the intended catch, or the greater ease of acquiring a desired shape or barb.

Whether the current collection of Romano-British fishing hooks can be viewed as representative is determined by their relation to noted cultural occurrences, the extent of their survival and retrieval in archaeological contexts, and consistencies in the aforementioned classification. Almost all the hooks have been recovered at freshwater environments. The absence of data from coastal sites may be a result of iron oxidation under highly acidic conditions (Alcock 1990); that said, the absence of more soil-resistant copper hooks from coastal sites is a significant phenomenon that indicates a reduced presence of shore-based hook and line fisheries. Hooks are often found individually. Only the sites of Wroxeter (H15-H23), London (thirty artefacts), and South-Shields (H2-H5) have produced several hooks, the latter for which we currently have no data. At Wroxeter, though all the hooks are of the 'J' type, they vary in material, barb, and size (from 28 to 68 mm in length) and have no chronological data with which to propose a combined assemblage. London has revealed a large number of hooks with consistency among several types that may potentially indicate a related production, nevertheless, the comparatively dense population of the city would maintain the hypothesis of a supplementary dietary-role for the current number of hooks. Fishing as a leisure activity by the elite, or as a supplementary provision for villa owners, may be reflected by the scattered rural examples of more complex and distinctive types, such as the notched or the needle barbs. The same may be said for military sites, where individual hooks have been identified. Where chronological data is available, there is a noted shift in the predominant context of hooks, from military in the 1st century, to urban in the 2nd to 3rd centuries, to military and rural in the 3rd to 5th centuries. Although based on a small number of dated finds, this is consistent with the occupation and transitional phases outlined in Chapters 1 and 2; the military presence, followed by the colonisation of new and formerly Iron-Age settlements, followed by an increase in villa structures and the refortification of settlements towards the end of the Roman occupation (see Mattingly 2007 346; Allen et al. 2017). To this end, hooks appear to be consistent in various aspects: the socio-political transitions of the island, their standard size and distribution among riverine and/or estuarine environments, and their individual recovery throughout. There are numerous issues with hook assessment and publication that warrant caution in suggesting that the current evidence may be representative. Other than advocating a continued catalogue of hooks, identifying targeted species may prove useful in affirming the function of the Romano-British hook as a subsistence tool with no defined commercial value.

Relating the various hooks to species is a more complex task, for which hooks alone provide a partial picture. Other than Northern pike, few inland species would be large enough to require large hooks. Species such as the Atlantic sturgeon or the Atlantic salmon can reach lengths of around 6 m and 1.5 m, respectively. The primary suggestion of the 'J' shaped hook is one used for subsistence fishing, perhaps this is more accurately described as 'domestic-subsistence' whereby the small volume of acquired fish reflect an alimental subsidy rather than a commercial resource. Noted species that could be targeted by hook and line in Britain includes marine fish reaching the brackish waters of the inland reaches of estuaries, such as flatfish, seabass, and stray gadids; diadromous species and those capable of withstanding freshwater at the lower reaches of rivers, such as flounder, salmon, and mullets; and freshwater fish, such as cyprinids, brown trout, perch, and pike. The latter may account for the Elongated J hooks recovered. The lack of evidence for long-lines highlights the absence of intense marine fisheries targeting deeper species, while the few coastal finds indicate the capture of individuals only, such as sparids and wrasses. The current evidence is indicative of these individual catches, which now requires an assessment of the ichthyofaunal remains to determine if the hooks are indeed representative.

6. The Lead Net Weights

The lead artefacts included in this study are the cylindrical lead weights, consisting of two broad types: the cast lead cylinder and the altered lead sheet. As discussed in Chapter 2, Mediterranean typologies have identified more numerous types of lead weights related to fishing (Galili et al. 2002; Bernal 2010; Vargas 2020); among the British evidence, the most diagnostic and recorded examples (published and in grey-literature reports) are the cylindrical weights formed by rolling or folding lead sheets. A range of discrepancies are visible among this type and it is unknown if these relate to alternative subtypes, damaged examples, or tools with an alternative function. The latter suggestion is particularly influenced by the recovery of Roman curses (*defixiones*) throughout Britain. As highlighted in Chapter 3, although these artefacts may appear similar, there are noted differences that require elucidation here. It is therefore important to differentiate the various subtypes and identify the most consistent morphological attributes with which to determine evidence of fishing.

The frequency of each subtype is illustrated in Figure 78. Of the 313 artefacts, 190 (60 %) are rolled and clasped lead weights. The remaining diagnostic types constitute 21 % of the artefacts; meanwhile 19 % are currently undiagnostic due to the absence of data, although they have been described as rolled cylindrical weights. The ‘cast tube’ is represented by only three examples (W74, 175 and 224), which means that the remaining 310 artefacts are all the result of the altering of lead sheeting. The ‘multiple folds’ is represented by a single find (W26), while the ‘overlapped’, ‘folded’, and ‘partially unrolled’ are fairly consistent. That said, the fourteen ‘partially unrolled’ finds derive from only two sites, Worth and Heybridge, and the fifteen ‘folded’ weights are from only three sites, at Wroxeter, Rushock and Heybridge. This is in stark contrast to the ‘overlapped’ type, which, though consisting of only fourteen finds, has been found at ten sites across the country. The ‘clasped’ weight is the most common type and is therefore the primary focus of the halieutic assessment; nevertheless, it is necessary to distinguish the various subtypes and their attributes to determine the cause of morphological discrepancies and whether they relate to fishing practices.

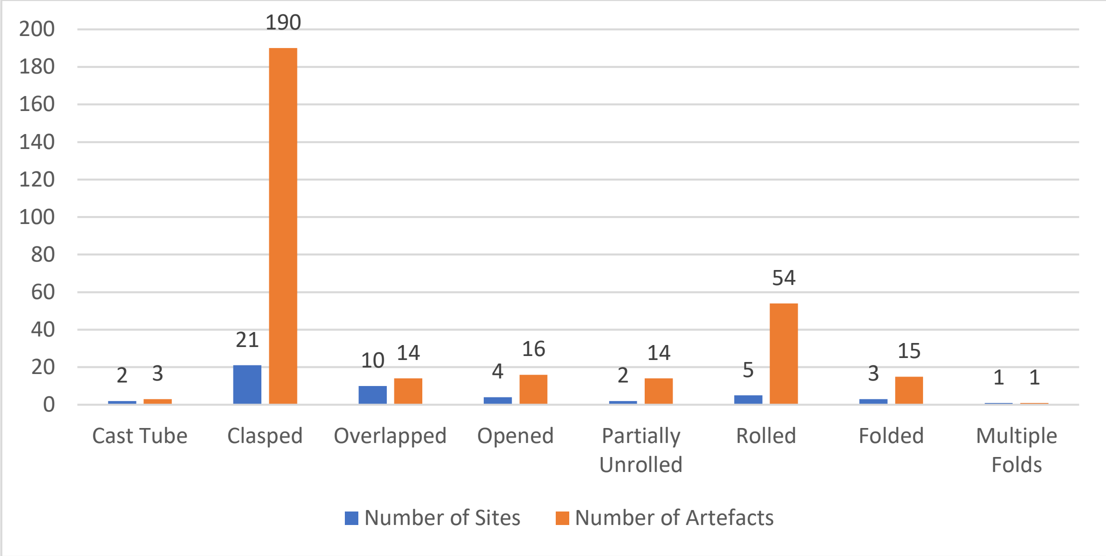


Figure 78: Number of sites and number of artefacts divided by the weight subtype. The rolled type relates to unrecorded examples with a basic description.

6.1 Distribution

The lead artefacts derive from thirty-three sites (see Appendix C, Part 2, for full list of locations). Assemblages tend to be small, with only a single artefact having been found at twenty of the thirty-three sites. Those with ten or more examples include Wroxeter, Worth, Gill Mill, Lydd, and Heybridge. Heybridge is by far the largest case study, with an estimated 192 rolled or cylindrical lead weights, of which 145 have been included in this investigation; those that were too poorly fragmented have been excluded as they represent an unknown number of objects. This collection derives from an assemblage of over 350 weights, many relating to other non-fishery functions such as steelyard and scale weights, equalling close to two tons of lead (Atkinson and Preston 2015). The following largest assemblage is Lydd Quarry (Kent), where sixty-two artefacts were recently recovered from two phases of excavation, but which have been stored prior to any adequate assessment. The next largest site is Wroxeter with twenty-seven artefacts, a disparity that demonstrates the significance of the Heybridge and Lydd assemblages.

Weights have mostly been found in proximity to estuarine or coastal environments. The largest site, Heybridge, is in the South-East region, where the rivers Chelmer and Blackwater meet the Blackwater Estuary. Only two examples are currently known for London (W21 and W22), while the remaining two sites in the South-East are further inland in the Thames Valley, at Gill Mill (W45 to 54) and Swindon (W5). The South region contains the second largest assemblage, from Lydd Quarry, in Kent, which is a coastal site with no known past or present estuarine or riverine environments in proximity. Kent is especially rich in artefacts, with an additional ten weights from four sites, three of which had access to coastal environments. An additional five artefacts from the South region derive from three sites in Hampshire (W1), Dorset (W3), and the Isle of White (W27 to 29). All are in proximity to estuarine environments and the coastline of the Solent. The western extent of the South region, including the Cornish peninsula, has produced no weights at this time.

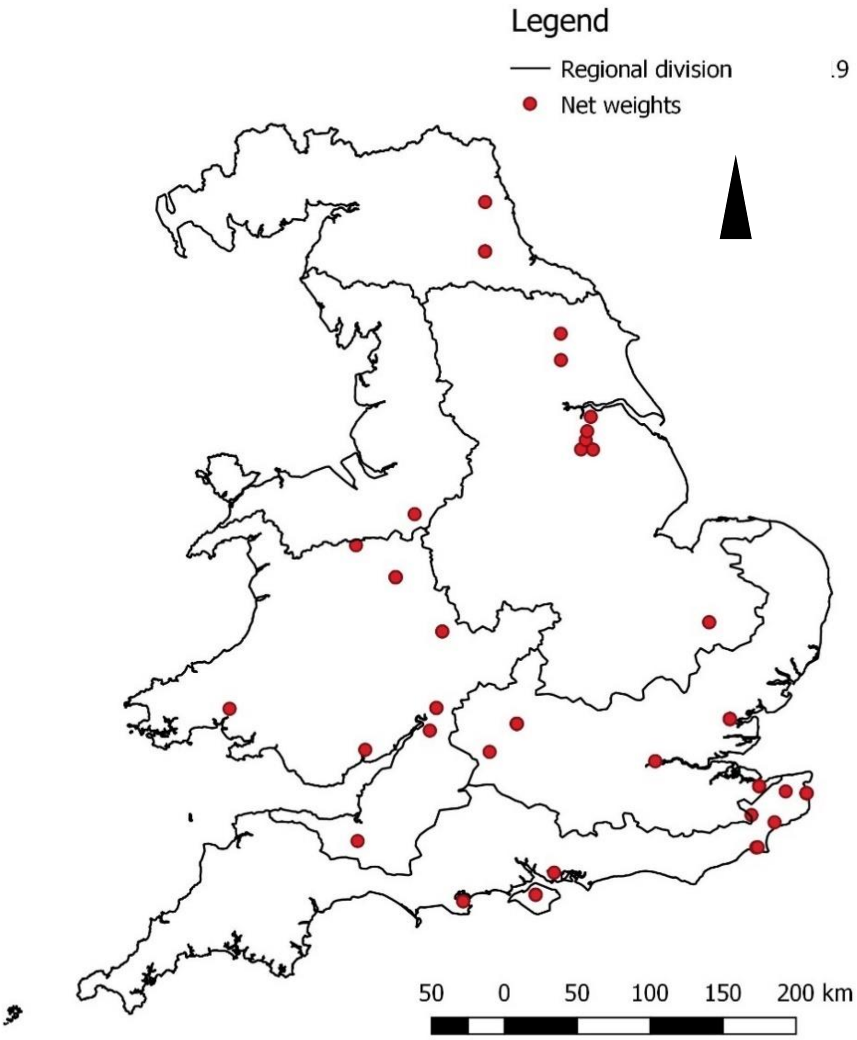


Figure 79: Distribution of lead artefacts divided by major watershed region.

The South-West region is represented by eight sites with a collective thirty-eight weights. Regardless of the Severn Estuary and the expansive coastline of southern Wales, Gloucestershire, and Somerset, all of the artefacts are from riverine environments. Two artefacts have been recovered in Wales, from Caerleon (W11) and Camarthen (W12). On the English side, as with the Caerleon example, six additional weights are from inland zones in relative proximity to the Severn, at Gloucester (W34 to 37), Frocester (W4), and Taunton Deane (W6); however, the majority of the South-West weights are from further inland and greater elevations. Two weights from Rushock, Worcestershire (W25 and W26), a single weight from Oswestry, Shropshire (W8), and twenty-seven weights from the far inland site of Wroxeter, Shropshire (W75 to 101).

The North-West region is represented by a single inland artefact from Shavington-cum-Gresty in Cheshire (W7). No weights have been found on the Irish Sea coastline of Britain, including in the North region where five examples have been found at the inland riverine sites of Newcastle (W2) and Binchester (W30 to 33). In contrast the North-East is represented by eight sites but only nine artefacts. There is a noticeable concentration in north Lincolnshire, where five sites are located on the high ground between the rivers Eau and Trent (W16 to W20). Further north two sites follow the River Derwent at East Riding (W9) and Barton-le-Street (W10). The North-East region also encompasses the Wash and the vast flood zones and river mouths of this area, yet only two artefacts have been identified at Mildenhall, Suffolk (W23 and W24).

6.2 Typological Consistencies

The primary function of a fishing weight is to sink a net or line, for which the weight is considered the primary control in the manufacturing process. Weights among the Romano-British examples range from 2 to 121 g, with only one example surpassing this (W26 at 249 g); however, due to the absence of strict guidelines for these objects, the weight is a detail that is often omitted. A total of sixty-seven examples in this study are missing the volume of weight (e.g. Webster 1975; Zienkiewicz 1986; James 2003; Priestly-Bell 2006), of which forty-eight have been weighed in bulk and have an average estimate of 20 g (Lydd Quarry: Pirestly-Bell 2013) and 28 g (Dicksons' Corner: Parfitt 2000). The large collection from Heybridge was also subject to an overall weight range and average, published online (Atkinson and Preston 2015), a consequence of post-excavation assessment restrictions; however, this assemblage was accessed and assessed in detail for this investigation. Thus, a total of 246 weights included in this assessment include a specific volume of weight. The majority of the artefacts have a weight range of 19.2 to 27.8 g which alludes to a desired standard weight (Figure 80). The proposed weight averages for the sites of Dickson's Corner and Lydd Quarry (20 and 28 g respectively), further supporting this observation. The following objective is to determine if the shape of the artefacts relate to the desired weight, and if there are any further consistencies that pertain to a consistent manufacturing process.

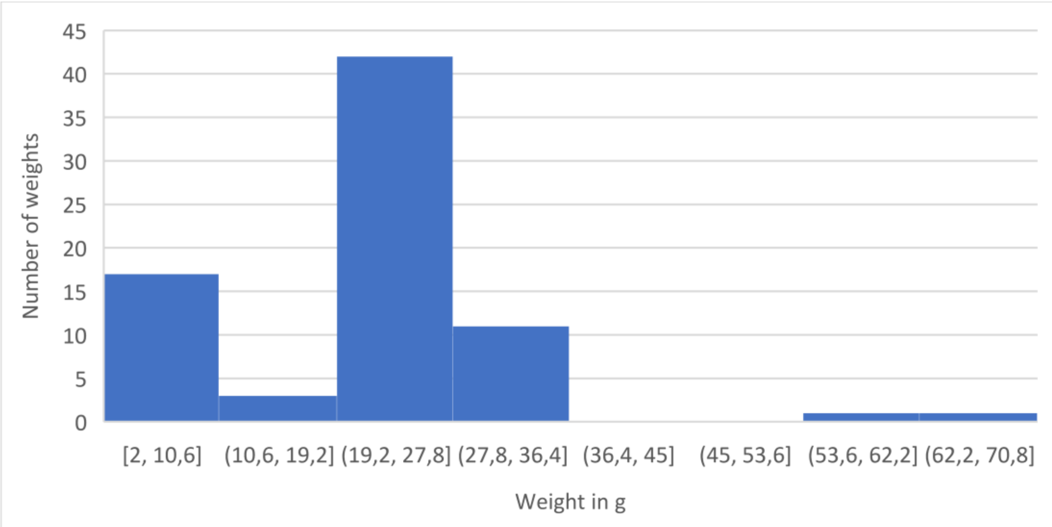


Figure 80: Histogram of predominant weight ranges in grams.

6.2.1 Sheet Thickness

The reason for large disparities in weight is the density of the object, which can be affected by various criteria: length and width, the amount of overlap of the lead sheet, and the sheet thickness. In this manner, objects of similar size may vary in volume. Sheet thickness for Romano-British weights is a datum that has been excluded from previous studies but is an important addition to determine consistency in the material and method of manufacture. The sheet thickness ranges from 0.6 to 6 mm. There are only six examples above 5 mm, while the majority, a total of 136 weights, are between 2 and 3.5 mm thick. A total of twenty-one artefacts are below 2 mm and only two examples are below 1 mm, W20 from Roxy Cum Risby (0.6 mm) and W37 from Gloucester (0.95). The current figures reveal that the majority fall between 1.5 to 3.5 mm thickness (Figure 81).

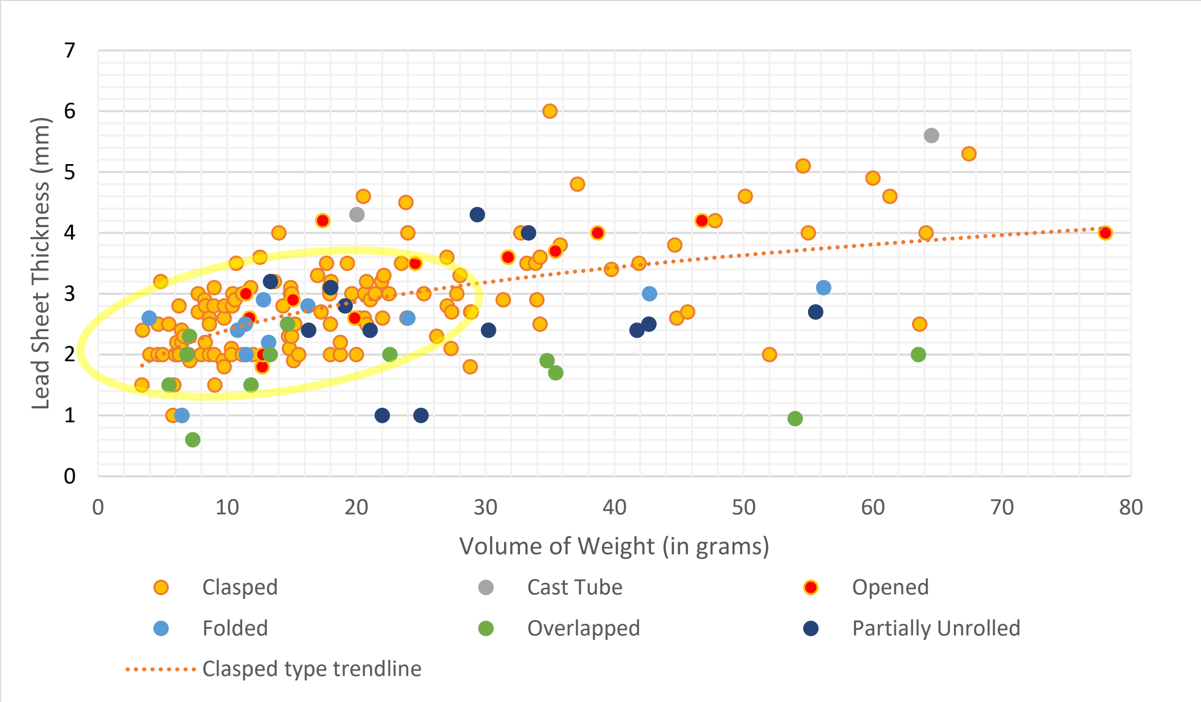


Figure 81: Ratio of weight-to-sheet thickness, divided by weight type. 180 artefacts are included in order of weight (lightest to heaviest) in the horizontal axis, and their corresponding thickness in the vertical axis.

The subtypes are generally inconsistent, although it is important to highlight that the cast tubes are all above 4 mm thick, a likely result of the production method. It is the overlapped subtype that has revealed the most consistent sheet thickness in relation to the large disparity in weight (Figure 82), with variations between 6 and 60 g maintaining a consistent and relatively thin sheet thickness, at under 2 mm (averaging 1.9 mm). The multiple rolls of the overlapped examples influence the volume of weight, which may suggest a conscious use of longer lead sheets for their fabrication; this may also relate to alternative functions other than fishing, which is discussed in the interpretation.

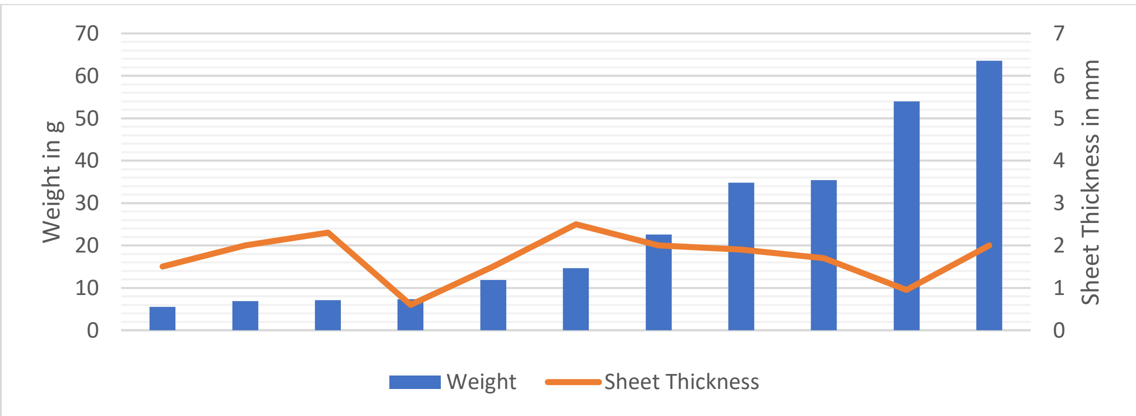


Figure 82: Ratio of sheet thickness to weight of the overlapped subtype.

The clasped weight reveals several consistencies within the 1.5 to 3.5 mm range (Figure 81), yet several examples stand out as thinner or thicker than their counterparts. Weights above 25 g appear to have more numerous discrepancies but are also represented by fewer examples. Among the lighter examples there is only a slight increase in weight based on sheet thickness, which suggests that sheet thickness was not used as a control; The concentration of weights between 1.5 and 3.5 mm thick does suggest a consistency in the material that was used; if so, the additional morphological attributes of the artefacts should play a more direct role on the intended weight.

6.2.2 The Size of the Artefacts

As these objects are made of lead, size has a significant influence on weight. Size ranges between 11.5 and 85 mm in length and 7.5 and 39.5 mm in width (not including the 'partially unrolled' type). The lightest examples are naturally on the lower end of the measurements, while the larger examples can vary substantially in weight. Indeed W26, from Rushock, is the heaviest example (249 g) and is 45.1 x 35.9 mm. In contrast, W221 from Heybridge, is the second largest example at 62.5 x 26.6 mm but weighs 58.51 g, a substantial variation. The largest example to date is W130 (85 x 20 mm) a clasped type recovered from Camarthen (James 2003), but for which there is no weight datum.

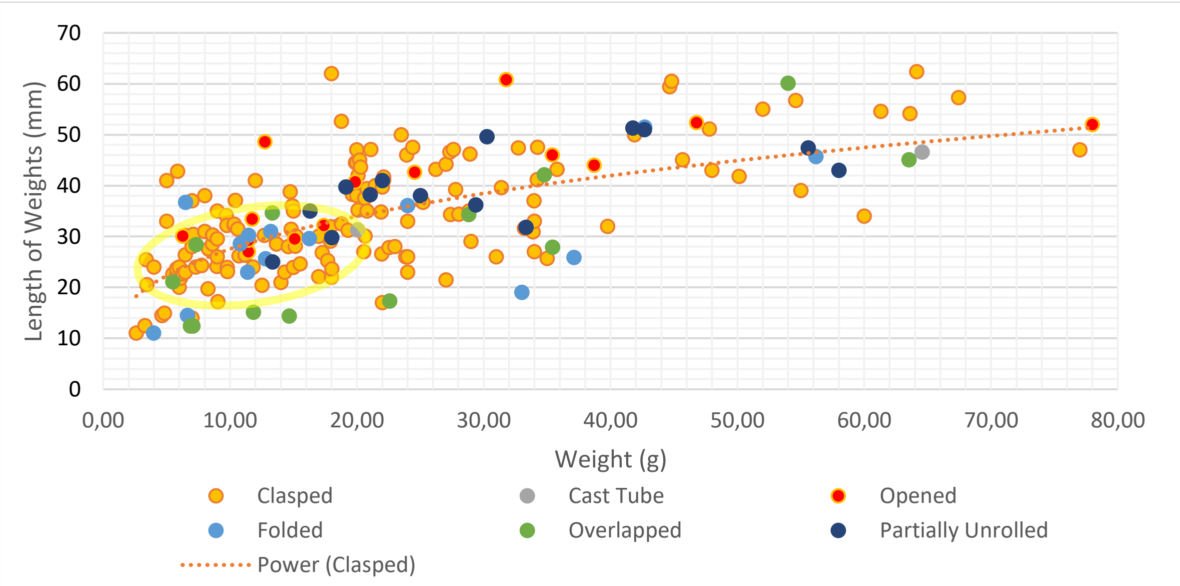


Figure 83: Ratio of weight-to-length, divided by weight type. 213 artefacts are included in order of weight (horizontal axis) and their corresponding lengths (vertical axis).

Length has also revealed various inconsistencies among the subtypes. Many of the 'opened' weights are progressively heavier with added length, though two larger examples of substantial length are comparatively light (W180 and W288). The 'overlapped' weights have numerous inconsistencies regardless of the uniform sheet thickness at under 2 mm, which highlights the influence of multiple layers on the resulting weight. The clasped weight reveals a notable correlation of weight-to-length (Figure 84). Of the 156 clasped weights with recorded data of both values, 105 are between 20 and 40 mm in length and 2 to 20 g in weight (67%). Of the remaining heavier examples, several follow a general progression of weight to length, but there are notable discrepancies that suggest additional criteria impacting the final product.

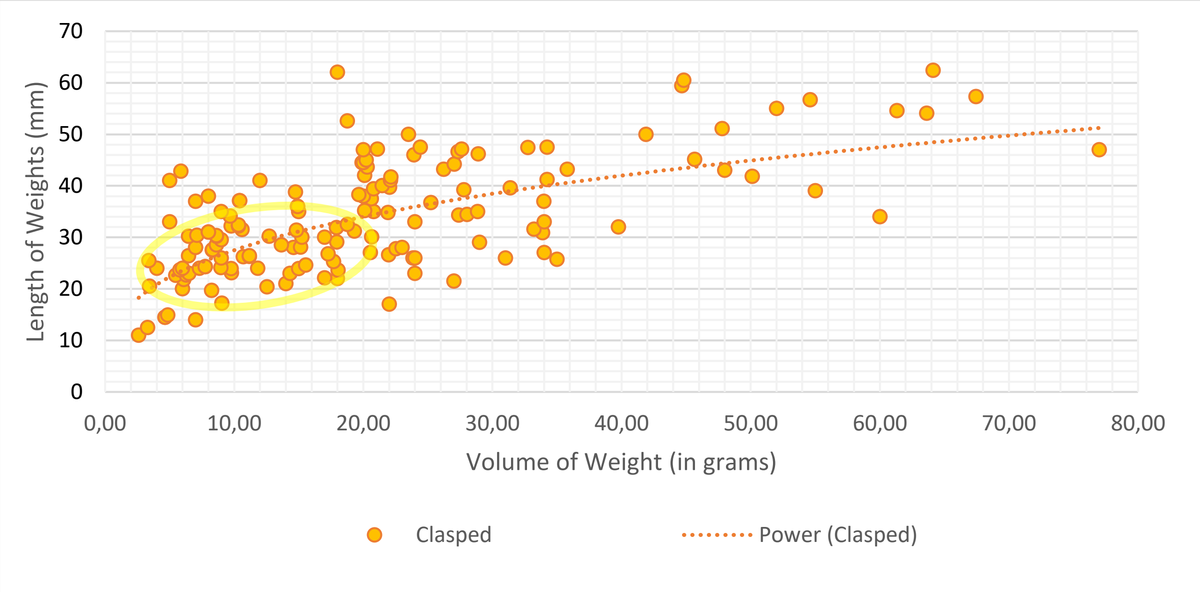


Figure 84: Ratio of weight to length of the clasped subtype. 156 artefacts are included in order of weight (horizontal axis) and their corresponding lengths (vertical axis).

The artefacts do not have consistent widths, for which reason these inconsistencies are an additional factor in the control of weight and the noted discrepant lengths. As previously stated, width is prone to damage, more so than length, as cylindrical weights can be compressed or opened; nevertheless, if a controlled in the production method width adds sufficient mass to the object impacting the resulting weight. The graph below (Figure 85) shows several artefacts that are shorter or longer than others of equal weight and where the width is influential of the subsequent mass (e.g W16, W48, W252, W256). As shown above (Figure 80) there appears to be a consistency in the weight of these artefacts at 19 to 27 g, which implies that there was an intended weight during production. If this is the case, it appears that weight was the desired product, rather than a preferential length or width.

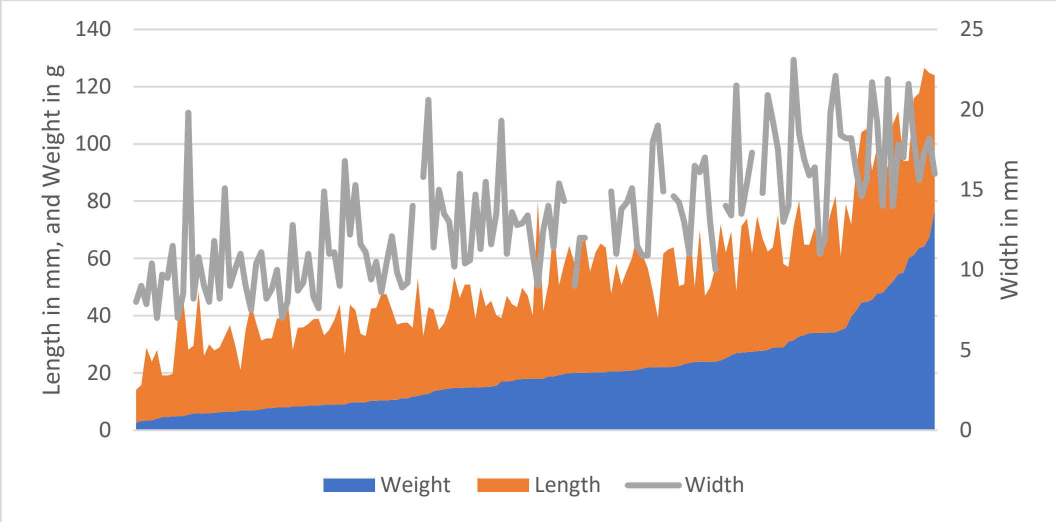


Figure 85: Discrepancies in length-to-weight ratios of the clasped weight and the potential impact of width (shown in grey).

There are too many discrepancies among the collective clasped weights to confirm this, for which it is important to look at assemblages where multiple artefacts have been recorded. To our disadvantage, sites with multiple artefacts are largely unpublished or have partial data. Only the site of Heybridge has produced numerous artefacts that include the relevant data. However, the 104 clasped weights from Heybridge constitute the majority of the clasped subtype from Britain and therefore projects a similar picture (Figure 86). Eighty-one of the artefacts are below 30 g (77 %), supporting the previous suggestion of an intended mass. The remaining heavier weights either represent an acceptable discrepancy for the artefacts to be used together or are representative of various net types.

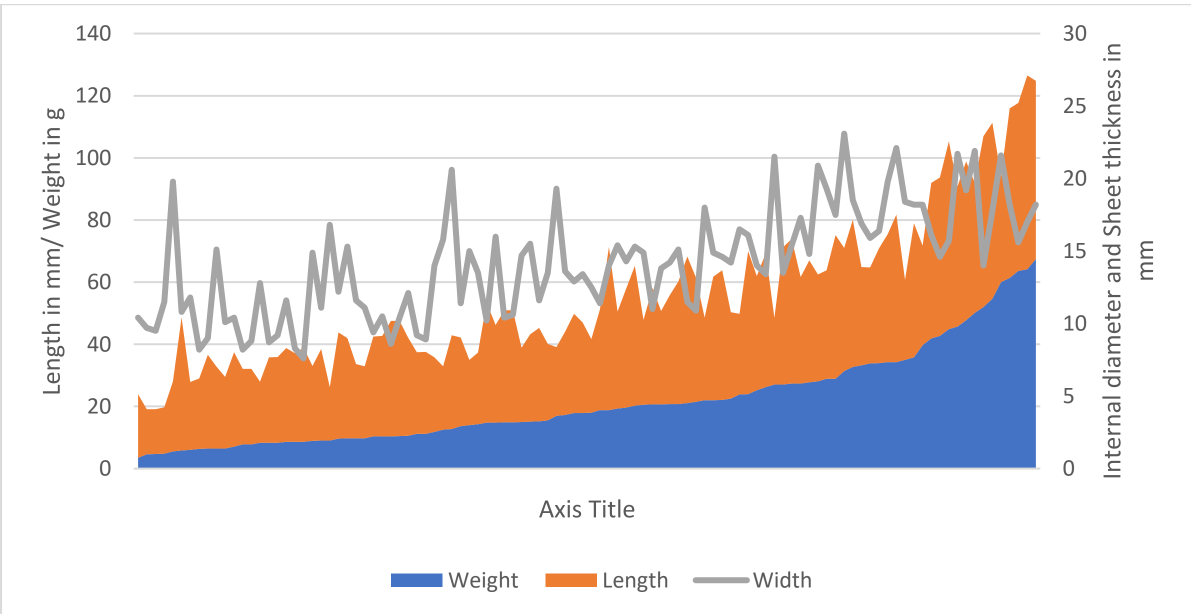


Figure 86: Discrepancies size to weight ratios of the clasped subtype from the site of Heybridge (104 artefacts).

6.2.3 The Perforation

The perforation of a weight has been described as the result of the thickness of the cord to which the weight was attached (Alfaro 2010; Bernal 2010, 117), as such, a consistency in perforations is expected if a net structure was being used. This 'internal diameter of the perforation' ranges among the clasped subtype between 1 and 6 mm, but with a uniformity around 2 to 4 mm. Forty-one of the clasped weights with measurements have been damaged, resulting in warped internal diameters. The same is the case for the opened and partially unrolled subtypes. The overlapped and folded sub-types are largely compressed to the extent that there is no perceived perforation.

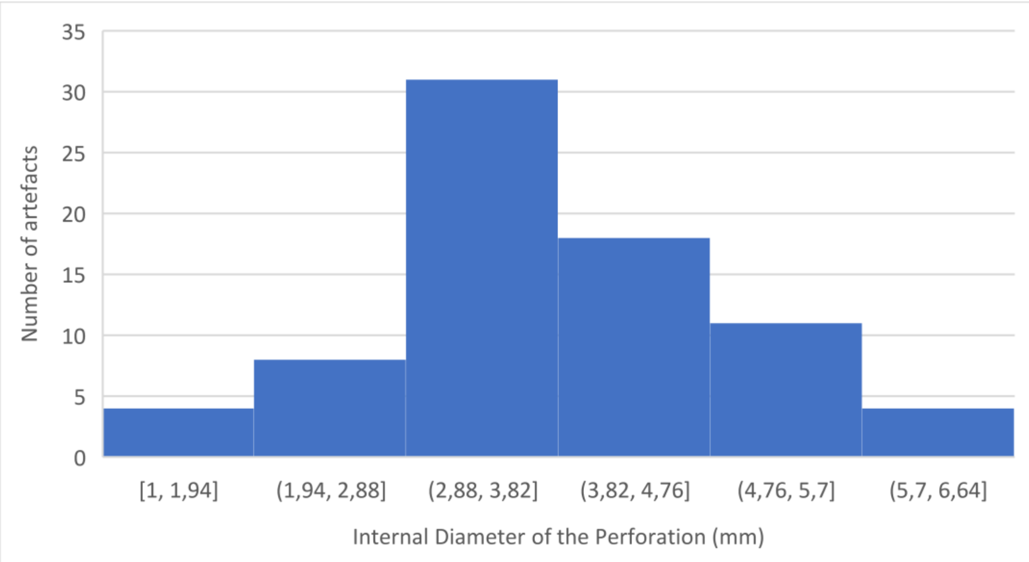


Figure 87: Histogram of predominant size range of the internal diameter of the perforation of the clasped weights (96 artefacts).

6.3 Typological Distribution

The six regional divisions by major watersheds all include freshwater, brackish, and marine environments, though there is the previously noted dominance of estuarine zones in the South-East region, and short river systems and extended coastline in the South region. This appears to be reflected in the recovered clasped lead weights from Romano-British sites (Figure 88). All the weights from the South region were recovered at coastal sites; while most of the weights from the South-East derive from the large brackish environments of the Thames and Blackwater estuaries, with a small collection of weights from the riverine site at Gill Mill, in Oxfordshire. The remaining regions depict an absence of coastal or estuarine weights. It is important to highlight that several artefacts lack the relevant data with which to suggest a morphological classification (excluded from the subsequent assessment), meanwhile, uncertain chronologies prevent the inclusion of large assemblages that may influence the under-represented regions. One example is a collection of forty-three weights from the Humber estuary (see Appendix A, Part 2), which resemble Roman examples in every aspect, but may indeed have a medieval date. While all subsequent regions require the inclusion of stricter archaeological records of such artefacts, it is only the South and South-East, that currently indicate the location of potential Roman fisheries where numerous weights and therefore nets were used.

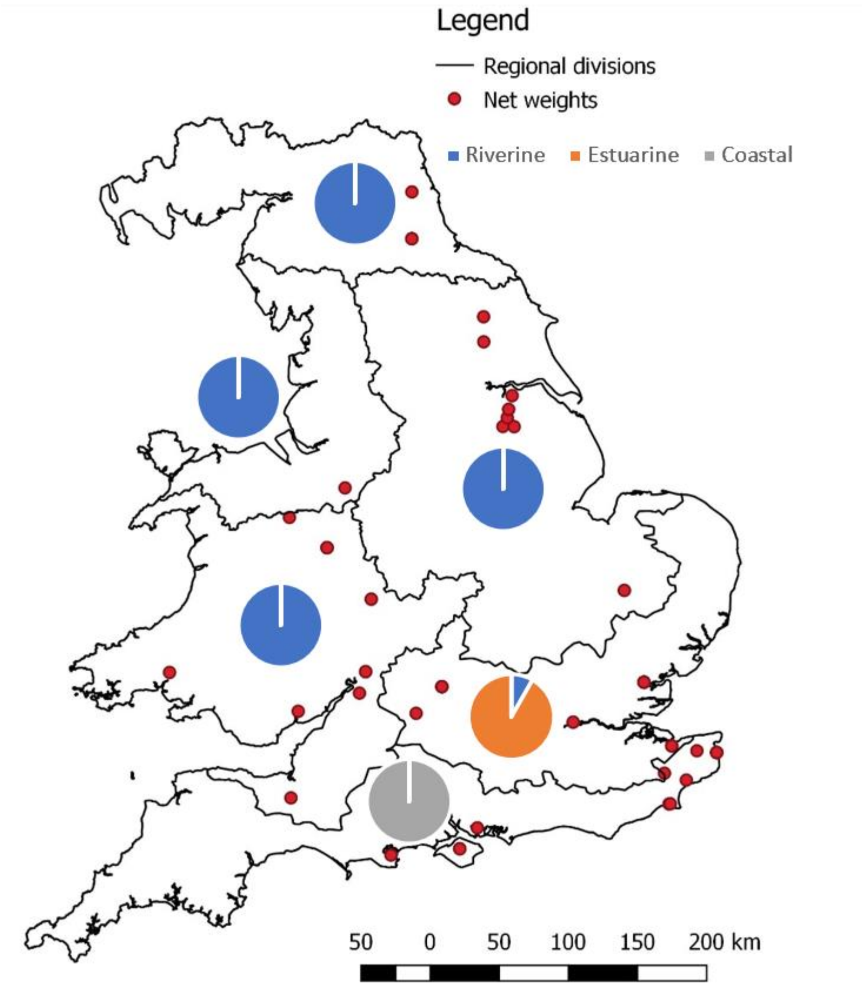


Figure 88: Distribution of weights and the inclusion of the clasped type weights based on the type of aquatic environment in which they were recovered (represented by pie-charts).

If viewed by the volume of weight, there are further geographical patterns of interest (Figure 89). As stated, the South and South-East regions contain the largest assemblages of clasped lead weights (from both coastal and estuarine environments), at these sites, a range of sizes are represented. In contrast, the numerous freshwater sites consist primarily of weights below 20 g. If the size of the weights is representative of the size of a net, this may indicate the use of smaller nets in freshwater environments. The exceptions include Gloucester and Wroxeter, both inland freshwater sites. The latter has been shown to have a substantial number of artefacts relating to fishing and is therefore an anomaly for inlands sites.

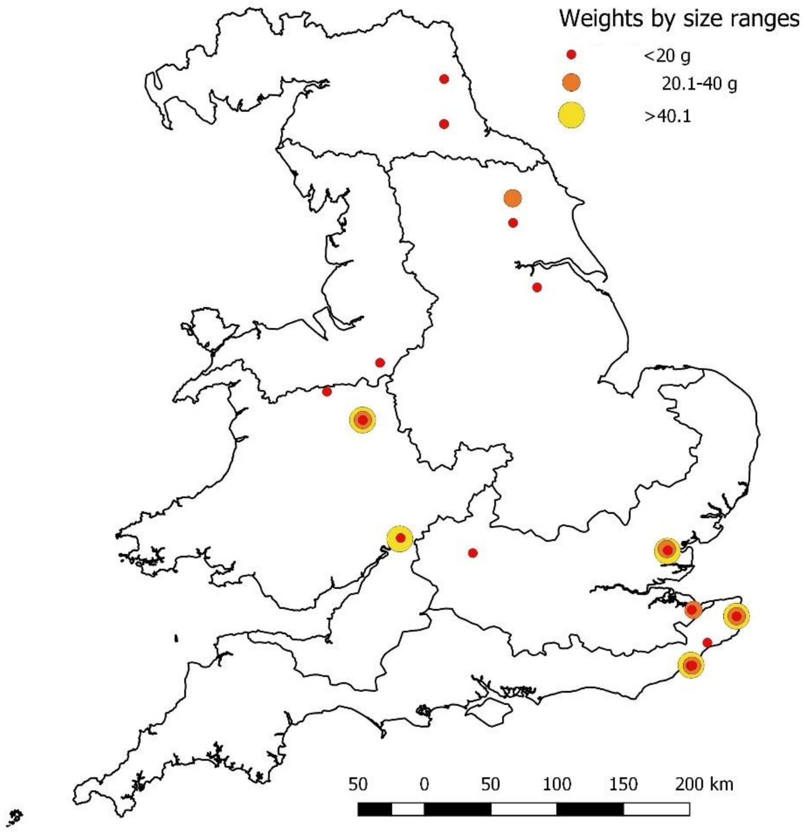


Figure 89: Distribution of clasped weights based on three average weight ranges.

To elaborate on this distribution, a further subdivision of the artefacts into 10 g accumulations elucidates on the frequency of these size ranges (Figure 90). A measure of 10 g intervals have been chosen due to the uncertain differentiation between the 19-27 g averages and smaller or larger examples. The larger weights (>40 g) appear to be rare examples and constitute a minority of the evidence by a substantial margin. The most common are between 10 and 30 g; of interest is the dominance and consistency of c. 20 g weights at coastal sites, followed by the even distribution of both small and medium examples at estuarine sites. These appear to indicate consistent fishing practices using a standard measure of lead weights. The type of net that would have been used is a more complex matter that requires the inclusion of the accompanying archaeological evidence.

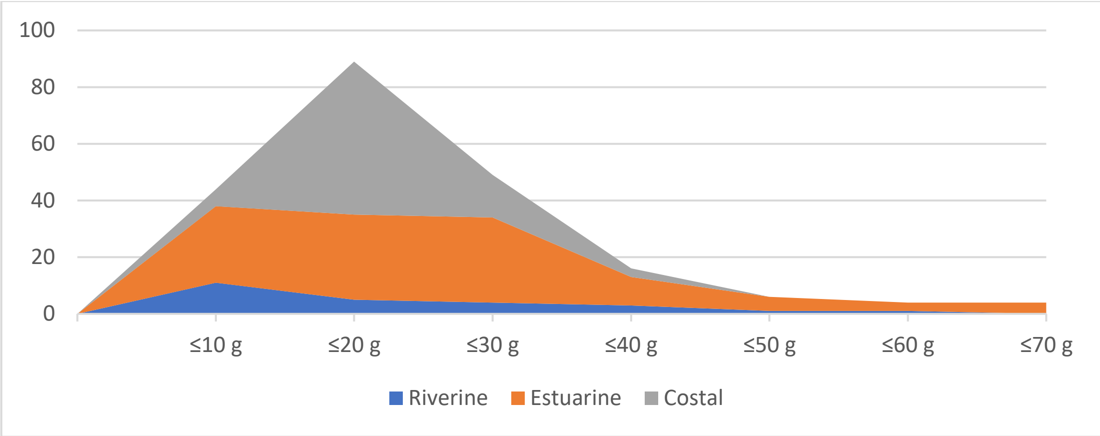


Figure 90: Number of clasped lead weights by volume of weight and according to aquatic environment.

The site of Gill Mill has produced ten weights (W45 to W54) recovered from the same deposit (Booth and Simmonds 2018). These reveal several consistencies that allude to their use on a single device: they are all of the clasped type; the recorded internal diameters are consistent at 3 mm, with two slightly warped examples with measurements of 3 to 4 mm (W45) and 2 to 4 mm (W50); they have a consistent sheet thickness of 2mm; and they have a weight range between 4 and 18 g. Collectively, the volume appears to be diverse, yet, seven examples are between 5 and 9 g, with only two examples above 10 g. The measurements appear to have a greater disparity, with a range between 20 and 62 mm; however, as previously discussed size is not consistently indicative of weight. The Gill Mill examples suggest some consistency in weights used, supposedly on a single device, with the internal diameter being the primary indicator due to the constant thickness of the cord to which they were attached.

The site of Graveney, Kent, is another example of a small assemblage with consistent artefacts (W38 to W44), though missing the inclusion of the internal diameter and the sheet thickness. The seven clasped weights, recovered near brackish and freshwater environments, reveal a greater uniformity of both volume of weight and size. The weights range between 19.9 and 27.6 g, though only W40 is below 20 g; meanwhile, length ranges between 35.2 and 47.5 mm, though W44 is the only example below 41 mm. The fact that six of the seven weights are above 20g, suggests that this was indeed the intended target and that such a consistency relates to a uniform production method and choice of lead sheeting, and potentially their application on a specific net.

One final site that bearss mentioning but needs further investigation, is Lydd Quarry, Kent. Two excavations (Site 12 C and Site 18), have produced thirty-seven and twenty-five weights respectively. The limited study has produced weight averages for the former (Priestley-Bell 2006) and weights but no other data for the latter (Priestley-Bell 2013). The former, as previously discussed, has an estimated average of 20 g per weight. The latter assemblage of Site 18 does include individual weights, ranging between 2 and 48 g. Although it may appear a large disparity, eighteen of the artefacts are between 10 and 20 g, with only three above 20 g, and with seven examples with a close range between 16 and 18 g. If the former site is consistent with these measurements it is possible the evidence from Lydd Quarry is indicative of a fishing method where an intentional weight range was used.

6.4 Interpretation

The weights assessed above constitute the most numerous and diagnostic examples from Roman Britain, that is, the rolled lead sheets. These devices vary in size and production method, drawing attention to the potential for function-specific rolls among various net-fishing methods. Although the rolled net weights are relatively simple in morphology when compared to the fishing hooks, they represent one portion of a complex and organic device for which we have no archaeological remains, the net. One objective is therefore to determine if the assessed objects can reveal more about the methods of capture. The previous assessment has reviewed data from 310 artefacts and highlighted several consistencies that may prove fruitful in the current endeavour. Alternatively, a more vigorous method of recording is advised and outlined so that future assessments may advance the current hypotheses.

Of the 313 lead artefacts included in this study, those termed the 'clasped' type, are the majority with 160 identified objects (60 % of the total record); this percentile is further increased if we consider the 'opened' type and the various examples that appear to be altered or damaged clasped weights. The variety of volume, size, diameter of internal perforation, and sheet thickness, allows us to state with some certainty, that they represent various types of nets rather than one method. Various projections of data identify consistencies in these artefacts and some specifications are indeed apparent. The most numerous clasped weights tend to be small and relatively light, under 50 mm in length and under 30 g in weight. Large rolled weights are rare. A range of smaller nets are the likely candidates for the acquired clasped lead weights, but further discrepancies, even among the small weights, may indicate specific types of small-scale net fisheries.

Observations of sheet thickness has revealed no clear relationship with the volume of weight. A narrow margin of 5 mm from the thinnest (0.6 mm) to thickest examples (5.6 mm) can still have a crucial impact on the resulting weight; however, the identified average thickness is of approximately 3 mm. This is indicative of a consistent material being used for their production, whether purpose made sheeting, or recycled material. The curse tablets highlighted in Chapter 3.2 as causes of misinterpretations, have a thin sheeting at under 2 mm, which is consistent with the overlapped subtype. Additional criteria for this interpretation include the narrow or non-existent perforations, and the multiple layers, absent from the predominant clasped weight.

One hypothesis proposed and advocated by several scholars (Galili et al. 2002, 197-198; Alfaro 2010, 79; Bernal 2010, 119; Dütting and Hoss 2014) is the use of the smaller cylindrical weight, identified here as the 'clasped' weight, for cast-nets, due to both its lighter structure and narrower perforation; however, we must acknowledge that a diverse range of nets included light drift or drag nets, would not have required large volumes of weight to function. For these, the c.20 g clasped weights may well have been suitable. Furthermore, the general morphology of these weights does not change alongside the increase of volume for which the >30g examples were probably used on larger nets. There is clearly insufficient evidence to suggest a maximum limit of weight for smaller casting nets.

7. The Netting Needles

The Romano-British netting needles consist of twenty-seven examples consistent with the modern *Mediterranean-filet* needle (Figure 91). As discussed in the Methodology, the assessment criteria for these tools is underdeveloped, while proposed interpretations are limited; it is therefore important to elucidate on any and all observations made in regional studies. The comparatively small collection of British examples prevents a similar comparative assessment as proposed for the hooks and weights, instead, this chapter focuses on the morphological attributes that may relate to its function in the production of nets.

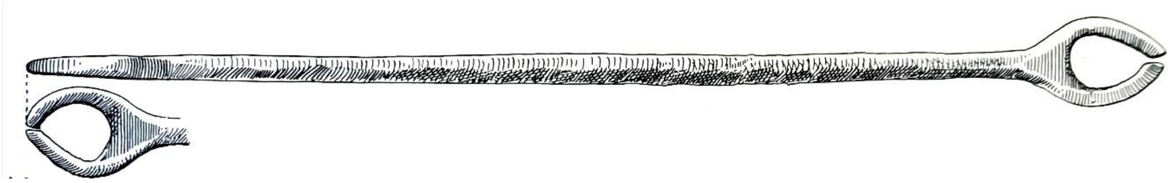


Figure 91: Example of a needle with eyes set at right angles. N23 from Richborough, Kent (Cunliffe 1968).

7.1. Distribution

The twenty-seven netting needles have been recovered throughout Britain and in all but the NW region (Figure 92). Seven needles have been found in proximity to coastal environments (N1, N2, N7, N20, N22, N23, and N25), all of which are restricted to the eastern and southern coasts. Of the remaining 20 needles, three are in proximity to estuaries (N14, N26, and N27) and 17 are from riverine ecosystems. In the case of N10, N11, and N12 from Northamptonshire, N15 from Oxfordshire and N4, N5, and N6 from Shropshire, the sites are located in isolated inland zones, where access to large aquatic ecosystems (such as estuaries and coasts) was unlikely.

London has only produced two netting needles, a stark contrast to the numerous fishing hooks recovered there; nor is the largest collection of needles from the South-East region, as might be expected. Instead, the region with the most netting needles is the South, with five examples from Dorset and four from Kent. Though the majority of these artefacts are from riverine ecosystems, we mustn't forget the short length of South region rivers and the overall dominance of the coastline and small estuaries, which are in proximity to the various Roman sites from which the needles derive. Nine needles for an entire geographic region, defined by thousands of aquatic habitats, is not a large number. The largest assemblages of netting needles are composed of two artefacts only and at four sites. This is the case at South Shields (N1 and N2), Wroxeter (N4 and N5; with N6 deriving from a separate context), Hod Hill (N17 and N18) and Richborough (N22 and N23). Furthermore, it is uncertain if Hod Hill and Richborough needles are from the same context.

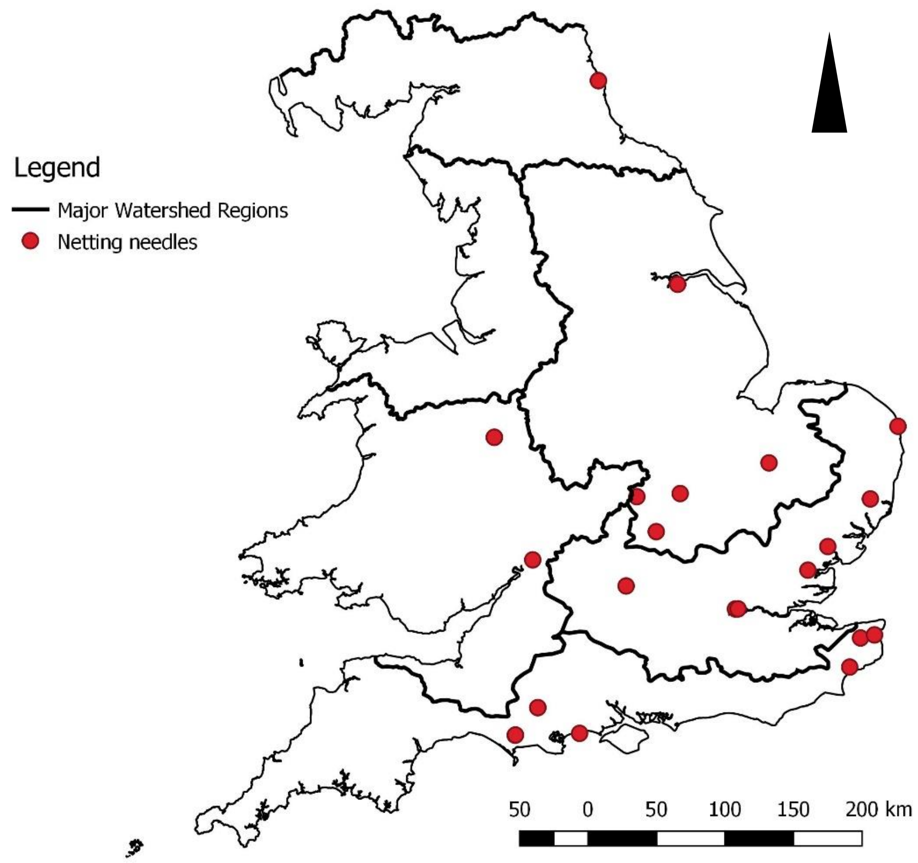


Figure 92: Distribution of netting needles by region of major watersheds.

7.2 Morphology

The needle consists of two eyes, one at either end, formed by two prongs widening at the middle, where it is intended to fit an optimal supply of cord, forming a semi-enclosed 'eye' (Figure 91). These 'eyes' can be symmetrical, or set at right angles, as is the case for eight examples from Britain (N8, N13, N15, N17, N18, N19, N22 and N23; see Figure 93). The eyes can be round or ovoid in shape, ranging from 4 x 4 mm in internal diameter (N1), to 30 x 9 mm (N17). Only one example has a 'V' shaped open eye at one end (N3). The methods of recording these tools is discussed in detail in Chapter 4, including a proposed 'internal prong' diameter and 'rod length', absent in previous artefact records. The subsequent data is assessed here.

The primary recording method to date has been the 'total length' of the object, from the tip of the prongs on one end to the other, or to the point of truncation. At least one surviving end is necessary to identify these objects, but there is an incalculable theoretical number of rods that may have lost both eyes in post-depositional deterioration, leaving behind undiagnostic metal object. Only two examples (N16 and N19) have been truncated along an arbitrary point of the rod, making any estimation of their original lengths highly speculative. Where one set of prongs have been truncated at their base, an 'estimated total length' is arguably possible, given the apparent symmetry of the opposing ends. This aspect is the first morphological characteristic to consider.

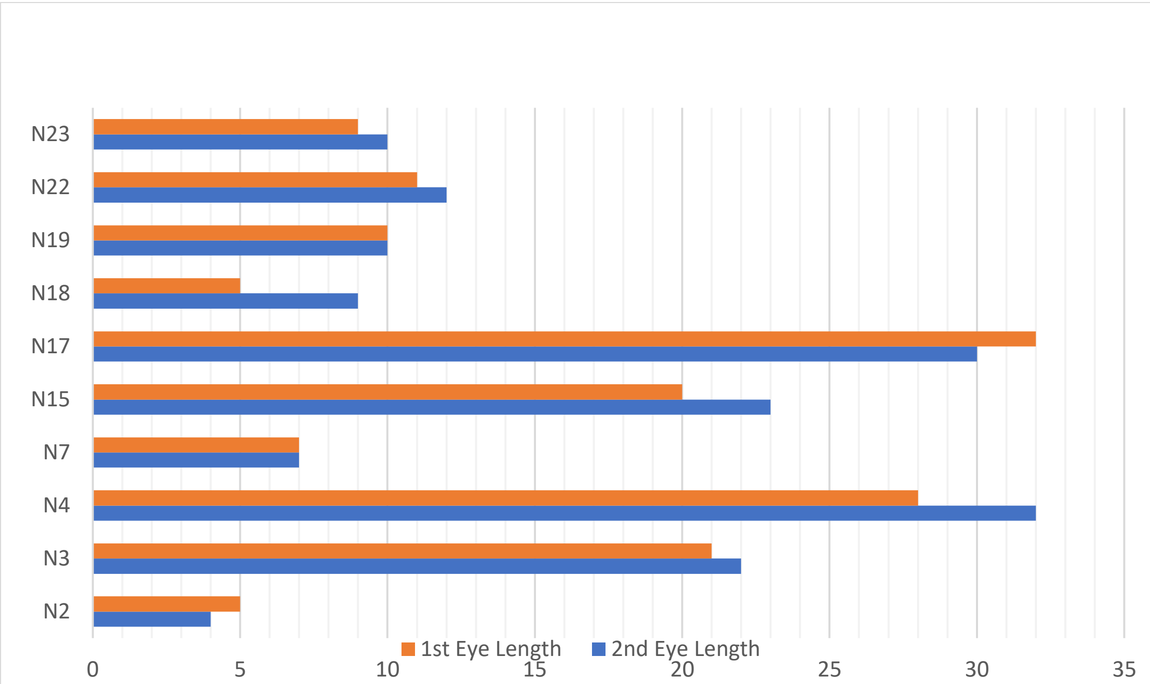


Figure 93: Measurements of opposing eyes to determine the extent of asymmetry. Measurements are of the internal length of the eye.

The consistency in the diameter of the opposing eyes is illustrated in Figure 93. There are only ten examples of needles where both ends survive and for which measurements are available. Two examples are symmetrical (N7 and N19) and one example has a substantial variation of 5 mm (N19), while the remaining eight needles have a variation below 4mm, representative of a

10 % variation Some discrepancies are expected in the forging process, though it should be noted that the material used has not played a significant role here, as both Fe. and Cu. examples are equally represented.

The next aspect to consider is the length of the tools. The current estimates suggest there is no relation between the diameter of the eyes and the total length. The combined eye length ranges between 10 % and 36 % of the total length. One extreme case is N8 from Hacheston, Suffolk, which has lost part of one set of prongs for which an estimated total length is produced, and which reveals eyes that encompass 42 % of the total length; none exceed this. Large and small eyes are otherwise evenly distributed between the total-length ranges that measure between 95 and 255 mm. Once again, the material does not impact the length.

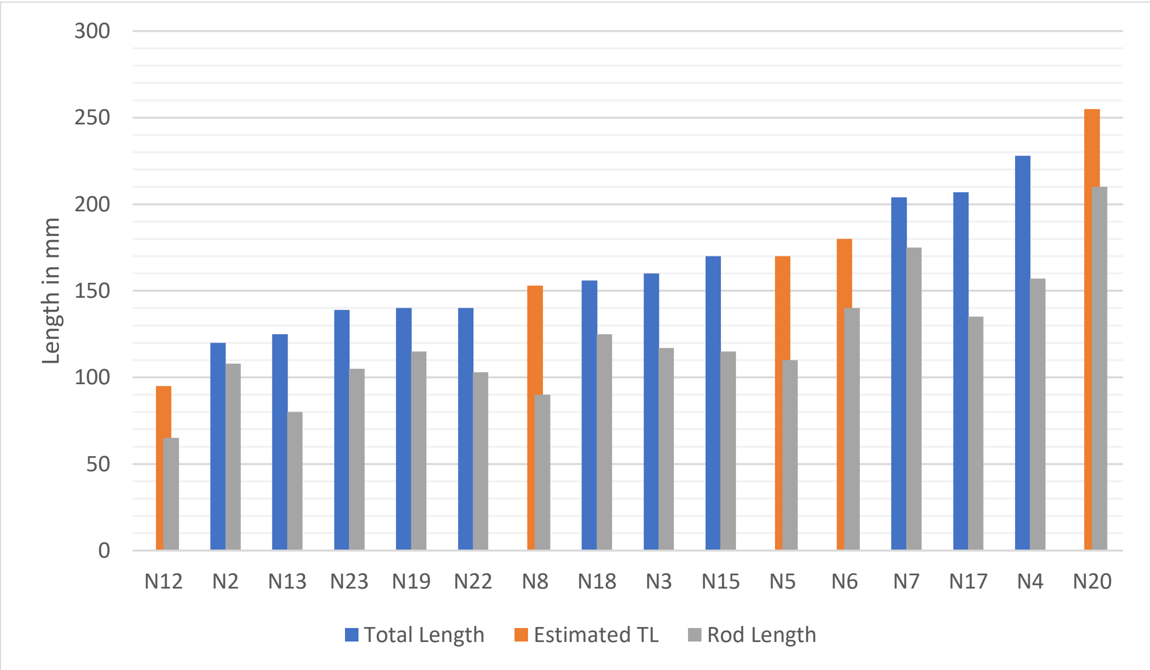


Figure 94: Correlation of rod length (RL) to total length (TL). needle lengths in millimetres. Estimated total lengths (orange) for artefacts missing the prongs on one end.

The length of the rod is another measurement that can be taken (Figure 94). It extends from the base of the prongs at one end to the other and is therefore representative of the cord length that can be placed on the device. An extended rod length may indicate a desire to extend the amount of cord used, however, increased length can lead to an un-wielding device. There is some consistency in the devices as eleven of the diagnostic needles have a total length between 100 and 200 mm. The rod lengths appear to correlate directly with the total length, ranging between 64 and 90 % of the total length but averaging 74 % (121 mm). The implication is that the tool may have been constructed to a standard specification.

The final measurement to consider is the outer width of the prongs/eyes. As the needle must pass through the mesh diameter it is producing, it is argued that the width relates to the mesh diameter and may provide an intended mesh size. Not all the Romano-British examples have a record of the various measurements, but those that do, reveal a diverse range of 5-21 mm. If compared with the total length of the needle (Figure 95), it appears that the size of the needle does not relate to the acquired width. For example, N20 is the longest example at 255 mm but has an average width of 12 mm; while N22 is only 140 mm long but has wider eyes at 12.5 mm (both have an internal diameter of prongs of 6 mm). If the mesh diameter is indeed related to the width of the prongs (as discussed in Chapter 2.3.3), this questions the reason for a discrepancy in length between needles that have almost identical widths. Either this is an unintentional construct, or the length relates to the production of the net by other means.

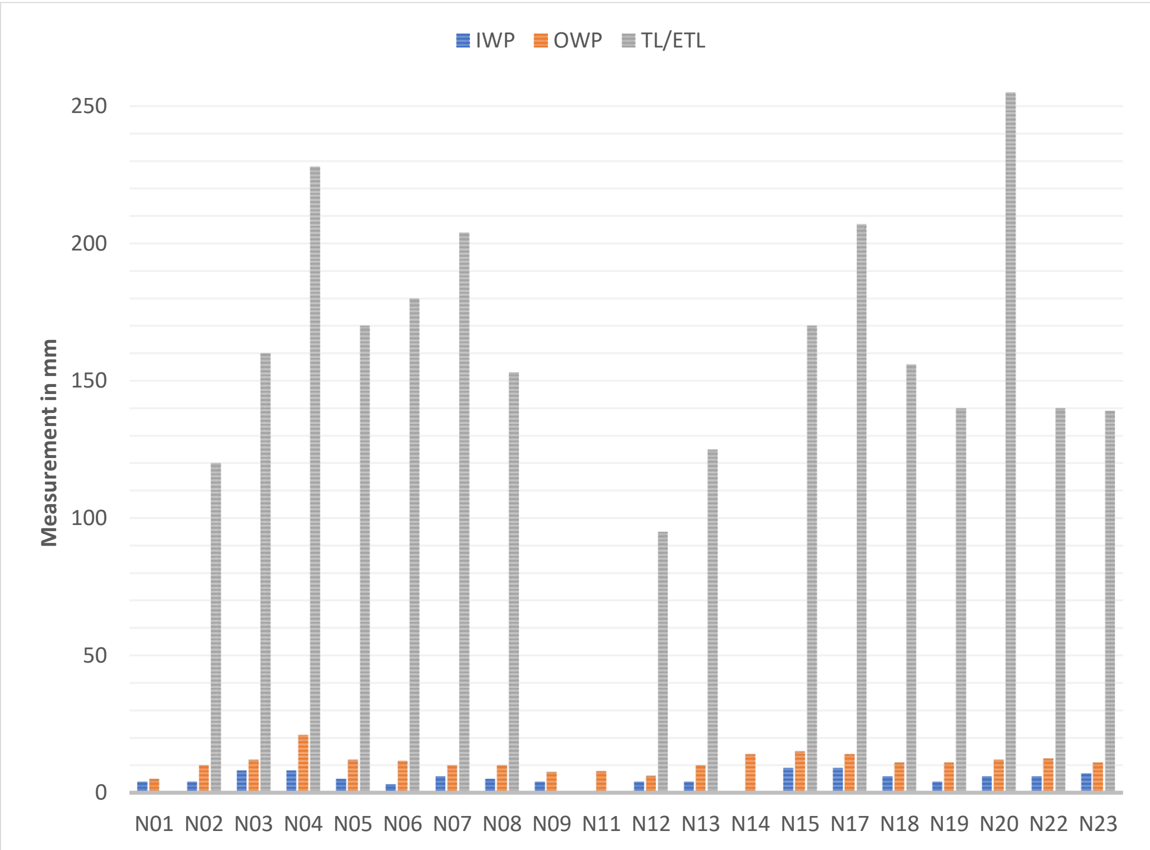


Figure 95: Relation of internal width of prongs (IWP), outer width of prongs (OWP), and the total or estimated total length of the needle (TL/ETL).

7.3 Interpretation

In the Mediterranean, the pronged netting-needle continued to be used for fishing into the 20th century. In Britain, though some Saxon and Anglian examples have been recovered, the introduction of the shuttle variety (Figure 96) soon replaced the Roman netting needle (the Mediterranean type). Where the bifurcated and double-ended needle type remained in use after the Roman Empire was in the production of hairnets (*reticula*). Like Roman fishing nets, the production method was almost identical but required a narrower mesh and therefore narrower tools. Examples of hair-net needles have been found in Britain up to the 16th century (e.g. Crowfoot et al. 1992; Rogers 1997; Figure 99), often used for the netting of silk (Crowfoot et al. 1992). They are identical in many aspects and only slightly shorter than the average Romano-British examples. A netting needle from York (Finds number: 6634) is 111 mm long and dated to the 15th century (Rogers 1997, 1790), which is shorter than all the complete Roman needles bar one, N12, an irregular shaped example of uncertain date from Wicken, Northamptonshire, which may indeed be a Medieval artefact.

Figure 96: Depiction of Arachne in the 1361 De Mulieribus Claris, a representation of the netting needle reveals both a toung-variety needle and a spacer. Both appear to be made of wood (Open source image).

The width of a needle does provide a minimum width to the diameter of the net, but it is not a control; this is obtained by the ‘spacer’. The spacer is a cylindrical or rectangular object around which the mesh is woven and on which the knots are tied (Figures 96 and 97). These objects can be made from organic materials, such as wood or bone and are therefore far less likely to survive. Organic or not, these objects are not very characteristic and can take various shapes and lengths, for which reason they would likely be overlooked in archaeological excavations if they were to survive. Although the needle does not dictate the mesh size, it must be narrower than the spacer for it to fit through the mesh diameter. During production, the mesh is stretched producing a diamond shape with the spacer on the bottom half. The shuttle must pass through the top half to produce the knot directly above the spacer. The resulting mesh is a square shape with a diameter equal to the width of the spacer. The netting needles recovered therefore provide us with a minimum diameter of the subsequent net-mesh. There is no discernible maximum diameter as a small needle can be used to create a large mesh.

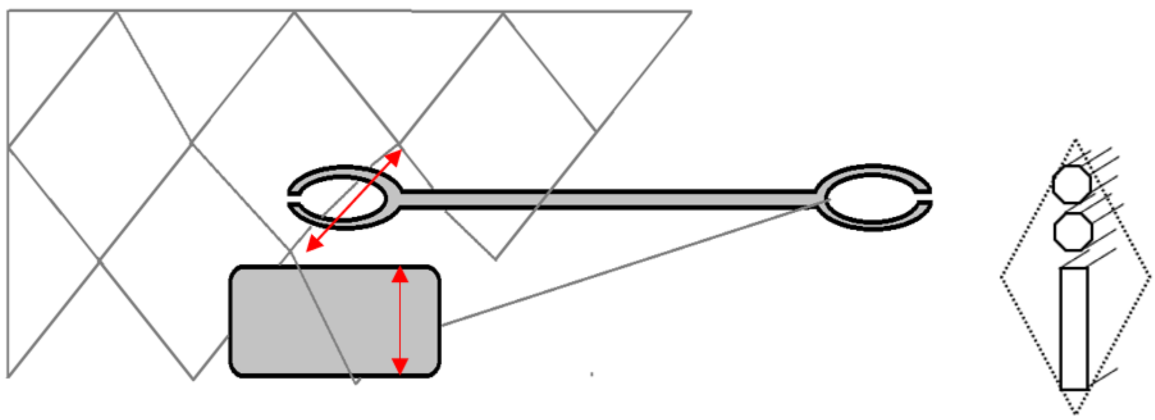


Figure 97:Demonstration of netting and the resulting diameters of the mesh based on the tools used (Illustration by L. Graña).

The Romano British examples have a width ranging between 5-21 mm and with an average of 11 mm. If we accept that this must fit through a space of equal or greater diameter, and if we take into consideration the thickness of the prongs which adds to the total width and subsequent length of surrounding cord, we have a minimum mesh diameter ranging between 7.5-27 mm. These figures are based on the narrowest example, N1, with an outer width of 5 mm and a prong thickness of 2.5 mm; and the widest example, N4, with an outer width of 21 mm and prong thickness of 6 mm. The remaining examples will vary depending on the thickness of the prongs. Sixteen of the needles have a width between 10 and 20 mm (76 % of the diagnostic material). Of these sixteen, thirteen are between 10 and 12.5 mm wide, revealing consistency in the manufacturing process and an average minimum mesh diameter of around 12 mm (15 mm in the larger range).

Comparative fragments of surviving nets with identifiable mesh diameters are extremely rare, yet several examples from Iberia and Egypt are consistent with the identified minimum estimates from British needles. The first is a 4th century BC fragment from La Albufereta in Alicante, Spain, with a mesh diameter of 10 mm (Alfaro 2010, 71; Figure 98). A second and third example from the same site have a mesh of 20 mm and 12 mm respectively; meanwhile a fourth example of uncertain Roman date from Zaragoza, Spain, is a conical-shaped net for river fishing with a 30 mm mesh (Ibid, 75). Examples recovered from the 1st century BC to 3rd century AD site of Myos Hormos, Egypt, have produced two varieties, a finer mesh of 12 mm diameter and a coarser example of 35 mm diameter (Thomas 2010, 147). The former has been described as a cast net for the capture of small fish such as sardines (Thomas 2012, 177). No larger meshes assigned to fishing practices are currently identified, nor are any finer meshes below the capability of the British needles, which strongly supports the correlation of needle width to mesh diameter.

Figure 98: 4th century BC net fragment from La Albufereta Necropolis, Spain (Alfaro 2010, 70).

An important contrast is the diameter of needles with identified alternative applications, such as two 16th century hair-netting needle with a 1.19 mm and 2.76 mm width, recovered in London (PAS Accession Number: LON-539C81 and LON-9313A5, respectively; see Figure 90). These examples appear to represent an intentional reduction of width to ensure as fine a mesh as possible, supporting the proposed hypothesis that needle widths were relatively consistent with intended mesh diameters. Nevertheless, one example of a Post-Medieval netting needle from Katherines and Wapping, London, has also been identified as a hair-netting needle, though with a total width of 7 mm and with a shape reminiscent of the Roman examples (PAS ID: LON-A0460A). With restricted data on this artefact one can only highlight alternative observations: the first is that hair netting needles may have a larger range of diameters that are similar to the smaller Roman examples; the second is that Roman netting needles may have continued into the Post-Medieval period, perhaps as fishing equipment, for which a greater understanding of the latter may provide more critical evidence of net production methods. This is also an undervalued area of research that requires further support.

Figure 99: 16th century Cu. hair netting needle from London. 111.72 x 2.76 x 1.28 mm (Sumnall 2010).

In addition to width, the internal diameter of the eyes may highlight the organic material used. A large eye would accommodate a coarser thread and may therefore be indicative of an intentional more robust mesh. This is not causally related to the width of the prongs, as the length of the prongs appears to be an intentional construct for the control of the amount of cord attached. This is clearly visible in the Medieval hair nets, where a substantially long eye contrasts the characteristically narrow width (Figure 90). As previously discussed, the eye diameters are notably disparate among the British examples. Those with large eyes, with lengths between 20 and 32 mm, include N3, N4, N8, N15, N16, N17, and N22. Alternatively, there are eyes with very narrow diameters, several of which have a very circular shape, including N1, N2, N7 (Figure 100), and N18. These examples are from military sites and have diameters between 4 and 8 mm; no other patterns are apparent. Two hypotheses are proposed for the shape of these objects: First, that the production method influenced the shape, perhaps achieved by forging with a punch or around a cylindrical object, both of which would create the circular shape; this may be supported by the military nature of their provenance and the available manufacturing tools. The second is that they were intentionally shaped in order to accommodate a fine cordage, suitable for producing a fine mesh.

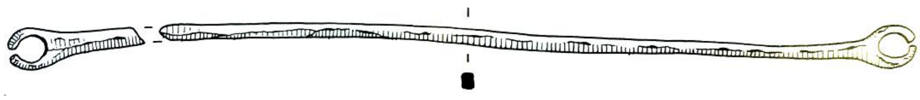


Figure 100: N7, Circular-eyed needle from Caister-on-Sea, Norfolk

One cannot ignore that all the needles recovered could have been used with a fine cord. Coarser meshes are often used for larger mesh diameters to produce large nets, at which point the use a metal needle is no longer a necessity and wood can be used to produce more robust tools. Wood would not have been ideal for fine meshes due to the fragile nature of the organic material with those dimensions; for this reason, one must acknowledge that the recovery of metal netting needles may represent small meshes comparable to those used in fishing or fowling. No wooden or bone examples from Roman-Britain exist, as such, this argument is purely theoretical. Regardless what alternative tools may have been available, we must work with the minimum requirements provided by the recovered netting needles.

7.4 Summary

The netting needles recovered from Britain have various distinguishing attributes that may reflect a relationship between morphology and function. The key distinguishing characteristics are the rod length, the internal diameter of the eye, and the maximum width, provided by the outer width of the prongs. From what we know of net production and the available cordage materials, as evidenced by recovered net fragments in the Mediterranean, we can suggest minimum ranges of function consistent with the Romano British evidence. The minimum diameters of the meshes that could be produced with the British needles is consistent with known fishing net diameters recorded in Spain and Egypt, which supports the hypothesis that netting needles were produced with widths in close proximity to the intended mesh diameter. This theory would suggest the nets produced in Britain were substantially consistent, with a minimum mesh range between 12 and 15 mm. There is the possibility that these objects may relate to non-fishing nets, but it is important to refer here to the literary evidence for nets in Britain, Vindolanda Tablet 593 (Chapter 4.3.1), where a fishing net is described alongside fowling nets. This may allude to a uniform production of various types of nets by a single producer, at least in a military setting.

8. Miscellaneous Artefacts and Fishing Installations

Figure 101:Depiction of the use of a trident. The Odysseus mosaic (©Bardo Museum).

Miscellaneous fishing remains, those that encompass a minority of the halieutic evidence, are rare for Roman Britain yet consistent with examples from other provinces. The various methods described in the literary sources and depicted on Roman mosaics are here represented by individual examples, which, though too sparse to reflect quantifiable economic purpose, are indicative of the range of Roman fishing practices that were available. These include the trident, the gorge, the gaff, the trap, and the weir; alongside structures such as the fishpond and fish tank, for holding or farming live specimens. Further examples of these tools may emerge at a later date, although their absence is also of significance in establishing the scale of fisheries in Roman Britain, for which it remains important to elucidate on their function and distribution.

8.1 The Trident

A trident has been recovered from Colchester (unpublished, data from Colchester Museum archive) and is composed of three prongs with barbed points and a socketed shaft (Figure 102). It measures 150 x 75 mm, with c.10 mm thick prongs, and a 15 mm wide socket. Tridents are described by Oppian (*Hal.* 4.535-538) in the capture of tuna and cetaceans, and by Aelian (NA. 12.43) in the capture of cephalopods and fish. Additional uses include gladiatorial weaponry and votive offerings (Bernal 2010, 135), though Mediterranean examples are often found in fishery contexts (e.g. Beltrame 2002, 66; Galili and Rosen 2008, 70; Bernal 2010, 135). Compared to an Israeli example believed to be for the capture of large marine aquatic animals (Galili and Rosen 2008), the Colchester trident is half the size. No typologies exist with which to interpret this disparity, but pictorial depictions can be of support. If the mosaic depictions are taken into account, the three-pronged representation in the coastal fishing scene from Tunis, Tunisia (Figure 101), is a close resemblance as it depicts a three-pronged trident of similar dimensions and clearly socketed (as illustrated in the distinct grey/brown division of the shaft and the wooden pole to which it is attached). This mosaic, in line with Aelian's description (NA. 12.43), depicts the use of the trident in the capture of cephalopods, such as octopus.

There is no ichthyofaunal evidence for the capture of cephalopods from Roman Britain, nor is the recovery of a trident at the inland site of Colchester a confirmed indication of fishing. Further examples are required to determine if this artefact is a result of fishing and whether it is a result of an alternative freshwater fishery or the result of an allochthonous deposition with ties to the marine waters along the coast. Beyond Britain, the evidence for tridents is sparse throughout the Roman territories (Bernal 2010, 135), which is itself an indication of its sparse application in comparison to other methods. Identified ties to marine or offshore fisheries might indicate a profitable fishery due to its potential use in the capture of large fish (as described by Oppian), but without such supporting evidence for Britain, one must assume that the Colchester trident may have been used in small-scale fisheries, potentially at local freshwater environments; or that it relates to a non-fishery function. Ethnographic comparisons allude to similar devices, namely leisters with more numerous prongs, used in the capture of eels (Brandt 1984, 44). This activity is termed 'stanging' in the traditional fisheries of Wales, where it is used on muddy shores and especially in winter (Jenkins 1974, 269). Devices of similar dimensions have also been used in the capture of salmonids during their October migration into rivers, where large number above a subsistence capacity could easily be caught (Ibid. 298). As is discussed in the following chapter, these species are commonly found in fish bone assemblages, for which reason, one would expect more numerous examples to be found.

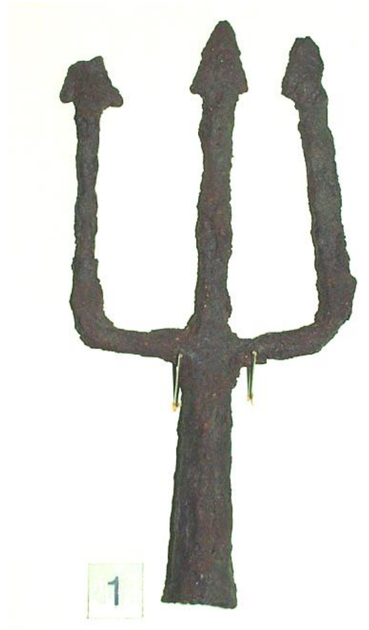


Figure 102: Trident from Colchester Museum collections 1930-39 Excavations (Image property of Colchester Museum).

8.2 The Gorge

An additional fishing tool is the 'gorge', a bi-pointed cylindrical device, often made of bone or wood, that was used as a lure to be swallowed and wedged within the fish's throat or gut (Figure 103 to 105). The gorge has been interpreted as a predecessor to the fishing hook with an early prehistoric origin (Brandt 1984, 70-71; Soria 2011, 189; Galili et al. 2013, 147). Examples exist for the Roman period outside of Britain (e.g. Thomas 2010, 151; Soria 2011, 190) and are frequent for the Medieval period within Britain (Steane and Foreman 1991, 90), supporting the interpretation of the subsequent artefacts. Three examples have been identified as gorges. The first is an individual example from Cressing Temple, Essex (unpublished, data courtesy of Mark Atkinson, Archaeology South-East); it has a semi-circular profile, a V shaped notch in the centre, and pointed ends, but it has unknown dimensions (Figure 103). An additional two examples come from Wroxeter (Cool et al. 2014). One is of uncertain date and may be a Medieval object according to the original finds record (Figure 104); this example also has no measurements, a thin and flattened profile, and rounded ends. The second Wroxeter example (Figure 105) has an irregular shape, a circular profile, and a 1.9 mm circular perforation through the centre; it is the only example with recorded measurements at 29 x 5.5 mm. As these artefacts are made from organic materials, the recovered examples are potentially representative of a larger collection.

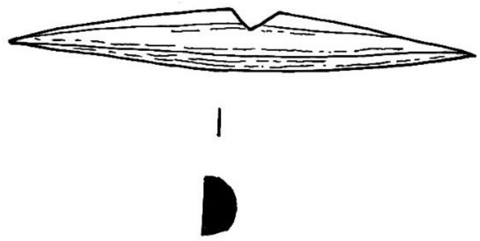


Figure 103: Cressing Temple Gorge. Image Courtesy of Mark Atkinson (ASE). Not to scale.

The addition of a notch and perforation to two of the examples is an indication of the line that was attached to them and the tethering method. The perforation of the Wroxeter example suggests the use of a cord <2 mm thick, which indicates the targeting of small fish, lest the line be snapped by larger examples. This is also indicated in the 29 mm overall length, which narrows the probable targets to fish with a narrower oral cavity; however, there are numerous candidates of such from freshwater environments for which it is difficult to suggest probable species.

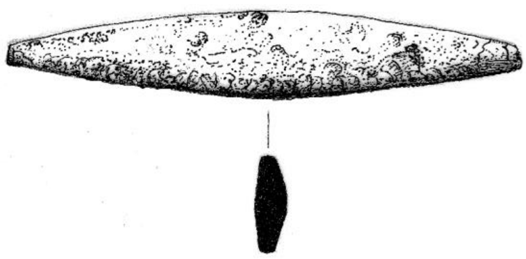


Figure 104: Roman to Medieval gorge from Wroxeter. SF136, context D140 (Illustration from ADS website).

Although it is considered a device with an earlier origin than the hook, the gorge appears not to have been a predecessor of the hook but rather developed as a separate approach to the problem of catching fish (Hurum 1977, 22; Brandt 1984, 69-70). Both devices are intended to be swallowed, but the primary distinction is that a gorge primarily functions as a passive method of capture, that is, it is a stationary trap that does not require the consistent presence of a fisherman or the addition of a rod. It shares this relationship with similar devices used for the capture of birds (Ibid. 70). To this end, the gorge may indicate local fisheries with continued access to the sites of capture. This system negates a leisure activity and highlights the potential for a subsistence fishery; however, one must acknowledge the potential use of these examples in the capture of birds rather than fish.

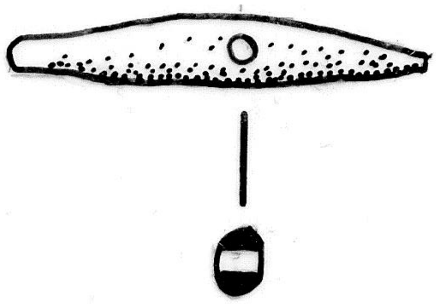


Figure 105: Roman gorge from Wroxeter (Illustration from ADS database).

An additional five artefacts of bone have been recovered at Wroxeter (Cool et al. 2014). These have not been recorded as gorges, but considered potential gaming pieces, toggles, or pegs (Greep 1983, 482; Cool et al. 2014). They range between 38 x 9 and 45 x 10 mm and are generally plain in appearance (see Appendix A, Part 4 for details); however, one example appears to have been decorated on one face and one side (Figure 106). If a decorated gorge, it is uncertain why the entire object does not include the circular depressions, which lends weight to the potential use as a peg or toggle, as suggested by Greep (1983, 482). This draws into question the likely function of the previous examples. A more thorough investigation of comparable artefacts is required in Britain, as is a more detailed description of the context in which these artefacts are recovered.

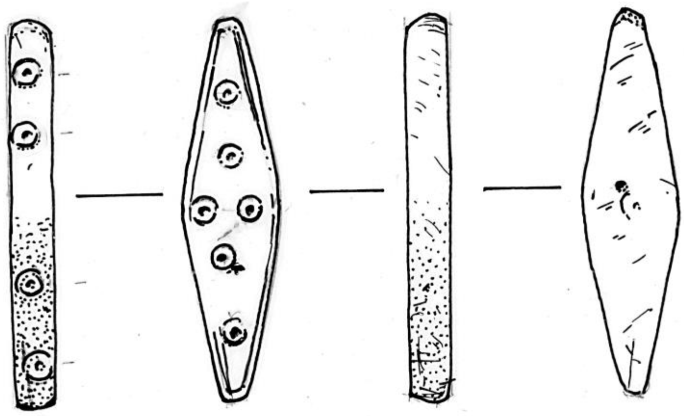


Figure 106: Decorated bi-pointed bone artefact of unknown function recovered from Wroxeter (Cool et al. 2014).

8.3 The Gaff

A final alternative fishing tool is the 'gaff', also known as the 'pole-hook' (Brandt 1984, 125). As the name implies, it is a rod with a large curved and/or barbed hook at one end with which to snag a fish, thereby aiding its retrieval from the water (Gabriel et al. 2007, 108). A mid-4th century iron gaff has been recovered at Santhill, Gloucestershire (referenced only in Timby 1998). There is no further information on the artefact other than its description as a fishing tool. Without more data for this artefact or additional examples, little can be said about its significance to Romano-British fishing. The gaff is often an indication of the capture of large fish (Gabriel et al. 2007, 165), however, they have also been used in shore-based fisheries in combination with weirs (Brandt 184, 125) or for the capture of octopus in rocky outcrops. The work of Jenkins (1974, 294-296), reveals the application of this device in the capture of individual salmon taking shelter in various crevices of rivers during the day. In this case, the gaff is produced on the spot by attaching a 300 mm long hook, which is carried for such a purpose, to a pole (Ibid. 294). On the one hand, the device shares various attributes with the trident and other spearing methods of capture; on the other, it may have been used alongside additional equipment for aiding the landing or movement of an already caught prey. Gaffs are indeed useful and versatile devices, for which reason it is important to note the relative absence of this tool in Britain.

8.4 Fishponds and Tanks: Evidence for Holding Live Fish

Additional evidence of fishing includes the discovery of more robust structures used for containing fish. There are two potential fishponds, one discovered at Water Newton (Cambridgeshire) and another at Shakenoak (Oxfordshire), both at villa complexes (Alcock 1989). These should not be confused with the purely aesthetic fish ponds which may have contained live fish with no dietary function; one example is the fish pond from Bancroft villa, Buckinghamshire, which, though of a substantial size at 13 x 2.6 m, was situated within a walled garden of the villa complex (Zeepvat 1994, 188; Martins 2004, 52). Limited excavation and a lack of environmental sampling have resulted in no fish bone remains with which to confirm the species recovered at any of the sites. Water Newton suffers further from a restricted excavation and publication, and therefore absence of data with which to hypothesise on the scale and function of the pond; nevertheless, at Shakenoak, Brodribb et al. (2005) have published on the three structures excavated from 1960 to 1976.

Three rectangular tanks have been discovered, the first (so-called Fishpond 1) consists of an excavated trench with carefully constructed dry-stone walls and a compacted clay base, while the second (the larger Fishpond 2) was dug into the ground (Ibid. 420). These two have a substantial size of 12.1 x 11.58 m and 65 x 27 m respectively (Figure 107 for plan of Fish pond 1; there is no plan for the larger pond). A potential third pond was uncovered, severely damaged by ploughing, but which maintained a similar stone wall structure on the north side and a potential diameter of 14.6 x 11. 3 m (Ibid. 421); this was also the deepest example with a depth of around 0.3 m (only depth estimates are provided: Brodribb et al. 2005, 421). Although no fish bone remains were recovered, the silt deposits that filled the tanks suggested a gradual deposition with slow-moving water, sustaining their use as water containers and highlighting their connection to a local water supply (Ibid.). All three ponds have the same date range of around AD 150. Whether they are examples of private fish holding tanks or evidence of small-scale fisheries is uncertain, but the large size of the tanks suggests a marketable product beyond the requirements of a single villa site. It has been suggested that they relate to a market for the local villa sites of the Thames valley (Ibid.). Although further interventions of potential fish bone assemblages are advocated, the location confirms a freshwater fishery of notable significance.

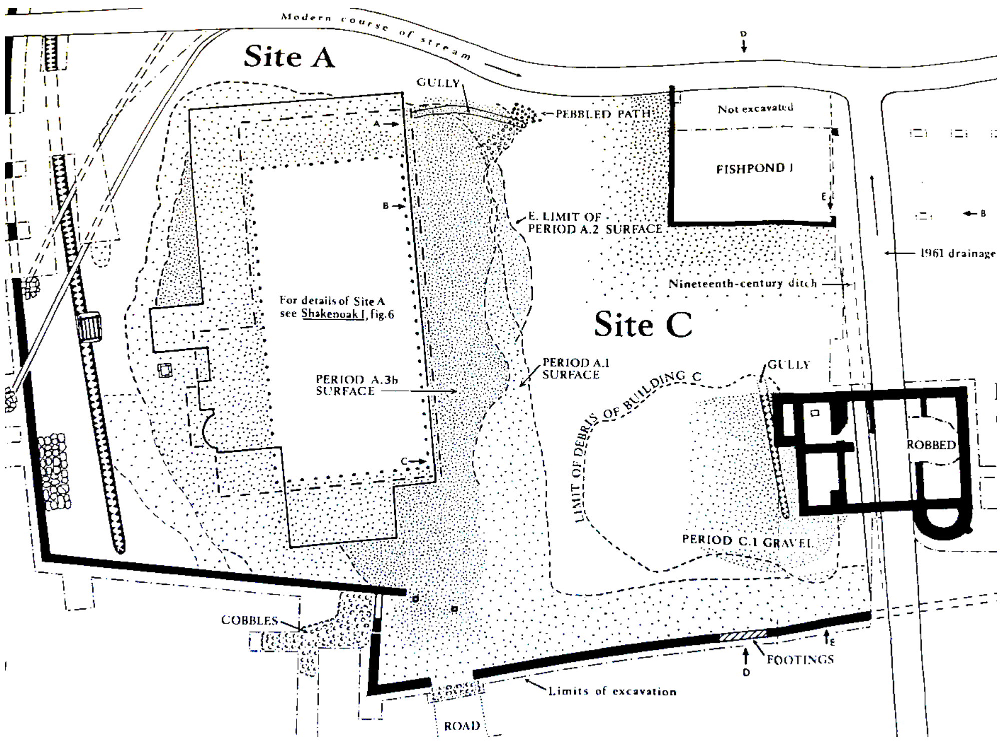


Figure 107:Plan of Fishpond 1 from Shakenoak (Brodribb et al. 2005)

Another tank has been excavated at Fish Street Hill in Southwark, London (Figure 108), of unspecified dimensions and heavily truncated by later construction. The tank consists of a quadrangular timber-lined structure, roughly 3 m in diameter, within a compacted clay trench, potentially acting as a water-tight sealant (Cowan and Wardle 2009, 105). Interpretations include the holding of uncertain liquids or the production of a fish sauce (Bateman 1986, 235). There is an absence of fish bone remains with which to confirm or deny these hypotheses, yet there are no other cases of timber-lined tanks used for the production of a fish sauce; this should not negate the possibility of an alternative product, such as pickled or salted fish, nor the use of the structure as a tank for holding live fish. London is indeed an important case study for the capture and consumption of fish, as attested by the numerous assemblages of fish bone remains. The site of Peninsular House has been interpreted as a fish processing site (Locker 2007), where no such timer-lined structures have been excavated, but which is indicative of a local demand for such products. A potential second timber tank of almost identical construction has been partially excavated and dated to the mid-1st century, though with no further details with which to advance its interpretation (Bateman 1986, 235). The potential for multiple tanks more strongly supports a marketable product, if indeed related to fish. Further excavations are required for ichthyofaunal assessments to confirm these functions.

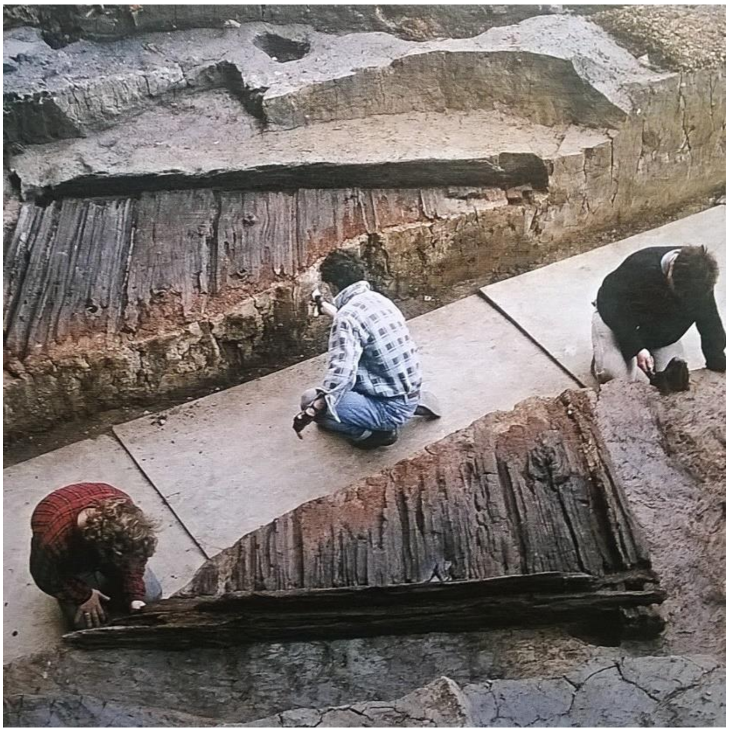


Figure 108: Timber tank discovered in Southwark (image taken from Cowan and Wardle 2009, 105).

8.5 Traps and Weirs

Fish traps and weirs are objects made from organic material, mainly wicker, willow, and other pliable woods, they are therefore rarely preserved. The former indicates a mechanism in which fish are held captive, while the latter is a structure that prevents, restricts, and/or influences the movement of fish, often into a trap (Figure 109). Traps and weirs can be used in both freshwater and marine environments (e.g. Brandt 1984, 153) and Roman examples exist of both types, such as the structure recovered on the coast of Portugal (Alves 1988-1989, 260), and the well preserved riverine traps from the Netherlands (Dütting 2016, 397); these are also consistent with the various descriptions in the literary sources (e.g. Pliny HN 9.38.74; see Chapter 4). It has been suggested that prior to the shift from costal to open-water fishing, stationary traps were used for the capture of shoaling clupeids (Harland et al. 2016). Regardless of the fragile nature of these objects, weirs have been found in Britain (e.g. Jones 1988; Cowan and Wardle 2009), all in riverine systems and with access to freshwater and diadromous species.

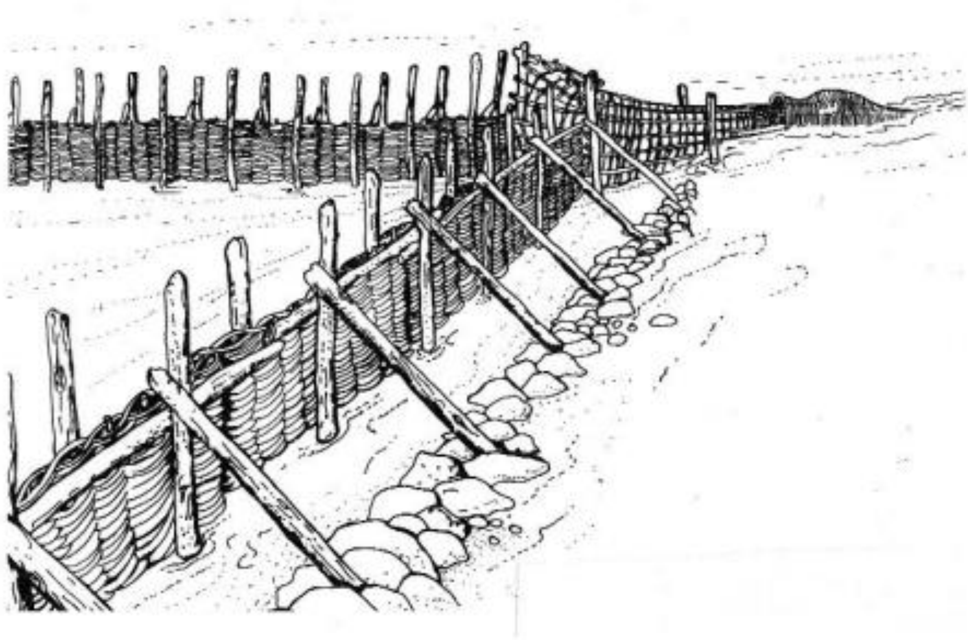


Figure 109: Reconstruction of a Bronze Age fishing weir and trap from Nottinghamshire (Image from Salisbury 1988).

Fishing weirs are barriers that intercept fish in their habitual route in freshwater, brackish, or marine aquatic habitats. They are permanent structures used to funnel fish species into traps or are used as traps themselves in tidal aquatic environments (Salisbury 1991, 76). They can take a V-shaped appearance, with the apex facing away from the shoreline (Crowther and

Dickson 2008, 64), or downriver in the case of freshwater examples; they can also be tick-shaped with the longest row of timbers on the downward trajectory of an outgoing tide, or linear, running diagonally from the coast in the case of marine or brackish water examples. Various other types and numerous shapes have been identified among wooden and stone weirs from later periods (Salisbury 1991, 77). Wooden fish weirs from various dates have been shown to follow a consistent and straightforward structure consisting of two rows of upright timbers or piles, between which runs a wattle structure providing the continuous barrier (Figure 110).

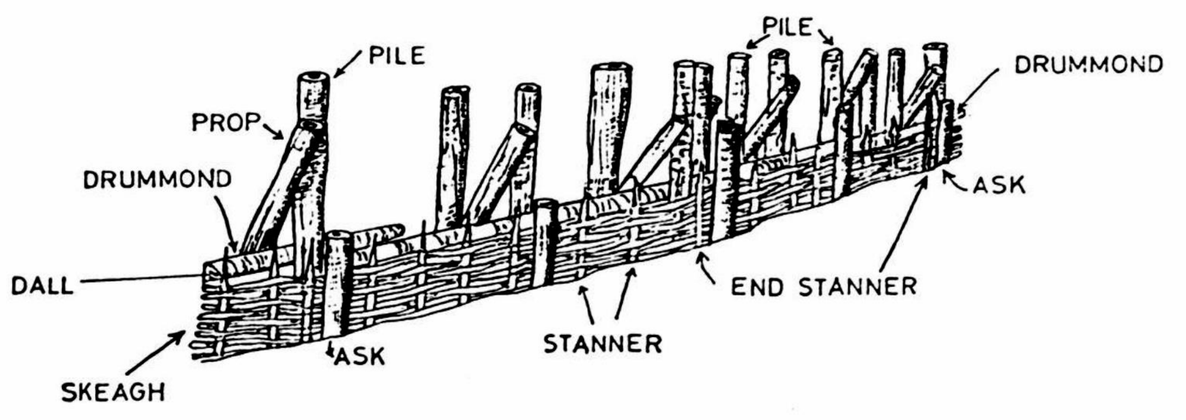


Figure 110: Reconstruction of a fish weir from Toome, Erie (Mitchell 1965, as referenced by Salisbury 1991, 79).

Most weirs and traps throughout the various periods are related to fishing practices in the intertidal zone of the coast (Fulford et al. 1997, 198). This is due to the prominence of Medieval examples and their location in these coastal zones (Figure 111). Several Medieval weirs were identified following the RCHME's National Mapping Programme started in the 1940s. The largest number are located in the Severn Estuary where there is a general absence of Roman evidence; this has been attributed to the identified alluviation of Roman surfaces, the consistent coastal erosion, sea level rise and tidal inundations, a disturbance or replacement of Roman structures by later examples, and the potential absence of exploitation of these aquatic resources due to cultural disparities and preferences (Crowther and Dickson 2008, 115; Chadwick and Catchpole 2012, 72). Although numerous factors can influence the survival of these structures, the scarcity of examples from the rest of Britain is suggestive of the latter being the primary cause.

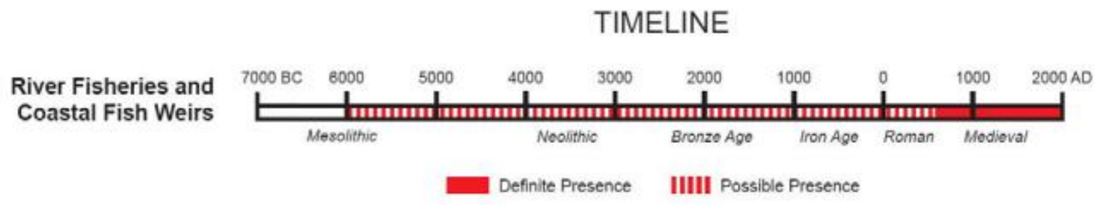


Figure 111: Estimates of potential fishing weirs throughout various periods in Britain (Historic England 2018, 7).

A sparsely published weir has been recovered at 117 Borough High Street, London (Southwark), consisting of over eight uprights and a wattle wall, truncated vertically, but visible in section as consisting of a minimum 1 x 3 m (as recorded to the limit of excavation: see Cowan and Wardle 2009, 106). The structure was excavated in 2000 and was found alongside an oyster shell dump and a double fishing hook (Maloney and Holroyd 2001, 86; Fitzpatrick 2002, 338-339). A date of AD 160-200 had been proposed (Cowan et al. 2009, 24-25); however, this has since been disproved by the identification of overlying timbers connected to the structure and of Medieval date (Killock, forthcoming). According to the Project Officer currently working on a larger publication that incorporates this site (Killock, Forthcoming), the Medieval structure is in fact a wattle lined pit. The double hook has not yet been interpreted and remains in storage (Ibid.).

At Shardlow, Derbyshire, a framework of vertical and horizontal timbers packed with brushwood has been uncovered. Although a ‘fish weir’ is one of three interpretations, the others are a ‘platform’ from which to fish, and a ‘kidweir’, a revetment used to stabilise the riverside (Martin 2005, 6). The additional recovery of sandstone blocks by the timber uprights used to reinforce the wattle frame has been noted in other fishing weirs (e.g. Historic England 2018), which supports a halieutic interpretation.

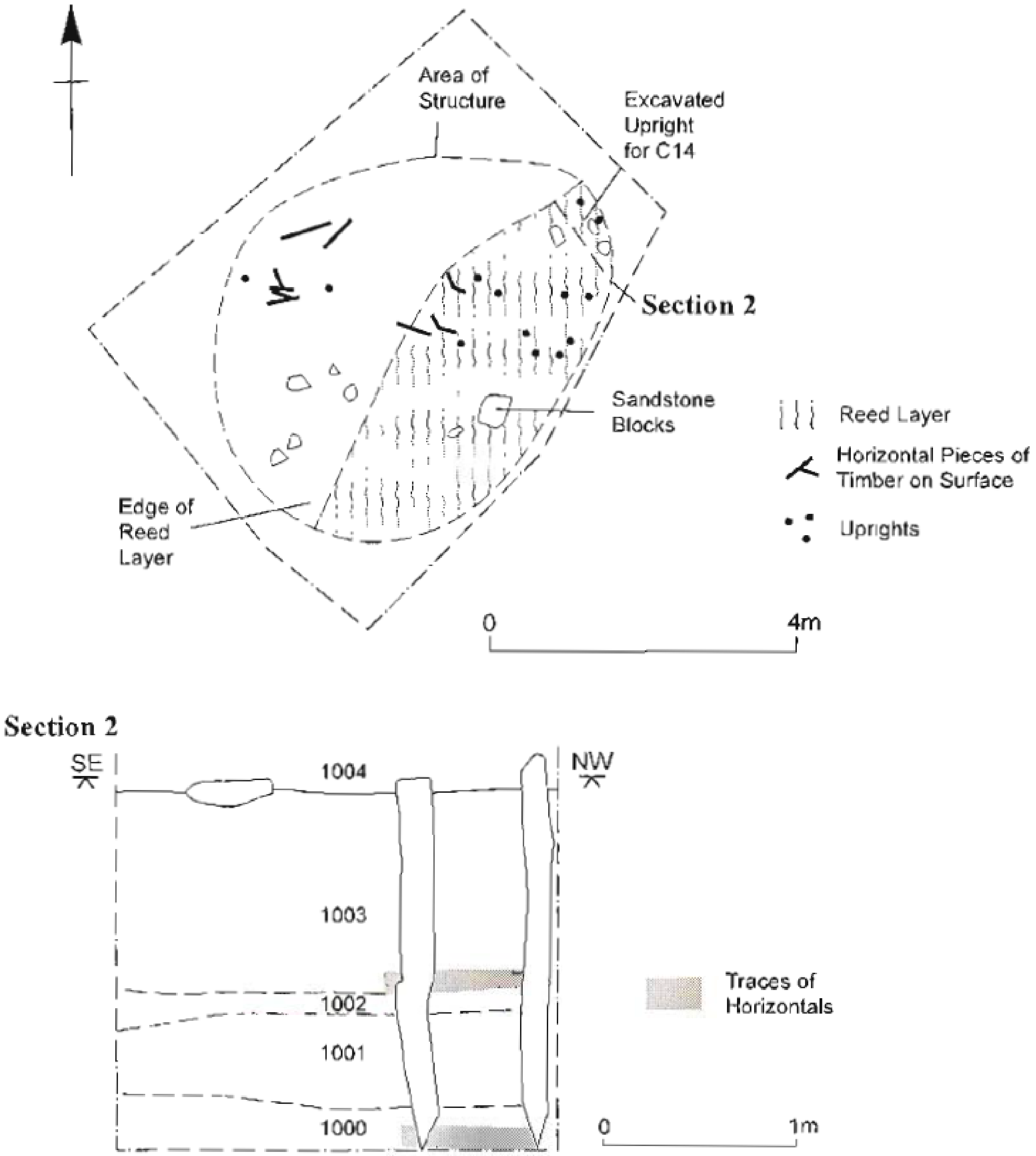


Figure 112: Plan and section drawings of the potential weir from Shardlow, Derbyshire (Figures 4 and 5 from Martin 2005)

The success of weirs in the Medieval period and their continued use from at least the Bronze Age to the Post-Medieval period reduces the potential for identifying Roman remains where continued use has seen the placement and replacement of structures for centuries. Several weirs find themselves on the cusp of Late Roman and Anglo-Saxon chronologies and bear mentioning here. The first is the fishing weir discovered at Putney, Surrey, in the 1970s, measuring 32 m in length with over fifty upright posts forming two parallel lines (Greenwood 2008, 116-118; Figure 113). The first line consists of forty-five uprights, while the second is quite sporadic (Figure 114). A small section of wattle has been preserved under the gravel bank of the river (Ibid.). The structure was made with oak and elm posts, which have been radiocarbon dated to AD 410 to 620 and AD 420 to 640 respectively (Cowie and Blackmore 2008, 212-213). A greater number of Late Roman finds, rather than Saxon, have been found in proximity to the structure (Greenwood 2008); however, both Roman and Saxon settlements were located in general proximity to the site.

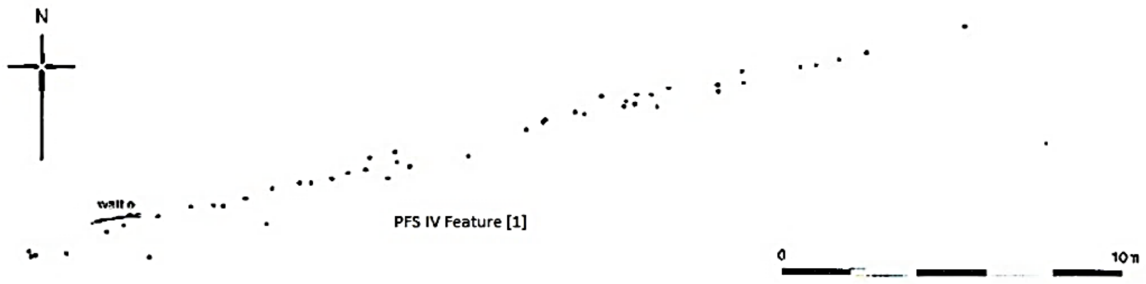


Figure 113: Plan of Putney fish weir (Greenwood 2008).

A well preserved weir was discovered at a quarry site in Shepperton in the 1970s. A full excavation was denied to the archaeologists (Bird 1999, 105) and yet the recorded structure is one of the best representations of this fishing method from ancient Britain (Figures 114 and 115). Radiocarbon dating of the timber remains produced a date range of AD 250 to 690 (at 95% confidence; note that an AD 410 to 650 date is suggested a 68% confidence; Ibid. 116). Various finds were found in proximity to the site which support either Roman or early Medieval dates. At least four rows of posts were identified, although only rows 1 and 2 were comprehensively recorded in the allotted time of excavation (Bird 1999, 107). They create a 'V-shaped' funnel tapering at the northern end. The longest series of posts were within row 1, reaching a total of 21.5 m. Wattling was identified in both rows 1 and 2. Once again, various theories were suggested, of which a fish weir or a kidweir are considered the most likely due to the presence of wattles; in addition to which, countering the interpretation of a kidweir, Bird (1999, 111) notes that the only evidence of a river bank has been identified by row 1, but against which the wattles would have been on the wrong side of the upright stakes to have afforded any structural protection; for this reason a fish weir is strongly advocated.

Figure 114: Photo showing the wattle remains from the fish weir at Shepperton. Image includes a 1 m scale divided by 20 cm sections (Bird 1999, 111).

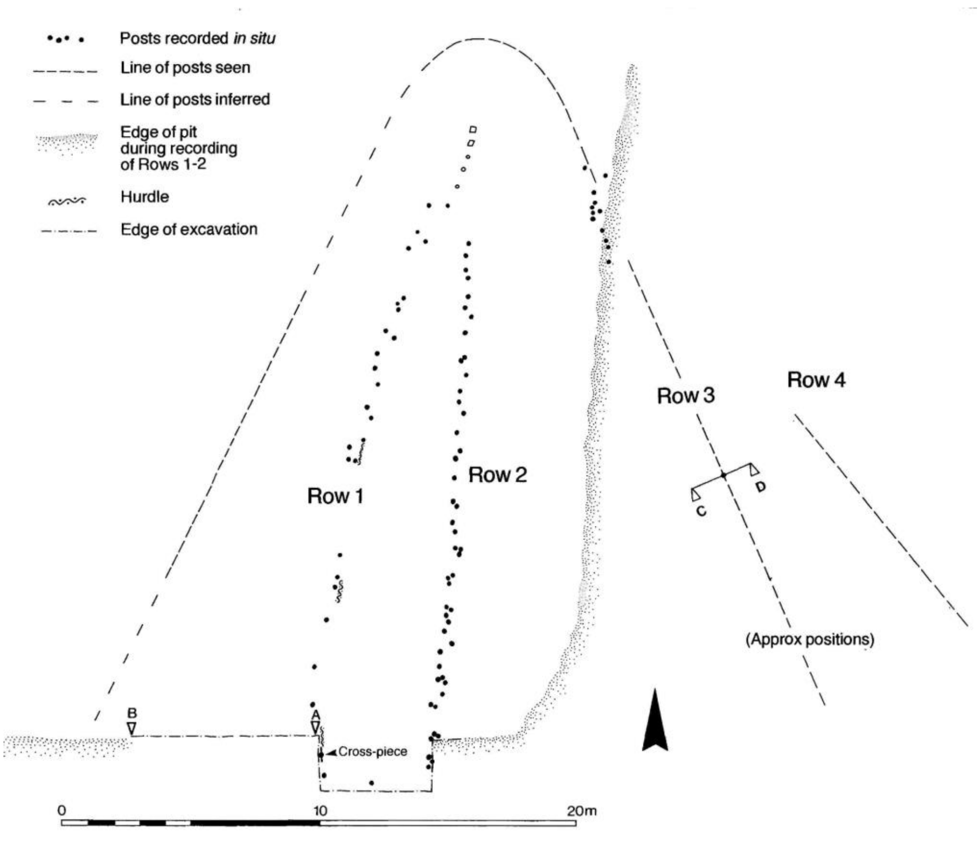


Figure 115: Plan of Ferry Lane, Shepperton, fishing weir (Bird 1999, 108).

8.6 Interpretation

Alternative fishing equipment is scarce to the point of being insufficient for inferring fisheries, as opposed to single fishing events. Rather than a technological adoption, one must accept the possibility of such artefacts being the result of single events conducted by individuals and for personal provision. Gorges do highlight the potential for more passive fishing methods targeting individual fish, while their fragile organic composition may allude to a more numerous collections yet to be identified. Meanwhile, tridents have been highlighted as implements used in freshwater environments by ethnographic examples (Jenkins 1974), which suggests the inland example from Colchester may not represent traditions of coastal and offshore fishing alluded to by the primary sources for the Mediterranean; however, both gorges and the trident resemble artefacts with alternative non-fishery functions that require a closer examination. As with the previously assessed hooks, weights, and needles, the miscellaneous artefacts are severely under evaluated to the extent that we cannot assign a fishery function based on the morphology at this time. Further studies are advocated, and it is likely more numerous unpublished examples exist that could not be located for this thesis.

Due to the uncertainty in the dating of potential Roman weirs and traps, there is no direct evidence with which to interpret the scale and influence of these fishing methods. This directly contrasts with numerous examples from the Medieval period and into the 20th century in certain parts of the country (e.g. Jenkins 1984, 239; Went 1984, 455; Kowaleski 2016, 27). The potential Roman case studies are restricted to freshwater sites, which, if indeed representative, indicate the capture of freshwater and/or migrating species in riverine environments, rather than the more lucrative use of weirs in coastal zones for the capture of shoaling species (Kowaleski 2016, 27-28). That said, there is also an absence of small fish traps comparable to the examples recovered in the Netherlands and associated with the military fisheries (Düting 2016), otherwise identified for Britain via the alternative fishing hooks and net weights from military sites. If one assumes the absence of evidence is indicative of the fisheries in place, it appears that beyond the subsistence catches with the use of hooks, only nets were used to achieve large catches of commercial value. One remaining resource that needs re-examination is the fishpond. The identified structures also allude to a commercial scale of fish farming that requires the inclusion of ichthyofaunal evidence. A necessary next step is the environmental sampling of unexcavated sections.

9. The Fish Bone Remains

This chapter presents the ichthyoarchaeological evidence for Roman Britain in its entirety with the aim of interpreting it, not in terms of culinary practices, but as evidence for economic activities, namely the extraction of aquatic resources. In addition to assessing the data, it is necessary to expand on the nature of the archaeological contexts from which the remains have been recovered. The addition of fifty sites to Locker's original ninety allows an assessment of the published and unpublished reports from 140 sites across Britain. A review of the sampling strategies and methodologies is provided, with the aim of demonstrating the nature of the fragmentary evidence that is available, and to begin a more cohesive chronological and geographical interpretation of the data.

Britain, at first glance, may seem an unlikely case study with which to advance the study of Roman fisheries, given its distance from the Mediterranean and relatively short occupation of under 400 years; however, Britain is a rich resource with unique factors that can illuminate previously overlooked areas, such as the temperate waters of northern Europe, the large volume of freshwater habitats, and its 'island' status, which have produced a comparatively restricted ecosystem with fewer species and sub-species of fish than the European mainland. The subsequent faunal evidence from the Roman period comprises seventy-one species from thirty-six families, one of which is not native but rather evidence of Roman imported goods (*Synodontis sp*.: Nile Catfish), and two of which are rare in British waters (*Scomber scombrus*: Atlantic Mackerel, and *Scomber japonicus*: Spanish Mackerel). Compared with the hundreds of species that were being caught and transported across the Mediterranean and neighbouring provinces over a longer period of time, this exclusivity facilitates the interpretation of the species and habitats that were being exploited.

The following chapter collates and illustrates the data of fish bone evidence, highlighting the geographical distribution, chronological phasing, sampling biases, cultural contexts and species statistics that are vital in advancing an interpretation of Romano-British fishing practices. The observations made here are further evaluated alongside the fishing tool remains for Britain in Chapter 10. All additional empirical data is included in Appendix C, Part 4. Meanwhile, a detailed description of the relevant species is provided in Appendix B, Part 2.

9.1 Distribution of Fish Bone Assemblages

Fish bone assemblages have been recovered throughout Britain (Figure 116). Though there is currently no data for Wales, bones have been recovered as far north as Edinburgh and as far south as the isles of Scilly. There is, as usual, a concentration of sites in the southeast of the country, but all the defined regions are represented by multiple sites, several of which are composed of numerous assemblages with distinct chronologies and/or context.

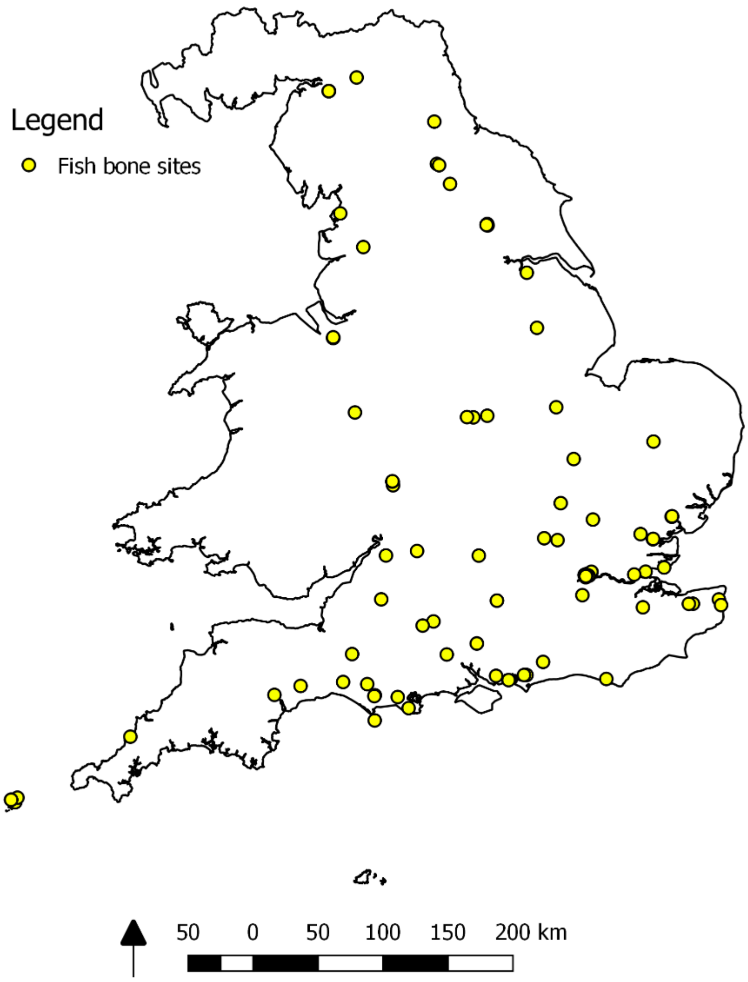


Figure 116: The distribution of fish bone sites by region, showing those published in Locker 2007 (yellow), and additional sites (red). A single case study from Edinburgh is not included here. Overlapping sites represent the recovery additional assemblages within

The North region consists of twelve assemblages from six sites. Carlisle is the most represented urban centre, with ten assemblages from three site. There is no current data for Newcastle, regardless of the numerous military sites and access to marine, brackish and freshwater aquatic resources. Excavations within the city have included ample sampling strategies and revealed numerous assemblages for the Medieval period (Jones and Nicholson 1999), yet it has been highlighted that Roman Newcastle consisted primarily of the legionary fortress of Pons Aelius, which was later replaced by the Norman castle and has thus provided limited remains (Snape and Bidwell 2002). The remaining assemblages recovered from the North region are inland and by riverine environments at Binchester and Birdoswald (Smith 1993).

The North-East region consists of thirty-seven assemblages from eighteen sites. It is the largest watershed, stretching from Bedfordshire to North Yorkshire, for which one might expect a greater number of fish bone assemblages. York and Leicester have produced the most numerous sites, with six assemblages from six sites and fifteen assemblages from three sites, respectively. Once again, all the sites are located inland and only Site 15 (Dragonby) is in relative proximity to the Humber Estuary. There is a distinct absence of sites on the western limit of the region, where the Pennines are located, regardless of the evidence for settlements and fortification by aquatic habitats. It should be highlighted that this area is the most isolated inland region of the country.

The North-West region consists of seventeen assemblages from six sites. Chester represents the highest concentration of fish bone remains, with ten assemblages from four sites within the city. The remaining two sites are at Ribchester and Lancaster. All three settlements are within riverine environments, but Lancaster and Chester are in relative proximity to the estuarine environments of the Lune and Dee mouths, respectively, and the coastal habitats of the Irish Sea. Further inland, the western boundary of the Pennines has, once again, produced no data, as is the case for the northern coast of Wales and Anglesey.

The South-East region is the most fruitful, with ninety assemblages recovered from seventy-three sites. In London alone, a total of fifty-seven assemblages derive from fifty-three sites. Colchester is also relatively numerous with thirteen assemblages from four sites. An additional ten assemblages from six sites are located by riverine and estuarine environments in proximity to the North Sea coast of Essex. This group includes the largest Romano-British fish bone assemblage to date at Stanford Wharf (Site 123). Several sites are located far inland, following the course of the River Thames and its many tributaries. These include nine assemblages from seven sites in Oxfordshire, Hertfordshire, Hampshire and Gloucestershire.

The South-West region consists of nineteen assemblages from eight sites. These are distributed among the riverine environments of the West Midlands, where there are eight assemblages at five sites, and the Cotswolds and Mendip Hills, where there are eleven assemblages from three sites. The latter includes the religious temple-site of Uley, Gloucesterhsire, where fish bone remains have been recovered from nine separate phases of deposition throughout the Roman occupation (Wheeler 1993). All the sites are located in riverine environments and there is currently no data for the southern coast of Wales or the Severn Estuary.

The South region consists of forty-two assemblages from twenty-eight sites. Five assemblages were recovered at three sites on the Isles of Scilly, off the Cornish coast. Only one other assemblage is from Cornwall, at Newquay (Site 103). The remaining sites are distributed from Devon to Kent, with notable concentrations in Kent, Dorset, and Sussex. Several sites are on or in proximity to coastal environments, which is consistent with the S region being characterized by short rivers flowing southward towards the long stretch of coastline of the English Channel. Eleven sites are located further inland in riverine environments.

It is noteworthy that most of the sites excavated and/or published after 2007 are geographically consistent with those published by Locker (2007). One explanation for this is that there are consistent archaeological interventions in these locations due to various factors which promulgate archaeological research (urbanisation, land reclamation, or academic interest); these are supported by case studies at York, Chester, London, Silchester, and Stanford Wharf. Another explanation is the consistency of the Roman exploitation of fish in these areas, which would be far more insightful of Romano-British fishing practices, but which requires further supporting evidence to support such an argument.

9.2 Sampling and Data Management

Environmental sampling strategies have adapted to the intensive methods of commercial archaeology, which is the current dominant method of archaeological investigation in Britain and, as such, the greatest contributor of ichthyofaunal evidence. One would be misdirected if the inconsistency and incomplete nature of the fish bone assessments over the last fifty years was attributed to the inherent pitfalls of commercial archaeology alone, such as financing and deadline restraints. Nevertheless, there are definite discrepancies in the methods of sampling and assessing fish bone remains that impact our interpretation of the subsequent assemblages. The identification of sampling bias can prevent misinterpretations of ichthyofaunal remains and, where strict sampling strategies are ensured, it may be possible to accurately hypothesise on the methods of capture, consumption, and deposition. This bias is clearly demonstrated in archaeological reports where material collected by hand is empirically compared to wet-sieved sample residues, the latter revealing a much more numerous and broad collection of ecofacts. Examples include the Isles of Scilly (Ingrem 2006) and Beadle Street in London (Nicholson 2013b). At both sites, only robust bones from larger species, such as conger eel, gadids and mackerel, were collected by hand; meanwhile the sieved samples revealed a more numerous collection of fishes from the same contexts, such as eel, clupeids, flatfish, cyprinids, and various freshwater species. As we shall see, the latter group of fishes represent the primary resource for Romano-British fisheries, and in the case of clupeids (such as herring, sprat, and shads), the only resource that supported a large-scale fishery, such as those necessary for fish salting or sauce production. Regretfully, hand-collection as a sampling method is not an outdated system, but one that is the only recourse for excavations or evaluations where there is insufficient budget or cause for a more intensive sampling strategy.

9.2.1 Impact of Sampling Strategies on Assemblages

To better demonstrate the sampling bias, the 'site sampling-strategy' is a dataset that has been collected from all available excavation reports (Figure 117), highlighting the various sampling methods in relation to the assemblage size (measured by NISP) and confirms what is generally known, i.e. that wet-sieving (predominantly using 1mm or 0.5mm minimum mesh size) is the best method for fish bone recovery. Sites where wet-sieving has taken place have also included hand collection as a standard excavation strategy, but such ecofacts are combined with the larger samples upon assessment. As the data demonstrates, hand-collection alone will only yield small assemblages of larger bones.

Sub-samples are those taken to either produce a representative residue of a much larger assemblage, or to collect micro-ecofact data from various layers or fills within a feature. These samples are often small (between 1 and 2 litres per context) and for archaeobotanical or geoarchaeological purposes, and therefore, fish bone remains are a secondary and scarce ecofact that emerge from the residues. These residues, though sparse, are important because many evaluations and even excavations will only budget for sub-sampling for dating purposes; they are therefore the only representation of fish bone remains for many sites, regardless of the potential, albeit hypothetical, total volume that is lost.

The largest assemblages of bones in Britain are also represented by sub-samples, but a different type, that is, a small proportion (1 to 2 litres) of the collected bulk samples, which are on average between 10 and 40 litres per sample and can include the entire deposit; this is a consequence of a large assemblage being beyond the investigative capacity of any archaeological unit. Those highlighted in Figure 107 and further elucidated below include subsamples of large assemblages at Lincoln (Irving 1996), Peninsular House in London (Locker 2007), Stanford Wharf (Nicholson 2012), Dorchester Hospital (Hamilton-Dyer 2008), and St Mary Bishophill Junior in York (Jones 1988; though there are no confirmed dates for this Late Roman to Anglian site). These sites constitute the evidence for fish processing in Britain and the tens of thousands of fragments have required a sub-sample assessment only.

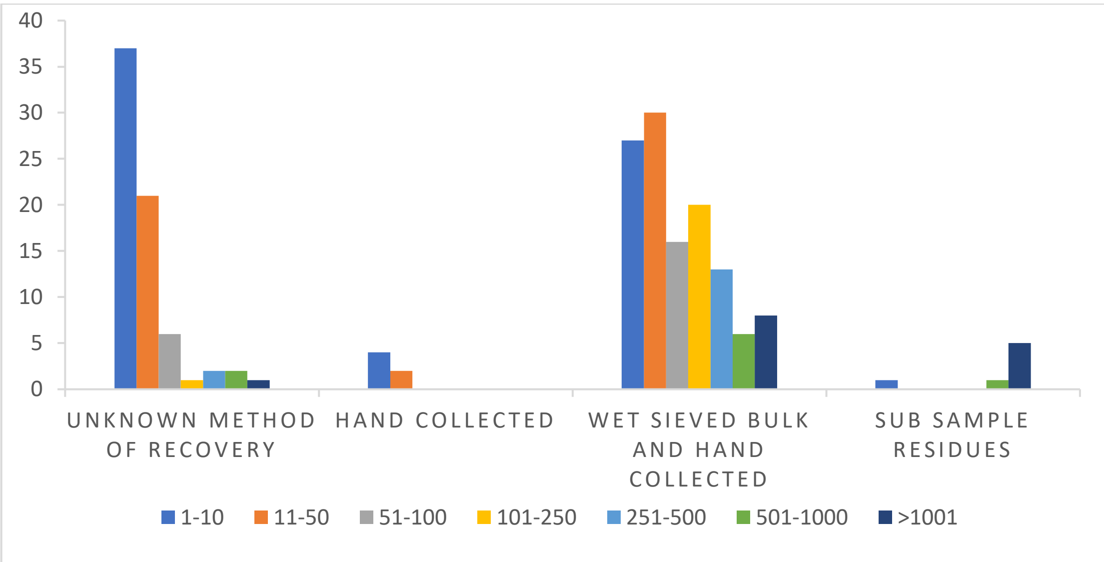


Figure 117: Number of assemblages based on sampling methods and NISP they yielded. Colours refer to NISP range in each assemblage.

One must also consider the high proportion of assemblages for which there is no information of the sampling methods involved, most of which are a result of outdated early methodologies or unpublished assessments. A large proportion of these are assemblages composed of less than ten fragments, both diagnostic and undiagnostic (with no way of ascertaining species or family of fish) and are most likely the result of sub-sample residues or hand-collected ecofacts. The significance of including this information in assessments and reports must be emphasised, as small assemblages have been the primary factor in defining fish as an unimportant resource during the Iron-Age to Roman periods in Britain. In contrast, where wet-sieved samples have produced small assemblages, one can suggest fishing played a minor role with greater certainty (Nicholson 1992; 1993; 1995; Nicholson and Scott 2004).

The excavation dates of ichthyofaunal assessments illustrate the progression of ichthyoarchaeological studies in Roman Britain (Figure 118). There has been a noted increase in the number of assemblages of various sizes over the past five decades with an improvement of recovery and recording techniques in the 1990s. This has been attributed to the guidelines published by Wheeler and Jones (1989), which has produced a more consistent methodology of assessment and encouraged a growing community of ichthyologists interested in archaeology, and vice-versa (Morales 2014). Although the figures of the last decade are skewed by yet unpublished assessments of recently discovered assemblages, there is a notable reduction in the disparity between the number of large and small assemblages. Whether the substantial disparity of the earlier publications is a result of poor sampling strategies or evidence of the sparsity of fish consumption requires a closer examination.

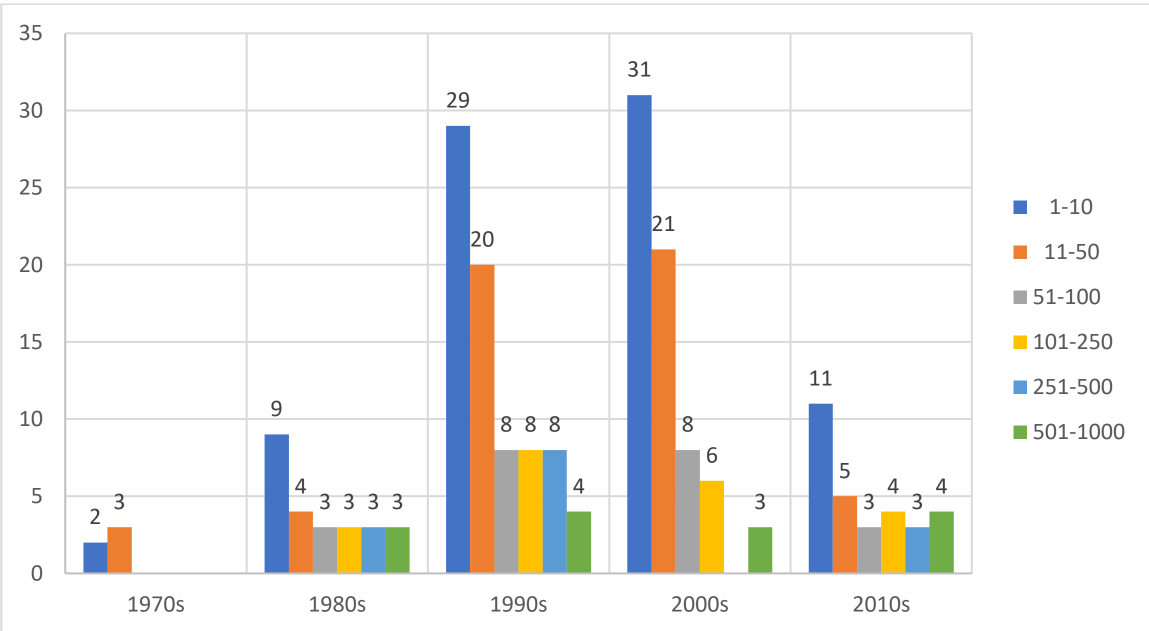


Figure 118: Number of fish bone assemblages based on NISP ranges and by date (decade) of publication of ichthyofaunal assessments.

9.2.2 Feature Type

To better approach this question we should not only consider the methods of sampling, but the targeted features and contexts from which fish bone remains have been recovered. There are standard criteria for which features require stricter sampling strategies, which is determined on a case-by-case basis (Jones 2011, 8-9); however, if contexts are thought to be unproductive excavators will often avoid sampling (Ibid. 9). Bones were not solely deposited as the residue of butchered meat, depending on the species, bones could also be digested, processed, and preserved with salt alongside the flesh, ground into a paste or powder, or even deposited by other mammalian and avian predators (Nicholson 1991). This results in range of archaeological features from which bones are recovered and, more importantly, the size of the resulting assemblages.

Where fish bone assessments have been included in comprehensive archaeological reports, it has facilitated the identification of context, date, and feature type (e.g. Nicholson 2012; 2013a; 2013b; Harland 2017), but with many exceptions. Even the most intensive sampling strategy has not ensured that the samples are not amalgamated in the report to simplify the ichthyofaunal interpretation. Many of the assemblages derive from various archaeological features and therefore contexts (e.g. Wheeler 1993; Nicholson 2002; Bullock 2010). Meanwhile, other assessments are the result of third-party contributions, where specialists themselves are unable to access the appropriate data and provide a more detailed assessment (e.g Jones 1988; Hamilton Dyer 1999). There are few fish bone specialist in Britain, therefore samples may either be sent for assessment, often with limited accompanying information, or may simply be stored due to lack of funds (Jones 2011, 14-15). Indeed, this has been the case for at least three case studies discovered during the completion of this thesis (e.g. Ingrem 2009; 2012; Nicholson 2010).

Where features have been identified, various discrepancies are visible in the provenance of assemblages of different sizes. Figure 119 depicts the percentiles of assemblages based on size averages by NISP and divided into feature type. Bar cess pits, all the features have produced numerous small assemblages. It is noteworthy that gullies and structures only produce one to fifty fragments. Large assemblages (those with over 1000 fragments) are represented by a diverse range of features, from wells to dumps and middens. One might expect pits, which are linked to human diet and waste, to be rich sources of information, but they have produced small to medium sized assemblages. General layers are more curious examples and, at first glance, unlikely sources of large fish bone assemblages. The >1000 NISP recovered from 'layers' compose the potential fish processing sites (those listed above) within buildings but stratigraphically overlying impermeable surfaces of clay or *opus signinum* (coarse concrete floors). Alternatively, 'layers' include a broad range of uncertain strata where bone deposits are unexpected and therefore often small (under ten fragments).

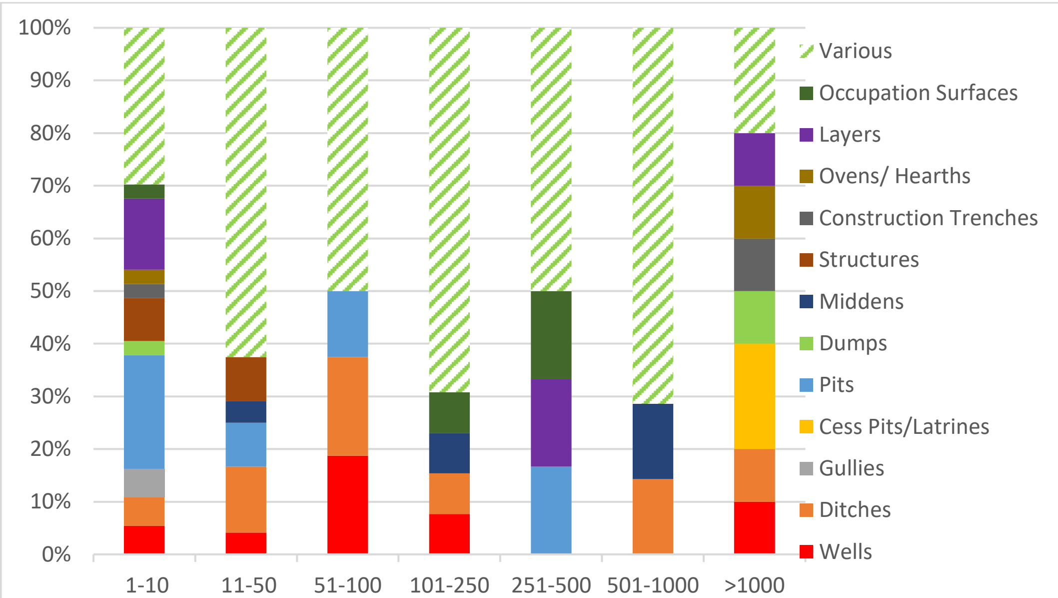


Figure 119: Averages of assemblage sizes based on the feature type of provenance. 'Various' indicates assessments where several features are referenced without specification of which were sampled.

Apart from a wooden and clay-lined tank discovered in London of uncertain function but containing small amounts of fish bones (Cowan et al. 2009, 105), there is no evidence of tanks potentially used for processing fish in Roman Britain, such as the contemporary examples in use throughout the Mediterranean. Indeed, the largest assemblage of salted fish, found at Stanford Wharf (Nicholson 2012), appeared to be situated in purpose-built trenches within the soil, using a similar method as that of salt production, which was also identified at the site (Biddulph et al. 2012).

Dumps containing fish are rare features for this period and often associated with construction and large-scale waste production. Those highlighted derive from structures in Winchester (Nicholson 2011), London (Nicholson 2013a), and the amphitheater at Chester (Harland 2017). Also associated with structures were the construction trenches (features that were cut during a construction or demolition phase of a building), which appeared to be backfilled with various deposits, many containing small fish bone assemblages. These are unlikely candidates for sampling, only included for the site at Chester due to the visible contents (Harland 2017). Wells were ubiquitous with Roman habitation and were constantly replaced and backfilled or re-used as refuse deposits. Subsequently, wells are a rich source of fish bone assemblages of various sizes, including the second largest assemblage not relating to fish processing, found at Fish/Monument Street in London (Burch and Rowsome 1992; Locker 2007), surpassed only by the assemblage from the construction deposits of Chester amphitheater (Harland 2017). Due to the extent of Post-Roman truncation of earlier features in large towns and cities such as London, wells provide us with a rare access to preserved deep strata. Unfortunately, many of the wells from Romano-British settlements were excavated in the first half of the 20th century, when ecofacts such as fish bones were not collected or assessed. Anecdotal references to the potential assemblages that were discarded at the time (e.g. Wheeler 1936) are a stark reminder of the lost data.

Alternatively, fish bone remains are consistently recovered from occupation surfaces and habitation layers, as well as several pits, with an average of close to 500 NISP. This is consistent with the gradual and wide-spread deposition of fish bones in living quarters. Whether evidence of animal consumption (domesticated or rodent) or the disregard for general waste within structures, the evidence suggests fish bones were not solely discarded by conventional waste methods. This also highlights an additional threat to the survival of more accurate representative assemblages of fish bones collected at archaeological sites, as general layers and construction trenches are not often the primary target of sampling strategies.

The most significant attribute to be considered from the information at hand, is the importance of unlikely features in producing a range of fish bone assemblages. Layers, floor surfaces, ditches, and deposits relating to structures appear to produce consistent ecofacts in the Roman period. Until recently, cut features (cess-pits, pits, and wells) were the primary target of environmental sampling (Jones 2011). To our benefit, habitation surfaces have become the target of intensified sampling, though often for the retrieval of artefacts rather than ecofacts. Nevertheless, this has had an indirect impact on the number of fish bone assemblages recovered since the 1990s. The current figures do reveal an inconsistent deposition of fish-waste at Roman sites, which may be the result of various natural or cultural transforms. Either way, it is a poignant reminder that fish were not deposited in refuse deposits and that evidence for fish consumption can derive from numerous features that are often overlooked by sampling strategies.

9.3 Implications of Cultural Context

Related to the type of feature from which the bones are recovered is the function of the site. As mentioned above, Romano-British sites can be divided into three broad categories: 'military', 'urban', and 'rural', which broadly reflect the various types and functions of sites over the four centuries of Roman occupation in Britain. The military presence in the north throughout the Roman occupation, the concentration of villa complexes around the Thames Valley and Cotswolds, and the appearance of civilian settlements throughout, but with a more densely populated southeast region, is a long-recognised pattern in Romano-British archaeology (e.g. Liversidge 1973, 33; Salway 1981, 14-17, 553-556; Mattingly 2007, 132-154, 266-267). At first glance, this is reflected in the distribution of ichthyofaunal assemblages (Figure 120). Granted, the elevated figures for London and the South-East region may reflect a larger concentration of archaeological excavations due to more intensive urbanisation, but the absence of military sites and scarce villas in this region, alongside the reduced military presence in the South region based on Saxon shore forts, is consistent with the current understanding of Romano-British cultural development (See Chapter 2).

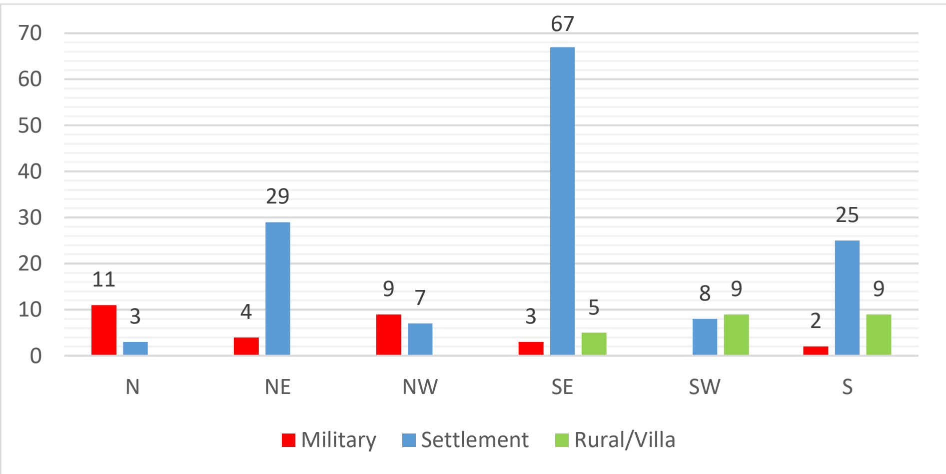


Figure 120: The number of assemblages per region based on site type.

Another significant aspect to consider is that the current regions are based on major watersheds, not political or social divisions of territory; nevertheless, they remain consistent with such cultural phenomena. This is a consequence of both the relatively small size of the British Isles and, more importantly, of the significant impact of topography on both the formation of aquatic environments and the influence on human occupation of the territory.

One must be cautious in suggesting that the current figures are an accurate reflection of Roman dietary trends or of the significance of fish resources, but we must also highlight that the consistency of fish bone remains from the various cultural contexts suggests our current data is sufficient to represent wider archaeological phenomena. This is an important step in demonstrating that the following ichthyofaunal assessments and subsequent data is representative, albeit to an unknown extent, of the regional fishing practices.

9.4 The Regional Discrepancies of Species

An initial overview of the NISP, based on aquatic environments (Figure 121), highlights previously identified trends in fish distributions (Locker 2007). These include the dominance of London and the South-East region, the consistent and low number of freshwater and imported fish, and the high number of marine species, which, although fish-processing sites are here excluded, still constitute the highest number of remains. These marine fishes include large numbers of species that reach estuarine zones where they can feed or spawn in lower saline environments (refer to Appendix B, Part 2 for catalogue of species habits and habitats). Marine species do not dominate in the North and North-East regions, where few assemblages have been recovered in proximity to coastal environments.

The following most numerous species are diadromous, inhabiting or migrating between freshwater and saline environments and which can be caught in most aquatic habitats. Several freshwater species can be found in brackish waters, while marine fish can also reach brackish and even lower-saline waters (see Appendix B, Part 2); however, those described as diadromous in this thesis include species that have been successfully targeted by fisheries in both freshwater and saline environments. These include the salmonids (*Salmo salar* and *Salmo trutta*) and the European eel (*Anguilla anguilla*), the latter of which is the most numerous, partially due to the disproportionately large number of vertebrae per specimen. Eel vertebrae are generally very small (between 2 and 6 mm) and are therefore often overlooked in hand-collected samples; the fact that eels dominate the diadromous specimens regardless of known sampling biases, emphasises their ubiquity and dominance in ichthyofaunal assemblages. Diadromous NISP surpass freshwater species in all but the North-East region; however, it is important to note that several diadromous species can become residential in freshwater environments and are therefore potentially caught alongside freshwater fish.

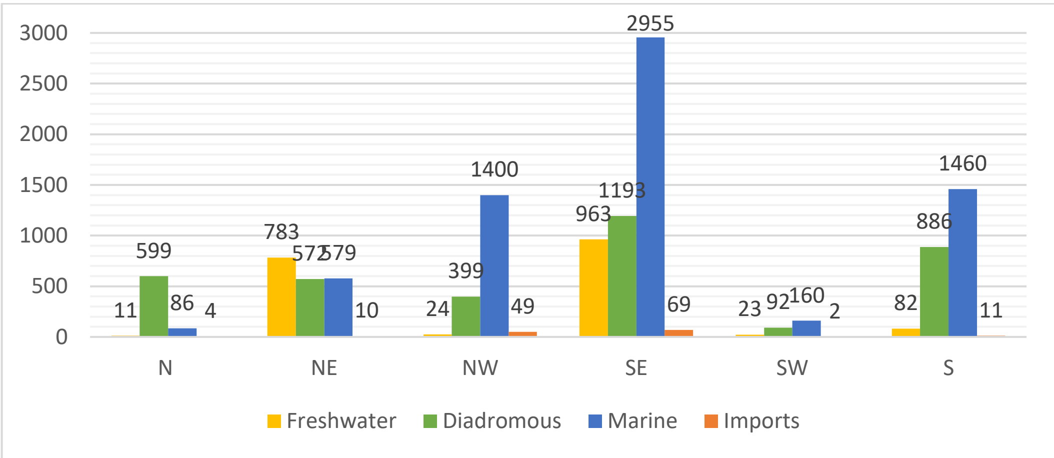


Figure 121: Regional distribution of fish from alternative environments. Figures are based on diagnostic NISP.

The third group of inland freshwater species include the large family of *Cyprinidae* (carps), consisting of 11 species, as well as the pike (*Esox lucius*), the perch (*Perca fluviatilis*), the loaches (*Cobitidae*), and grayling (*Thymallus thymallus*). The most numerous assemblages are in the North-East and South-East regions, where the largest number of inland sites in the country are located.

The final group consists of the imported species, which includes the *Scombridae* (mackerels) and the Nile catfish (*Synodontis sp.*). The scombrids include the *Scomber colias*, which frequents the Mediterranean and Black Sea, but also the *Scomber scombrus* and *Scomber japonicus*, which can be found in the English channel and further north (Wheeler 1978, 324); however, the latter two have been found with imported Iberian amphorae (Yule 2005; Locker 2007, 149), supporting their status as imported goods. These assemblages are few and consist of small NISP, perhaps as a result of the treatment of these by-products via salting prior to transportation. That said, they are also found throughout the regions of Roman Britain.

If the data is represented by 'number of occurrences' instead of NISP (Figure 122), two important aspects are revealed. The first is a general consistency in the frequency of species based on environment with that of the previous chart (Figure 121). The most frequent fishes represented by NISP in the North-East, North-West, South-East, South-West and South regions are unchanged, suggesting the subsequent species of fish are not only numerous but equally distributed throughout the sites. The exception is the North region, where diadromous species represent the dominant NISP, but there is a greater number of occurrences of marine fish. This correlates to the second aspect, which is that marine species are more numerous and widely distributed in the North, South-East, and South regions than other examples. This is not simply a result of a greater number of sites, but, as in the N region, a result of a broader range of families and species of marine fish than their freshwater and diadromous counterparts.

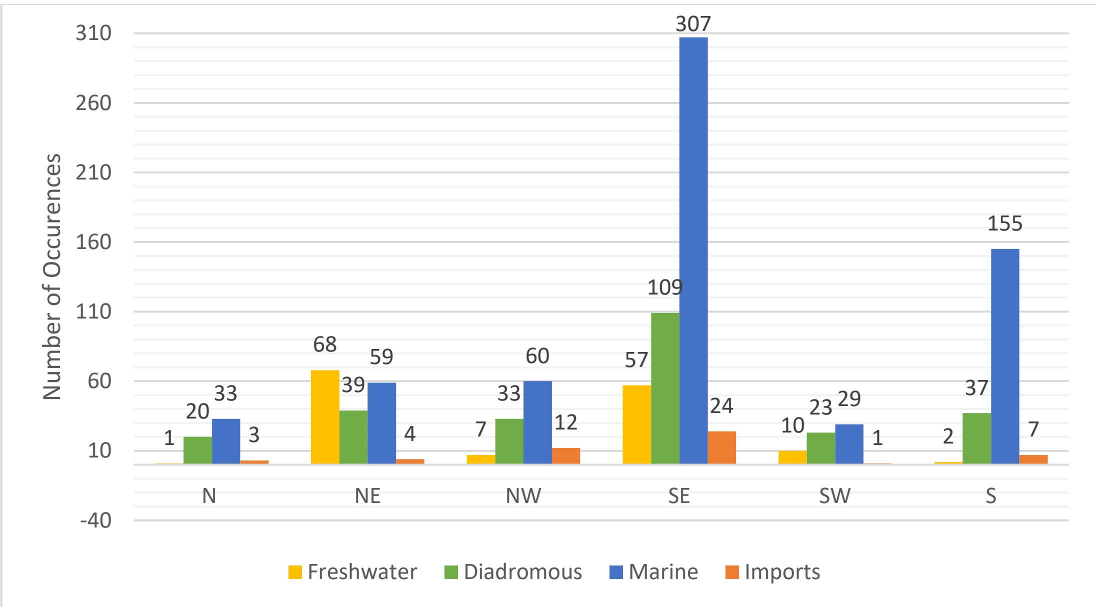


Figure 122: Regional distribution of fish from alternative environments. Figures are based on the number of occurrences of individual species.

To ensure an accurate assessment, both NISP and 'number of occurrences' are assessed for each region. As discussed above, NISP can produce bias data due to discrepant sampling strategies or disproportionate diagnostic remains between species, however, it is a useful tool for determining geographic distribution. The current data for NISP is insufficient to divide the evidence chronologically, as such, it is presented here as a whole for an individual site. In contrast, number of occurrences is not restricted by the volume of the assemblage, which allows us to assess the frequency of a species within a particular region. The following sections discuss each region individually by using both datasets.

9.4.1 Species in the North Region

As previously discussed, the North region is represented by a larger NISP of diadromous species than any other type (Figure 123). Among this group the salmonids are also the most represented family by number of occurrences, recovered from ten of the fifteen assemblages. This is closely followed by the European eel (*Anguilla anguilla*), which can also be found in large numbers, as is the case at Site 3 in Carlisle, with 353 NISP out of the total 475 diagnostic fragments. In contrast, the 'number of occurrences' for diadromous species is fewer than the combined marine species. The marine fishes are represented by nine species, though most have been found at one or two assemblages only. Among these the bones of cods (*Gadidae*) and flatfish (of various families), though undiagnostic to species level, are more easily recovered due to their robust nature and large size. Additional fish include, herring (*Clupea harengus*), mullets (*Mugilidae*), wrasses (*Labridae*) and gurnards (*Triglidae*), which reveals a diversity of targeted marine species with discrepant habits and seasonal lifecycles. *Scomber scombrus* is the only potential imported fish that has been recovered from three assemblages (Sites 3, 2d and 5b).

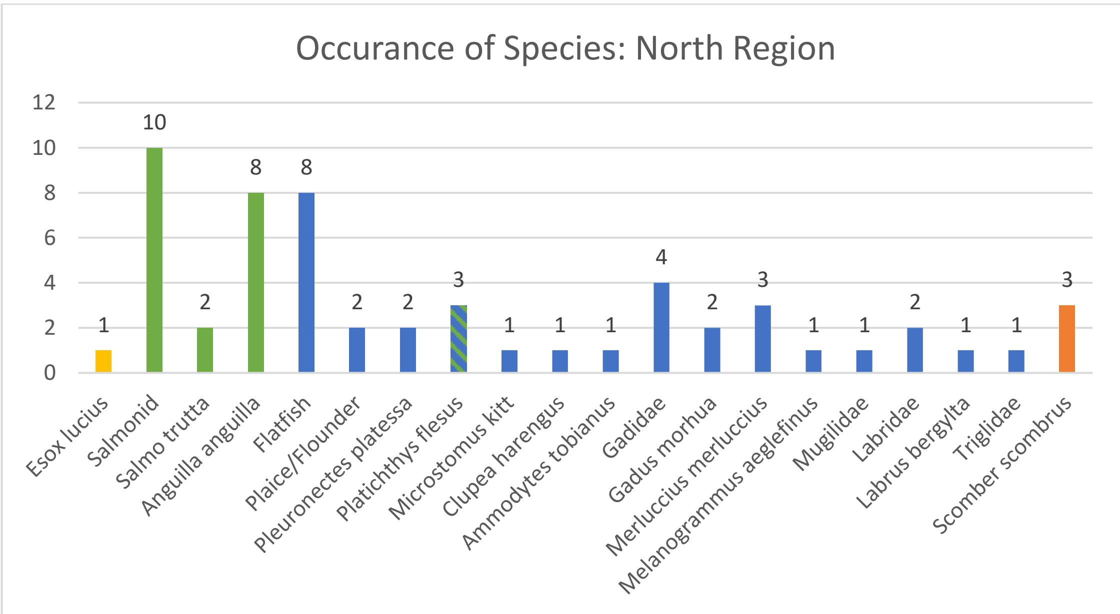


Figure 123: Number of occurrences of fish to species or family level in the N region, from a total of 15 assemblages. Yellow=freshwater, green=diadromous, blue=marine, orange=imported. The flounder (Platichthys flesus) is the only flatfish found in freshwater environments in Britain and is therefore highlighted= green/blue.

The North region is poorly represented by the distribution of assemblages. The three sites identified by Locker (2007) are found in proximity to the west coast (Figure 124). The military fort of Birdoswald (Site 1) is in proximity to the River Irthing, which is a tributary of the River Eden, which in turn runs through Carlisle and the additional sites (Sites 2 and 3). This connectivity is augmented by two additional sites at Carlisle (Sites 114 and 115), but where the recovered fish bone remains are yet to be assessed. The same is the case with the only site at the eastern perimeter at Binchester (Site 112). Where data are available, we can see an absence of marine fish in the inland site of Birdoswald, where only trout (*Salmo trutta*) have been recovered and which could have been caught in the local river. Carlisle, though also inland, shows a diversity of fish, including imported mackerel (*Scombridae*). Freshwater fish such as pike (*Esox lucius*) and diadromous fish suggest local catches, but a range of marine species reflect an influx of estuarine or coastal fish from which the diadromous examples may also originate.

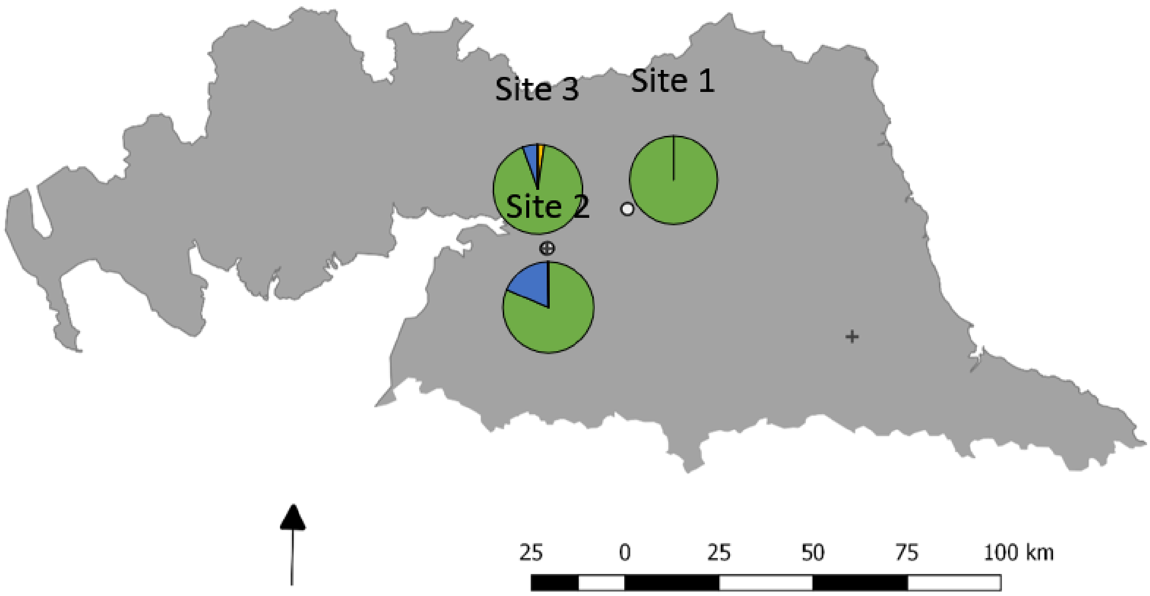


Figure 124: Distribution of environmental groups of fish in the N region. NISP of various species per site. Those sites with no NISP data are do not have a chart. Yellow=freshwater, green=diadromous, blue=marine, orange=imported.

9.4.2 Species in the North-East Region

The North-East region reveals a more diverse distribution of fish, including the largest selection of freshwater species (Figure 125). Seven species of cyprinids have been identified and though they are individually scarce, those identified to family level (*Cyprinidae*) have been recovered from nineteen assemblages, more than half of the total for the region. Additional freshwater species recovered from a large number of sites include the pike (*Esox Lucius*) and perch (*Perca fluviatilis*). Less frequent are small species such as the stone loach (*Noemacheilus barbatulus*) and the bullhead (*Cottus gobio*), but also a rare example of burbot (*Lota lota*), the only freshwater fish related to the gadids. This diversity of inland freshwater species highlights an indiscriminatory extraction of local resources. Tied to some of the same sites are the diadromous fishes, represented by four species including the salmon (*Salmo salar*), the brown trout (*Salmo trutta*), the smelt (*Osmerus eperlanus*), and the European eel (*Anguilla anguilla*). The eel is now the dominant species by number of occurrences, recovered from the largest number of assemblages, not only among the diadromous species but all known fishes from the North-East region. If the salmonids are combined, they are also a significant figure, although the two species and wider family have been found at some of the same sites. A fifth species of interest is the stickleback (*Gasterosteus aculeatus*), which can live in both saline and freshwater environments, but which is a relatively minute fish that is rare to find. The stickleback was very unlikely used as food and its recovery may relate to natural or animal deposition, but it is also a testament to the improvement of on-site sampling strategies that the minute remains have been collected and identified.

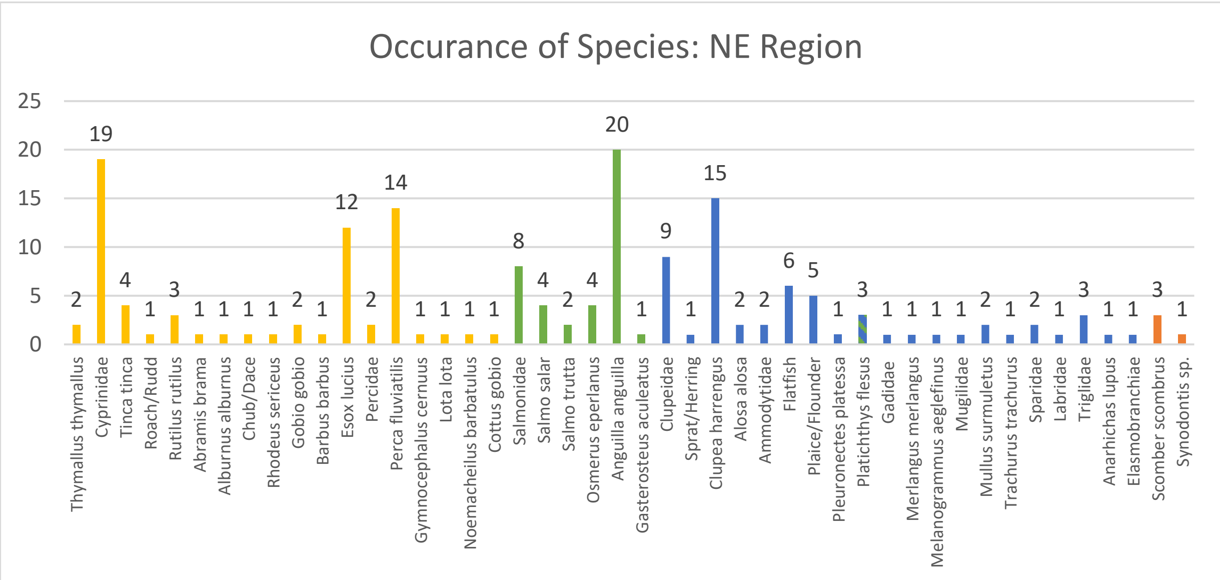


Figure 125: Number of occurrences of fish to species or family level in the NE region, from a total of thirty-seven assemblages. Yellow=freshwater, green=diadromous, blue=marine, orange=imported, blue/green= diadromous flounder.

The marine fishes represented in the North-East region are consistent with the North in diversity; however, clupeids, rather than flatfish, play a bigger role here. Herring (*Clupea* *harrengus*) is the dominant species recovered from fifteen assemblages, followed by Allis shads (*Alosa alosa*) and other undiagnostic clupeids (a combined twenty-seven occurrences). As will be discussed further, this region includes the potential fish-processing sites at York and Lincoln, where clupeids dominate. The NISP figures for the potential fish processing sites are not included in the subsequent map (Figure 126) as the current estimates would overshadow other species. It is conceivable that the recovery of clupeids further inland may represent the deposition of a processed fish product relating to the production centres at Lincoln and potentially York. The current evidence for this is limited to the recovery of clupeids and other small marine fish remains from Leicester (Sites 17 and 18), Thetford (Site 21), and elsewhere in Lincoln (Site 19, not relating to the potential processing site of the same assigned number). Further north, only York has produced evidence of clupeids. The site of Catterick Bridge (Site 4), though further inland, is represented by a few marine bones of various types, but notably not the typical species encountered at processing sites.

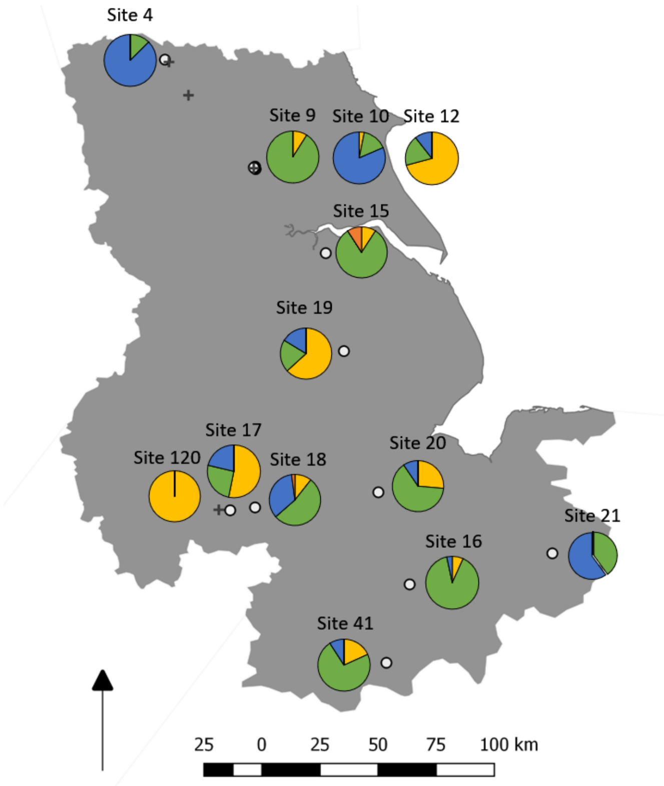


Figure 126: Distribution of environmental groups of fish in the NE region. NISP of various species. Those sites without data are excluded, as are the clupeid figures for fish processing sites at York and Lincoln. Yellow=freshwater, green=diadromous, blue=marine, orange=imported.

The rest of the North-East region is represented by a dominance of freshwater and diadromous species, which is consistent with the numerous inland sites. Dragonby (Site 15), an inland settlement, considered a large village (Mattingly 2007, 476), is the closest site to the Humber Estuary and the associated marine resources that are typically associated with processing facilities; however, no marine fish bone remains have been recovered there. Dragonby (Site 5b) has also produced the only known fragment of Nile catfish (*Synodontis sp*.) which must have been preserved by sun-drying and/or salting and exported from Egypt (Van Neer and Depraetere 2005, 168), for which one might expect the consumption of more local processed products. Additional imported products are potentially represented by Atlantic mackerel (*Scomber scombrus*) recovered at Leicester (Sites 18c, e and f).

9.4.3 Species in the North-West Region

The North-West region is represented by fewer species and assemblages than the North-East, yet it has revealed a larger number of NISP of marine species not related to fish-processing (Figure 127), which is due to the large assemblage recovered from Chester amphitheatre (Harland 2017). According to Harland (2017), the estimated size of individuals and butchery marks on a range of species indicate the consumption of fresh fish at an unprecedented scale. The seventeen assemblages derive from only six sites and are represented by twenty-three species. All the freshwater remains are from Chester, consisting of cyprinids, perch, and loach. Though infrequent, they have been recovered alongside the largest collection of marine species, which may indicate a supply of fish from multiple fisheries. Diadromous fishes are dominated by the European eel, recovered at twelve of the seventeen assemblages.

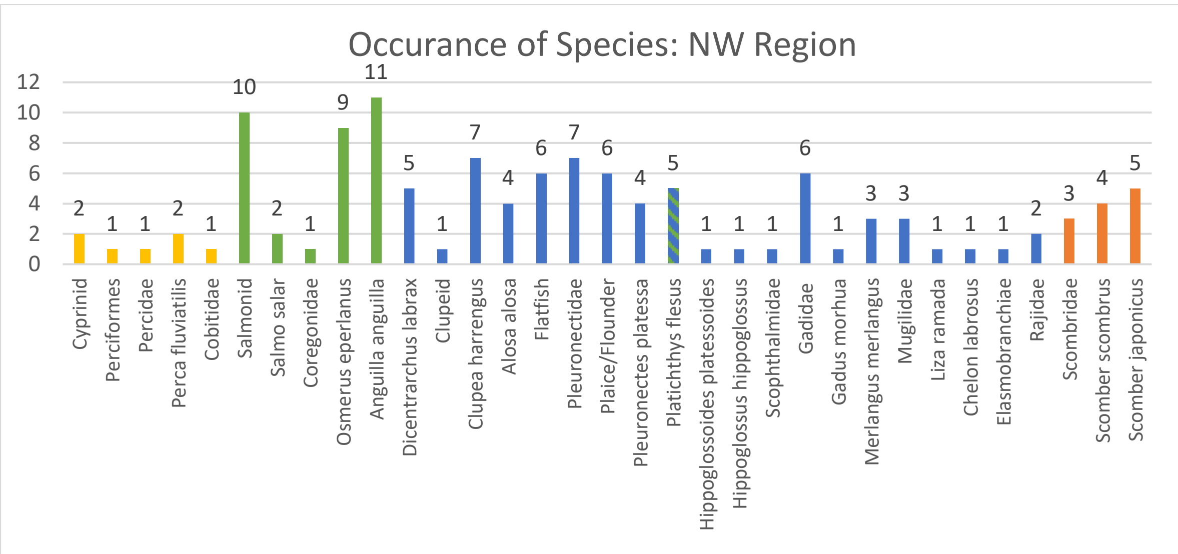


Figure 127:Number of occurrences of fish to species or family level in the NW region, from a total of 17 assemblages. Yellow=freshwater, green=diadromous, blue=marine, orange=imported, blue/green= the diadromous flounder.

Salmonids are also frequent followed closely by smelt. Lancaster (Site 6) is represented by a single fragment of salmonid, but there are no recorded sampling strategies with which to determine this as a chance or representative find. The remaining four sites are all within Chester which dominates the data available for the region. The marine species represented are consistent with the North-East region, with a prevalence of herring, but flatfish of various species, bass (*Dicentrarchus labrax*), and various gadids are also numerous. The recovery of ray and other cartilaginous species-remains adds to a picture of a diverse and effective fishery in the area. The mackerel remains are also numerous and, if relating to imported products, highlights the significance of fish as a desired product in this region.

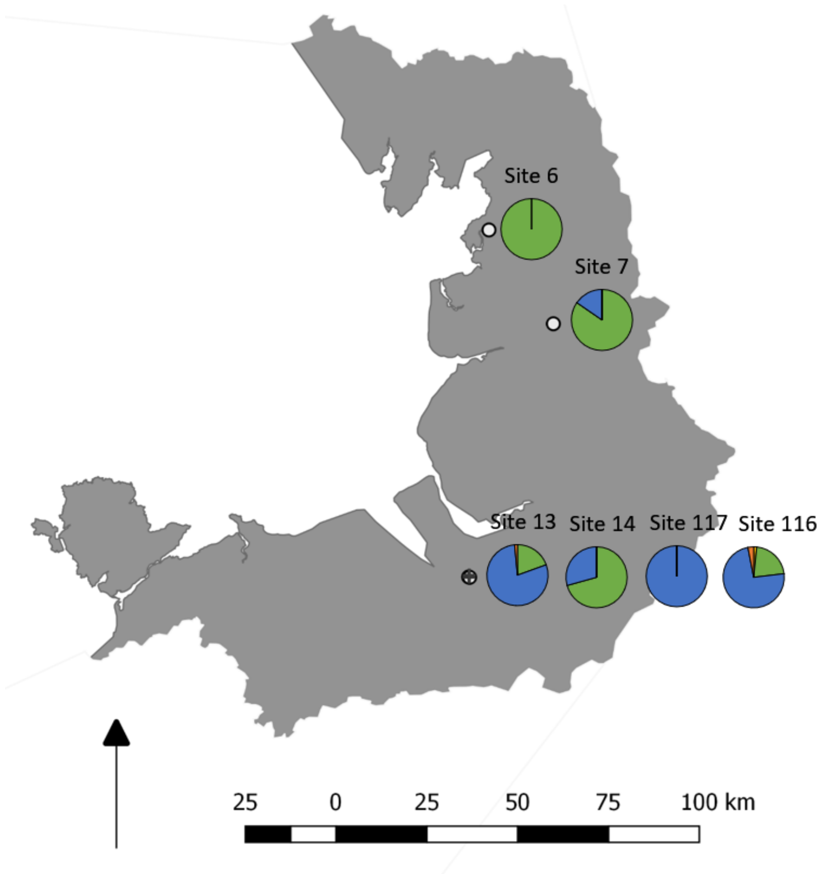


Figure 128: Distribution of environmental groups of fish in the NW region. NISP of various species per site. Yellow=freshwater, green=diadromous, blue=marine, orange=imported.

The distribution of species in the North-West region is highly restricted by the few assemblages recovered (Figure 128). The site of Ribchester (Site 7) is the furthest inland, though still at a significant distance from the demarcated border of the North-East region, a consequence of the influential Pennines. Alongside eel, smelt, and salmon, there are fragments of plaice/flounder and thicklip grey mullet (*Chelon labrosus*); if the former is indeed flounder

(*Platichthys flesus*), both it and the remaining species could be caught in marine, brackish, or freshwater environments, highlighting the difficulty with which these remains are assessed. The absence of strictly marine or freshwater species broadens the range of hypotheses for the potential fisheries that supplied these remains. Lancaster (Site 6) is relatively closer to the sea but is a poor assemblage consisting of a single fragment of a salmonid. Therefore, the North-West region is primarily based on the evidence from Chester. This city has produced ten assemblages from four sites. Its location by riverine environments and relative distance to marine and estuarine resources (around 12.5 km at present day) are indicative of the potential distance of transported aquatic resources and, therefore the radius of marketable fisheries.

9.4.4 Species in the South-East Region

The South-East region is the best represented and has produced the greatest number of sites (seventy-three), assemblages (ninety), fish bone remains (5233 diagnostic NISP excluding the processing sites of Peninsular House and Stanford Wharf; Figure 129), and number of species (fifty). Freshwater species are equally numerous to the North-East region, which includes cyprinids, pike, perch, and bullhead (*Cottus gobio*). Among the diadromous species, the European eel dominates by a large margin, recovered from 65 of the 90 assemblages in the region. Salmonids and smelt are proportionately less frequent than in the northern regions yet are more distributed than freshwater species. The stickleback is not strictly diadromous but can inhabit freshwater, estuarine, and marine habitats; as mentioned above, this small species is unlikely eaten, but a testament to the improvement of sampling strategies, as it has been recovered at eight assemblages. Marine species are numerous in diversity and distribution, of which herring (*Clupea harengus*) remains the predominant species, recovered at forty-three assemblages, alongside sprats (*Sprattus sprattus*), allis shad (*Alosa alosa*), and other clupeids of uncertain species. The clupeids are followed by flatfish (twenty-nine assemblages), especially the plaice (*Pleuronectes platessa,* from seventeen assemblages) and flounder (*Platichthys flesus,* from ten assemblages), which are often difficult to distinguish from each other and therefore commonly grouped together (plaice/flounder, from thirty-four assemblages). Combined with additional species, flatfish constitute a large number of remains, reflecting the capture of marine species in shallow marine waters and even brackish conditions; to our disadvantage, the uncertainty between plaice and flounder, the latter of which can be found in freshwater environments, highlights the potential error in flatfish attribution to marine fisheries only.

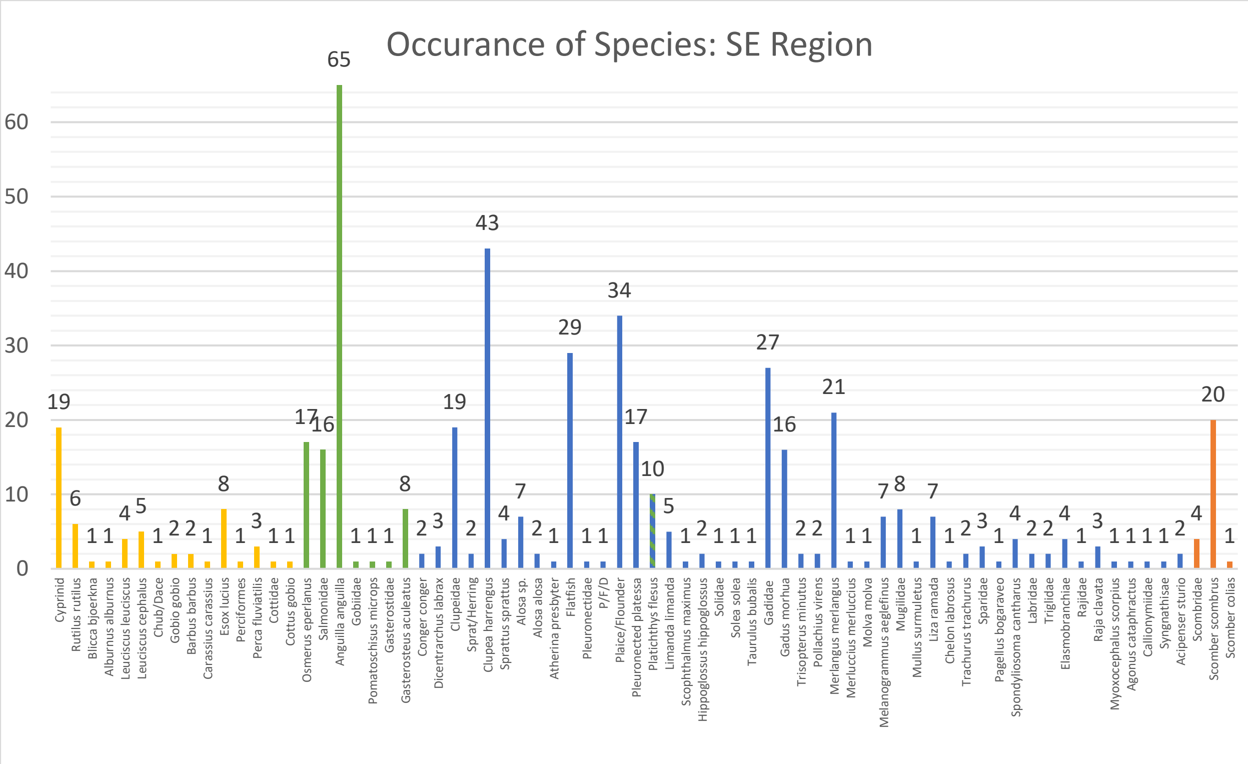


Figure 129:Number of occurrences of fish to species or family level in the SE region, from a total of 90 assemblages. Yellow=freshwater, green=diadromous, blue=marine, orange=imported, blue/green= diadromous flounder.

Gadids have been identified to family level at twenty-seven assemblages and are more numerous if the subsequent species are included, such as the whiting (*Merlangus merlangus,* from twenty-one assemblages) and the cod (*Gadus morhua,* from sixteen assemblages). Cods are surprising as they are often found offshore, where intensive fishing did not take place until the 11th century (Orton et al. 2014, 527). The NISP for these species are scarce, which suggests irregular and chance catches closer to shore, nevertheless, they pose further questions as to the catching methods. The remaining species are few but diverse, including breams (*Sparidae*), wrasses (*Labridae*), gurnards (*Trigilidae*), sea scorpions (*Taurulus bubalis*), thornback rays (*Raja clavata*), and other smaller species. Many have been recovered among the far more numerous clupeids at the processing site at Stanford Wharf (Site 123), which is ideally situated at the widening of the Thames estuary to target marine species that are otherwise uncommon further inland. Imported Iberian fish products have been highlighted in this region (Yule 2005) and mackerel remains have been found at twenty assemblages, with the addition of other scombrids. These are likely representative of such imports (Locker 2007 149), further supported by the absence of mackerels at Stanford Wharf, where many other marine species have been identified.

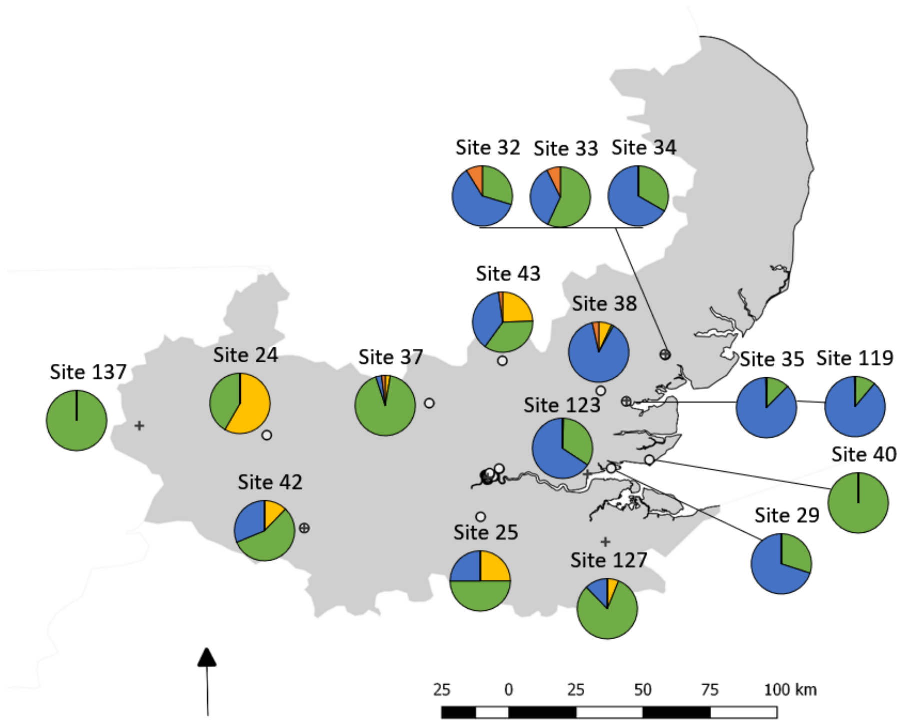


Figure 130: Distribution of environmental groups of fish in the SE region. NISP of various species represented per chart. Those sites without data are excluded. Yellow=freshwater, green=diadromous, blue=marine, orange=imported.

There is a far clearer pattern in species distribution in the South-East region than with northern areas. The sites within London are assessed individually (Figure 131), nevertheless, there are a substantial number of sites that are widely distributed throughout the South-East (Figure 130). Those sites located on the east coast are within riverine and estuarine environments with access to a number of diadromous and marine species, which is the case for Colchester (Sites 32, 33 and 34), Heybridge (Sites 35 and 119), and Canvey Island (Site 29). The site of Stanford Wharf (Site 123) is the largest fish processing site in Britain but is included here to demonstrate the diversity of the species that were collected there, including several diadromous species that would have migrated further inland via the Thames estuary and river, including eel, smelt, numerous stickleback, and gobies. The largest number of freshwater species are found further inland at Abingdon (Site 24), Beddington (Site 25), Silchester (Site 42), and Stevenage (Site 43), but these are relatively small in comparison to the accompanying diadromous and marine species. The latter two sites include clupeids, which are expected remains of potential processed fish products, but also flatfish and bass (*Dicentrarchus labrax*), which are unexpected so far inland. Diadromous species are found throughout the entirety of the region, including salmonid remains from Cirencester (Site 137). The migratory eels, salmon, and trout are indeed the most numerous species at inland sites. Imported species are rare and mostly found at large urban centres such as St Albans (Site 37), Colchester (Sites 32, 33 and 34), and London (Sites 44, 45, 46, 71, 82, 84, 92 and 96).

The various sites in London are primarily composed of marine and diadromous species remains. The latter is expected for the tidal and wet-land environments that would have been present at the time, as are a few of the marine species that inhabit low saline environments. This transitional zone between freshwater and brackish conditions may explain the scarcity of freshwater species, which have been recovered from thirteen of the fifty diagnostic sites (Figure 131); however, at Fish/Monument Street (Site 59), where a well deposit has produced the second largest fish bone assemblage in the country not relating to processed fish (Chester, Site 116, is the largest), freshwater species, dominated by cyprinids, are the most numerous, questioning their absence elsewhere.

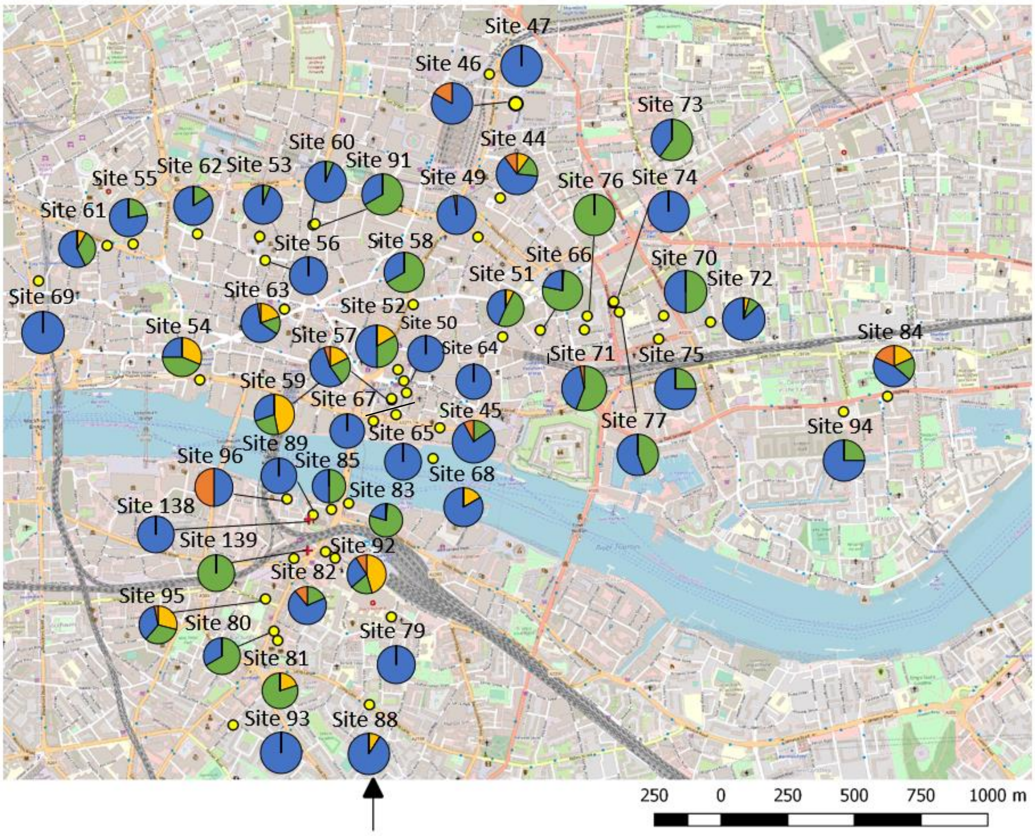


Figure 131: Distribution of environmental groups of fish within London, in the SE region. NISP of various species per site. Those sites without data are excluded. Yellow=freshwater, green=diadromous, blue=marine, orange=imported.

Fish/Monument Street has also produced a range of marine species, including fish that would have been caught in more saline environments (such as gadids, wrasses, sea breams, and mullets), suggesting the acquisition of fish from various fisheries. Species that are more consistent throughout London include the marine flatfish and clupeids, as well as the diadromous smelt, which is consistent with the species recovered at the fish-salting site of Stanford Wharf (Site 123). The dominance of these remains, over more local freshwater species, may highlight the targeting of specific fishes and, therefore, specialised fisheries. One final point is the absence of data on the southbank of the Thames, other than the concentration at Southwark, which is consistent with the geoarchaeological interpretation of a marsh or brackish aquatic environment in the area during the Roman occupation (Cowan 2009, 18).

9.4.5 Species in the South-West Region

The South-West region is relatively scarce, represented by nineteen assemblages from eight sites and containing at least thirteen species (Figure 132). Freshwater species include chub (*Leuciscus cephalus*) alongside other uncertain cyprinids, perch, and pike, but none exceed three assemblages for the entire region. Diadromous species, on the other hand, are the most dominant, this time with salmonids having the largest number of occurrences (eleven out of nineteen assemblages) and the greatest NISP. The eel is the second most distributed (ten out of nineteen assemblages), though the low number of NISP may result from sampling biases. Marine species are primarily represented by flatfish, followed by several coastal species, such as bass, sea bream, mullet, and cod, all of which are represented by one-to-three assemblages only. Clupeids are also scarce in both distribution and number, especially if we consider that there are no known processing sites in the region. Only one site has produced evidence of imported fish (mackerel), at the inland site of Wroxeter (Site 23b). The notable disparity between the South-West and neighbouring regions suggests either a recovery bias or a significant absence of aquatic exploitation. Several factors suggest the former is the case, such as the success of marine exploitation at Chester, a similarly isolated location, and the presence of the Severn estuary with equal potential as the Thames estuary for supporting larger fisheries.

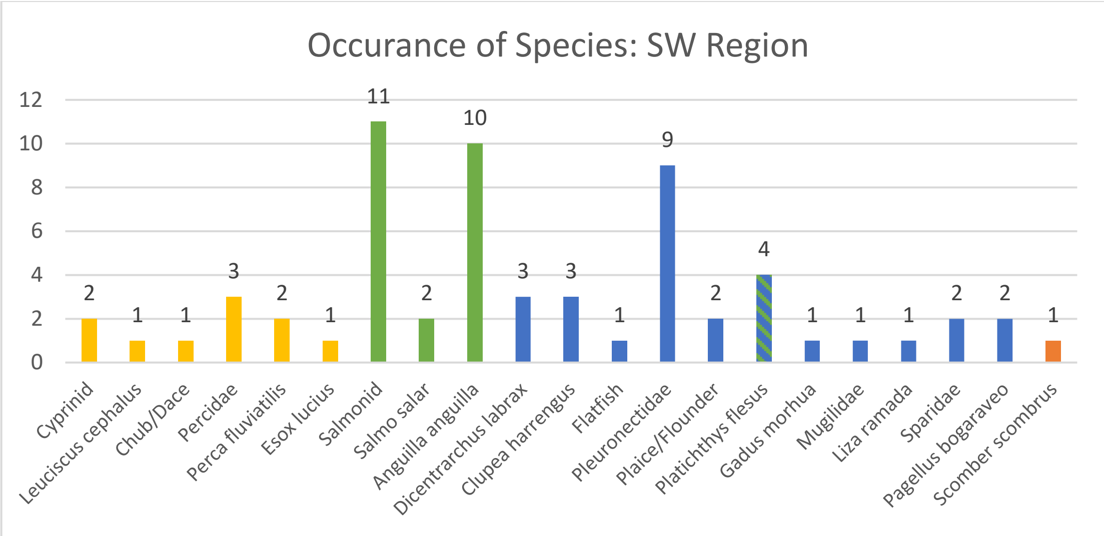


Figure 132: Number of occurrences of fish to species or family level in the SW region, from a total of 19 assemblages. Yellow=freshwater, green=diadromous, blue=marine, orange=imported, blue/green= diadromous flounder.

The recovered assemblages are inland and dispersed throughout the English side of the region (Figure 133). Wales has provided no known assemblages, which may be due to broader archaeological biases rather than issues with sampling strategies. Worcester (Sites 22, 23, 131, 134 and 135) has produced a large number of assemblages, though the remains are often scarce regardless of wet-sieving taking place (Nicholson and Scott 2004, 506; Clapham 2010; Pearson 2014 ; Hamilton-Dyer 2014). Nevertheless, the recovery of marine species far inland, including clupeids, draws attention to the potential transport of processed fish. A similar occurrence takes place at the site of Uley (Site 108a-i), though it is substantially closer to the Severn Estuary. At this site, clupeids have not been found, but various coastal species are present, such as mullets (*Mugilidae*), bass (*Dicentrarchus labrax*), and red sea bream (*Pagellus bogaraveo*), which may indicate the transport of fresh fish or otherwise the preservation of species other than clupeids by other means (drying or salting). Size estimations are currently unavailable for these species, though further analysis of size may elucidate on the method of preservation. The furthest inland site is Wroxeter (Site 23), which, though a scarce assemblage of hand-collected bones, has revealed a diverse range of local, marine, and imported fish. The dominance of freshwater NISP, may be due to the sampling bias and overlooking smaller clupeid remains, nevertheless, the isolation of this site has not impacted the evidential consumption of fish.

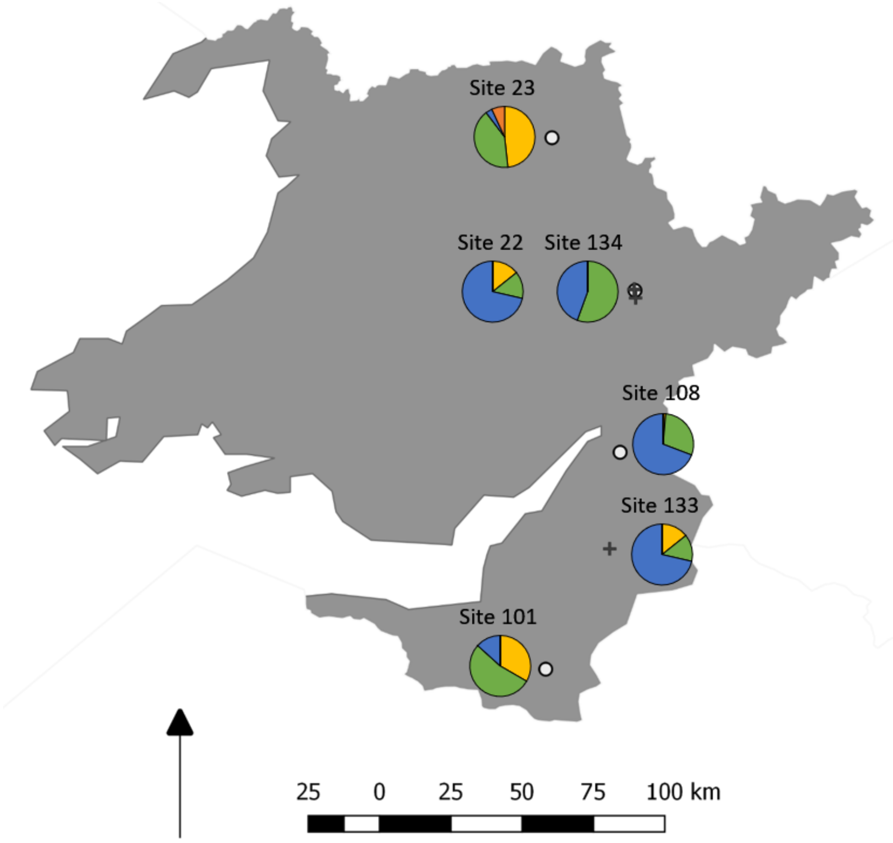


Figure 133: Distribution of environmental groups of fish in the SW region. NISP of various species per site. Those sites without data are excluded. Yellow=freshwater, green=diadromous, blue=marine, orange=imported.

9.4.6 Species in the South Region

The final region is the South, encompassing the coastal stretch of the English Channel, from the Isles of Scilly in the west to Kingsgate in Kent. This coastal region is suitably represented by a large range of marine species (Figure 134). There are forty-two assemblages from twenty-eight sites, comprising thirty-five species of fish, thirty of which are strictly from marine environments. The freshwater species are represented by cyprinid remains only and from two assemblages at Castle Copse (Site 30b) and Dorchester (Site 97). The initial inference is that of an infrequent exploitation of freshwater environments, which is initially supported by the fact that Dorchester has eighty-one diagnostic NISP of freshwater fish in an assemblage of 791 diagnostic fragments; however, the remainder is primarily composed of eel remains, with only a few marine species, as such, these could indicate a riverine fishery which targeted both cyprinids and migratory eels. The European eel is indeed the most represented species in the region, recovered from twenty-two of the forty-two assemblages. It is one of three diadromous species, which include the salmon and brown trout, as well as additional fragments assessed to the salmonid family only. Most of the diadromous remains come from the inland sites of Winchester and Castle Copse, the latter of which includes the only other freshwater remains.

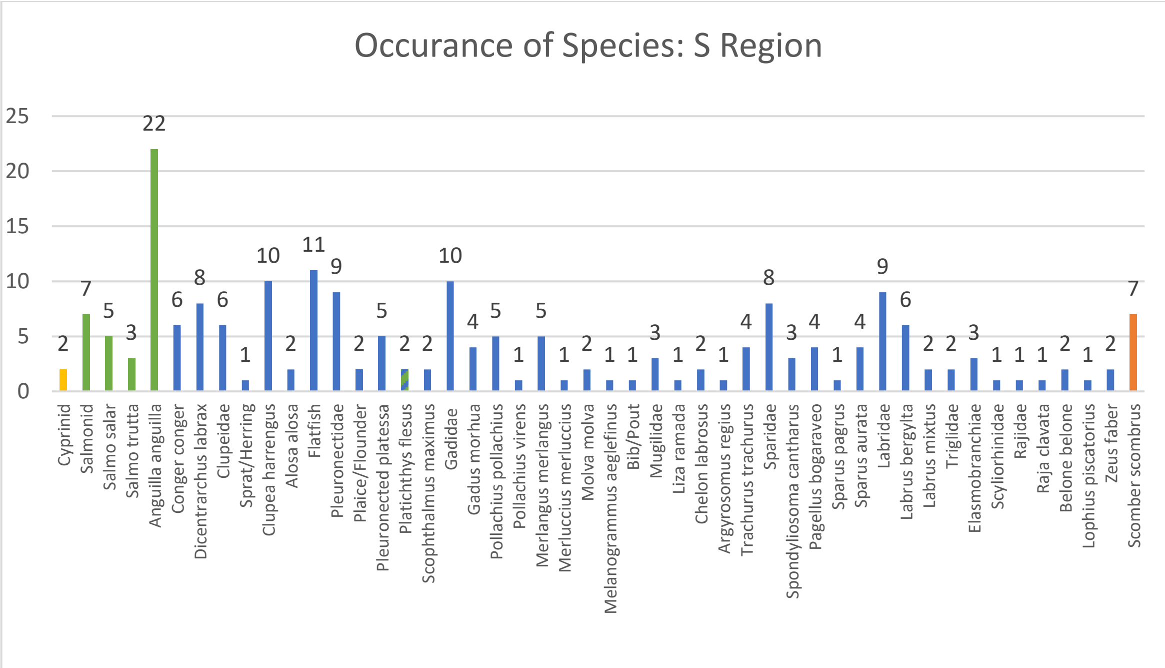


Figure 134:Number of occurrences of fish to species or family level in the S region, from a total of 42 assemblages. Yellow=freshwater, green=diadromous, blue=marine, orange=imported, blue/green= diadromous flounder.

The remaining sites found in proximity to, or directly on the coast, are represented by marine species only. The most numerous are once again the large family groups of flatfish and gadids, but there are additional solitary species such as the bass, conger eel, breams, wrasses, and John Dory (*Zeus faber*) that may reflect local chance catches, rather than evidence of targeted fisheries. The recovery of the thornback ray (*Raja clavata*) and angler fish (*Lophius piscatorius*) are especially interesting, as these species are often found at great depths, rather than the shallow and estuarine conditions reflected by the previous fishes. Atlantic mackerel has been recovered from seven assemblages, reflecting the potential import of Iberian goods.

The distribution of sites in the South region (Figure135) suggest a reliance on local catches, as those sites further inland have a higher proportion of diadromous species than those on the coast. The inland sites of Dorchester (Site 130) and Winchester (Sites 118 and 125) are particularly interesting as they have produced the largest number of clupeid remains (full NISP yet to be determined for Dorchester), which may reflect processed fish product reaching the largest settlements in this region. Clupeids are otherwise scarce, found at Fishbourne Palace (Site 36) and Castle Copse (Site 30), which are both villa sites, and at South Thanet (Site 128) and Chichester (Site 31), though scarce. One significant aspect is the consistency of the assemblages throughout the entire region, in contrast to neighbouring sites from the South-East and South-West. This strengthens the hypothesis that the major watersheds, the instrumental topography which directs water-flow, and the subsequent regions defined here, are influential factors in the distribution of fisheries and the acquired archaeological remains.

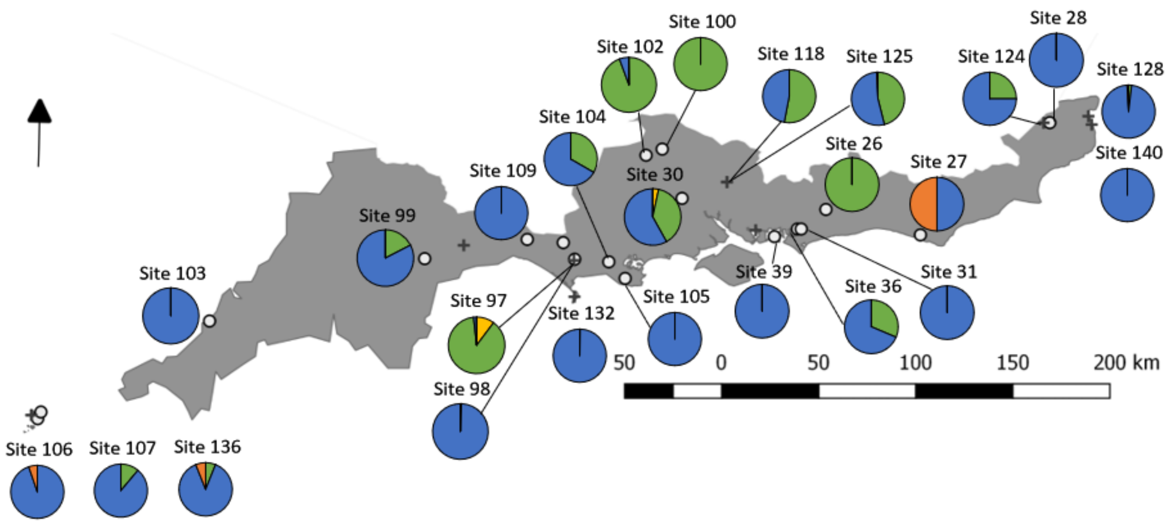


Figure 135: Distribution of environmental groups of fish in the South region. NISP of various species per site. Those sites without data are excluded. Yellow=freshwater, green=diadromous, blue=marine, orange=imported.

9.5 Dating

There are 140 sites in Britain with recorded ichthyofaunal remains dated to the Roman period of occupation (AD 43-410), however, the accuracy of these dates is conditioned by the restrictions of individual site investigations. Only a fraction of the sites have date-ranges within a ten-year period. Many have a broader range, within a century, which may still reflect patterns of change; nevertheless, most sites are assigned to a period between two and four centuries, making it impossible to highlight significant cultural patterns in fish exploitation and eventual change over time. A further issue lies in the data that are published, as there is a tendency in restricted reports to group fish bone remains together, regardless of the potential for various phases of deposition. Examples include Dee House, Chester (Jones 2001), County Hall, Dorchester (Hamilton Dyer 1993a), Greyhound Yard, Dorchester (Hamilton Dyer 1993b), and

No1 Poultry, London (discussed by Locker 2007), to name a few. Without access to the raw data, several sites must be excluded from the chronological assessment.

On the other end of the spectrum, there are several sites with numerous assemblages that reflect consistent consumption of fish throughout a period of 300 years; these include Carlisle (2a-g), Leicester (17a-h; 18a-f), Worcester (22a-c), Colchester (32a-i), St. Albans (37a-c), Uley (108a-i), Healam Bridge (111a-d), Chester (116a-f), Winchester (118a-d), and Heybridge (119a-d), with further sites representing shorter periods of 150 to 200 years. The thesis has attempted to assess and present the data in a manner that highlights patterns of species preference, or periods of increased deposits; however, a flaw in this methodology has become apparent. Almost no sites are in close proximity to each other, with which to determine consistent patterns of species exploitation. Hypotheses of dominant species may therefore be based on singular events. Leicester is a suitable example with which to demonstrate this issue (Figure 136), as it is the only settlement with multiple sites that have assemblages representing three centuries of Roman occupation. These are only two sites, at Little Lane (Site 17) and Causeway Lane (Site 18).

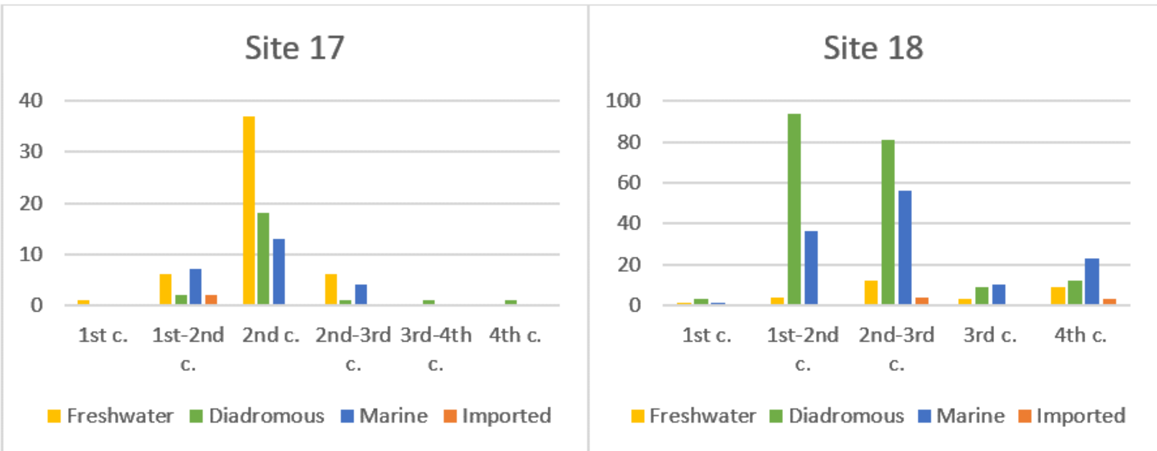


Figure 136: Chronological distribution of fish bone remains by NISP from Leicester at Little Lane (Site 17) and Causeway Lane (Site 18) throughout the entire Roman occupation.

The predominant species differ substantially, with freshwater species dominating Site 17, namely cyprinids, and the diadromous eels and salmonids present in site 18. All assemblages were subject to wet-sieving and assessed by the same ichthyoarchaeologist (Nicholson 1992; 1999), which suggests that the disparity is representative of more complex dietary, social, and/or halieutic discrepancies between the sites. While this is an avenue worth pursuing, insufficient accompanying data is available with which to elaborate on the historical context.

This dilemma is more poignant among the remaining isolated sites where no such comparative evidence is available with which to determine if the assemblage is representative of a dietary preference, or restricted fishing abilities. Attempts to interpret individual sites are therefore currently highly unreliable and excluded. Alternative methods of assessing chronological changes are required.

9.5.1 Chronology Based on Cultural Context

Though currently unable to focus on specific assemblages, which may highlight more complex social hierarchies or dietary practices, one can divide the chronological data by the broader cultural context of the site, be it a military, civilian, or rural context. The following charts (Figures 137, 138, and 139) illustrate the number of assemblages for each settlement type by century, or transitional centuries, where broader dates are produced. This does not include all the acquired data, as nineteen sites do not have any information on context, while an additional fifteen assemblages have too broad a date at sites where both military and civilian settlements were present at different times. Nevertheless, if compared to the established history for Roman Britain, the following assemblages are relatively consistent in their date and distribution.

Military assemblages (Figure 137) are consistent with the historical and archaeological evidence of the Roman occupation of Britain. The rapid southern expansion in the first decade of the invasion in the first century was followed by the creation of colonies and settlements from Kent to Devon (Mattingly 2007, 132-142) where fish bone remains have been recovered, yet there is only one assemblage in the South region that is from a fortification and dated to the 1st century (Site 109). It is not until the 3rd to 4th centuries and the remilitarisation of the southern and eastern coasts that military sites reappear in the South region (Ibid.), once again represented here by a single assemblage (Site 126). The South-East region also illustrates the invasion in the first century with three assemblages from a single site (Site 32 a, b, and c), which was also short-lived and followed by rapid urban development and absence of military sites thereafter. The North-East region was rapidly conquered following the capture of Camulodunum (Colchester) by Claudius and subsequent surrender of many tribes, thereafter considered client-kingdoms (Salway 1981, 86-91), which saw the construction of short-lived military fortifications. This general absence of permanent military sites persisted until the refortification of the coastline in the 3rd to 4th centuries (Mattingly 2007, 238-240), here represented by three assemblages from the same site (4 a, b, and c). One military assemblage from York may represent an earlier military presence in the North-East but remains undated (Site 9).

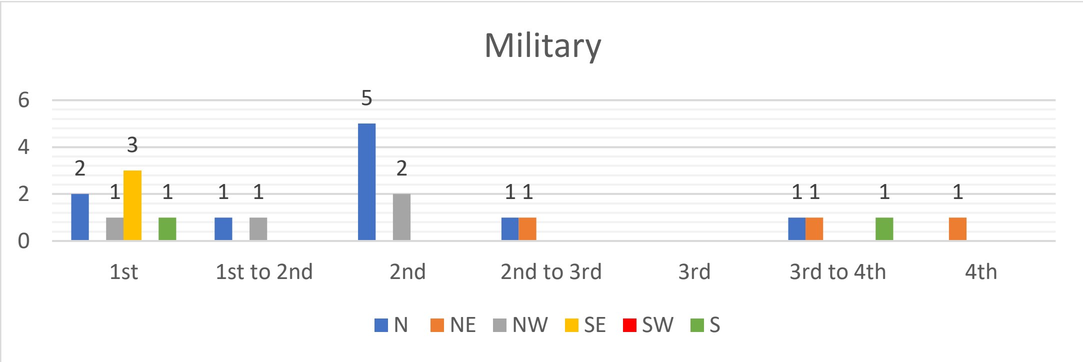


Figure 137: Number of assemblages from military sites per region and divided by century (broad date ranges are excluded).

In the North-West region, the military presence arrives in the second half of the 1st century and there remains a permanent military presence at Chester, Ribchester, and Lancaster, all of which have produced assemblages (Sites 7, 13 and 14). Military successes and failures culminate in the construction of Hadrian's Wall, commencing in AD 122, which involves the intensive militarisation of the already partially fortified Tyne-Solway isthmus, including the construction of permanent stone fortifications (Ibid. 152-159). This is illustrated by five assemblages from this period (Sites 1 and 2 c, d, e, and f) and an additional four prior and following the construction of the wall (Sites 2 a, b, and g, and 3) dominating the assemblages of the N region.

In contrast to the military presence, the urbanisation of Roman Britain via the expansion of previous native *oppida* (fortified settlements) into *civitates* (administrative centres), and the foundation of *coloniae* (colonial towns), was a more controlled and coherent process. Urban settlements housed a much larger population than any previous military structures, excluding the North region where Hadrian's Wall continued to house the bulk of the Romano-British legions and few adjoining settlements (*vicii*). The largest settlement was indeed London (*Londinium*) in the South-East, which was the province's capital. Fish bone assemblages have been recovered from settlements throughout Britain and the defined regions (Figure 138). The South-East is the most represented due to the numerous sites from London, which may reveal a consistent presence of fish throughout the occupation, with a gradual decline from the 3rd to

5th centuries. This may also be the case for the northern regions, comparatively absent from the 3rd century onward. Otherwise, the assemblages, though ubiquitous, are relatively small for urban environments.

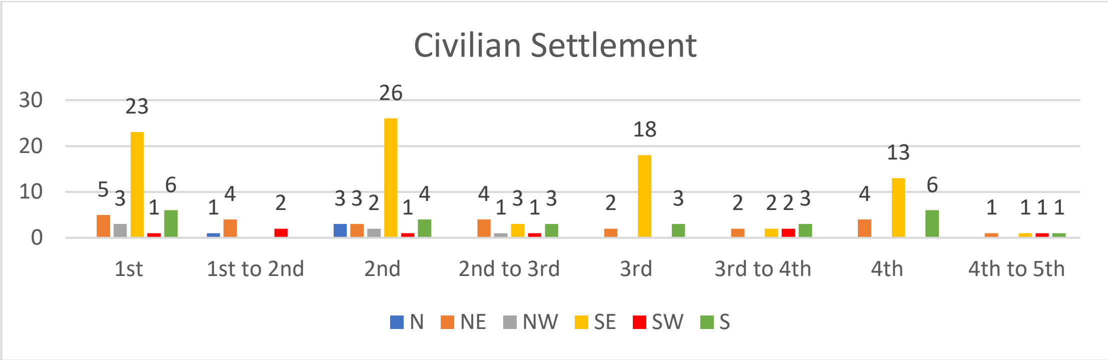


Figure 138: Number of assemblages from settlement sites per region and divided by century (broad date ranges are not included).

The final group is mostly composed of rural villa complexes with the addition of a few minor case studies of farmsteads and other 'uncertain' rural contexts (Figure 139). These are distinguished here as wealthy rural residences (villas) and rural homes solely dedicated to agriculture or animal rearing (farmsteads), though there is some overlap based on the level of archaeological intervention. The figures are small and difficult to interpret, though some aspects are noteworthy. At first glance we can appreciate the absence of any case studies from the northern regions, even the North-East region which stretches down to Hertfordshire to include the rivers draining into the Wash. All the southern regions are represented, with a notable dominance in the S and SW regions. This is consistent with the dominance of Roman villas in this area throughout the Roman occupation (Mattingly 2007, 371).

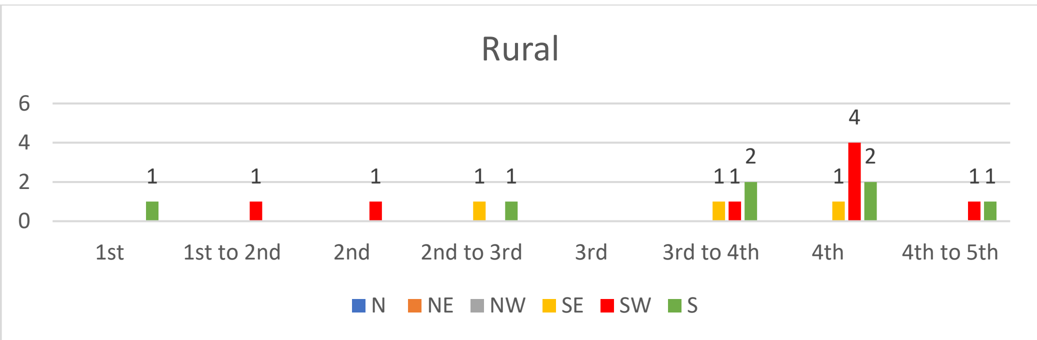


Figure 139: Number of rural assemblages per region and divided by century.

The largest of the villa complexes, also one of the earliest, is Fishbourne Palace on the Sussex coast (South region), which is an example of the rapid adoption of Roman culture by native elites throughout the 1st century; however, there is a peak in villa construction in the later 3rd century (Allen et al. 2017). This may account for the sparse fish bone assemblages in the 1st to 3rd centuries and the more numerous assemblages in the 4th century. This relative peak is represented by thirteen assemblages only and it is important to highlight that villa complexes number in the hundreds for the southern regions of Roman Britain (Mattingly 2007, 370). Many of these may lack fish bone remains due to their excavation in the early 20th century, prior to adequate sampling strategies, yet, the sampling biases aside, the figures currently suggest that fish was not a significant resource for these agrarian-based complexes.

9.5.2 Chronological Distribution of NISP

The subsequent objective is to combine the dated assemblages and represent the NISP for all species within a region (Figure 140). The first projection includes assessed subsamples of processed fish products from the sites of Dorchester Hospital (Site 130 a and b), St Mary Bishophill Junior, York (Site 113), Lincoln (Site 19 a and b), Stanford Wharf (Site 123) and Peninsular House, London (Site 65), where fish were either processed or deposited following processing elsewhere.

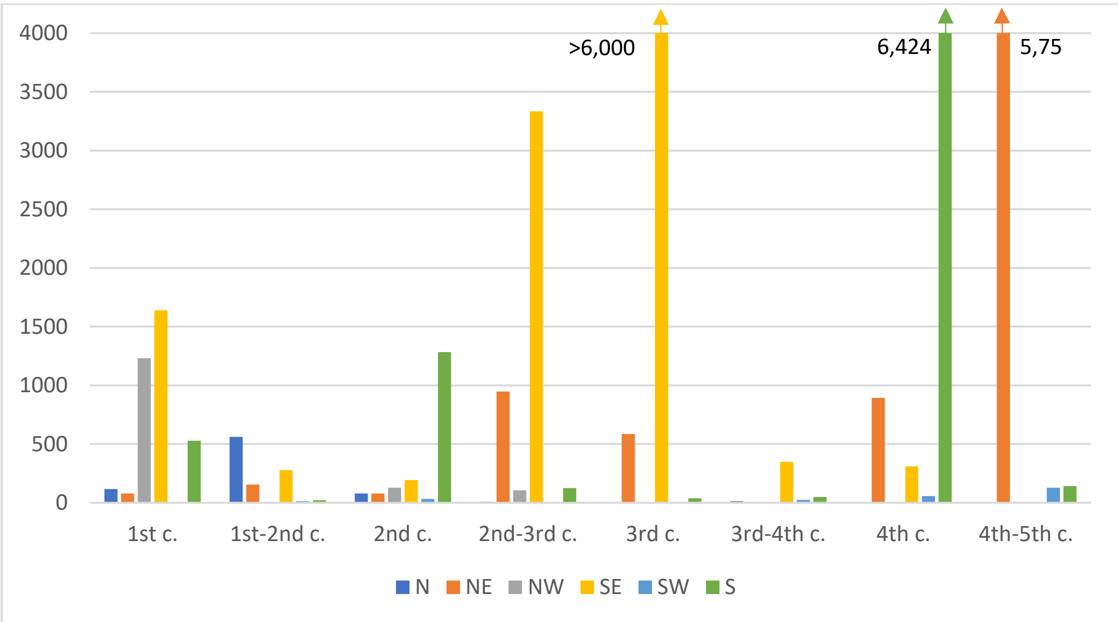


Figure 140: Complete diagnostic NISP for all species and assemblages with accurate chronologies (within a single century). Including sub-samples from processing sites.

The assemblage from Peninsular House has never been quantified, although clupeid bones are estimated to reach the tens of thousands (Locker 2007, 153). It is also unknown whether the fish was processed on-site or deposited there, for which reason it is important to highlight the neighbouring site of Stanford Wharf (Nicholson 2012) and the fact that both sites have a similar date, around the 3rd century. This consistency may reflect the production and transportation of locally processed products.

In contrast, the site of Dorchester Hospital has not produced evidence for the 3rd century, but does include large assemblages from the same site dated to the 2nd century (Site 130 a) and 4th century (Site 130 b), which may indicate a continuous supply of processed fish to the site from the 2nd century onwards. Emphasis must be made on the fact that most processing installations will only contain fish bone remains relating to the abandonment of the site. Without relevant architecture, it is rare to find evidence that identifies the earlier phases of processing; indeed, at Stanford Warf salt production on-site has been dated back to the Iron Age (Biddulph et al. 2012, 87), but it is unknown when the processing of fish commenced. Dorchester (Site 130 a) consists of an oven and potential refuse deposit, making it a significant case study that reveals an earlier date for the beginning of fish processing in Roman Britain. Lincoln has also produced two assemblages with potential processed fish, though a smaller sample has been assessed there. Sites 19 a and b date to the 3rd and 4th century, respectively, which strengthens the import of processed fish throughout the last two centuries of occupation. The final site at St Mary Bishopshill Junior, York, is problematic due to a partial excavation and uncertain dating of fish bone remains. The species and number of remains are consistent with other processed fish and a late Roman date is supported by the ichthyoarchaeologist (Jones 1988). Curiously, it is also consistent with the fish bone remains from Lincoln, dated to the 4th century, and both sites are at a similar distance from the Humber Estuary, the closest marine and brackish-water environment from which the fish may originate.

The figures of NISP from potential processed fish deposits are only partial, based on sub-sample remains. Current estimates for representative samples of >6,000 NISP may equate to hundreds of thousands of fragments, both diagnostic and undiagnostic. Even with such small figures, these sub-samples can overshadow the smaller assemblages. To obtain a clearer image of fish bone remains relating to alternative fishing practices the fish-processing sites have been removed (Figure 141). The first important aspect to consider is the scale of assemblages which do not relate to large-scale processed fish. Although most regions have a combined NISP of less than 600 diagnostic remains throughout the Roman occupation, two assemblages stand out: Chester amphitheatre in the North-West region (Site 116a, b and c) and Fish/Monument Street, London, in the South-East region (Site 59).

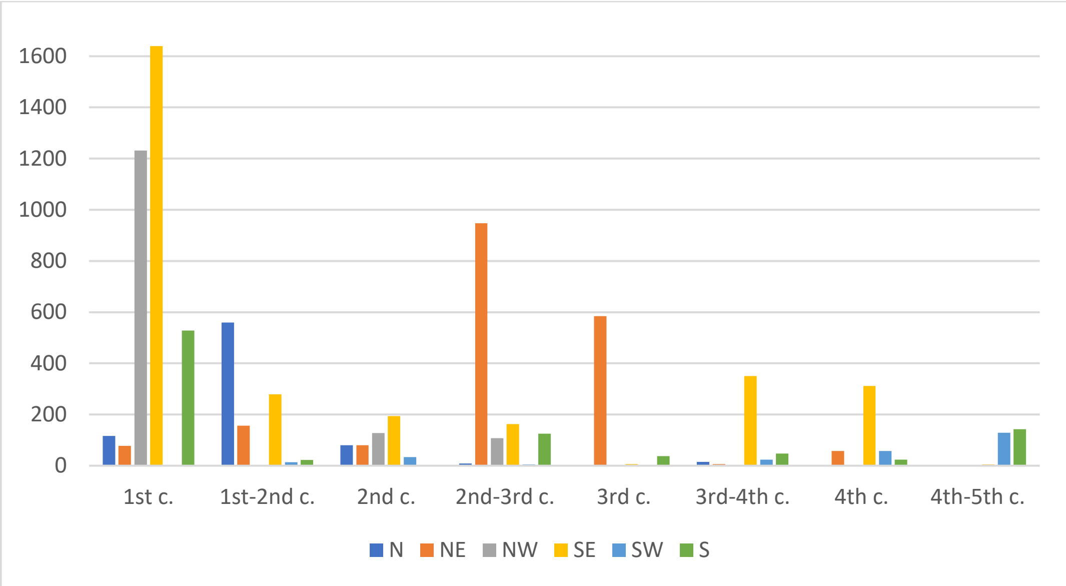


Figure 141: Complete diagnostic NISP for all species and assemblages with accurate chronologies (within a single century). Excluding sub-samples from processing sites.

Both sites date to the second half of the 1st century and constitute a collection of over 1,000 diagnostic marine, brackish, and freshwater fish bone remains that are believed to have been consumed or sold fresh (Harland 2017, 20). Other method of preservation may have taken place, but there is no evidence of salting in bulk to produce a homogenous paste or sauce. There is an absence of such large assemblages after the 1st century, with the appearance of processed fish in the 2nd and 3rd centuries. Chester is indeed an exceptional example as the North-West region reveals a gradual decline thereafter. The North region is consistently scarce, although the peak in the 1st to 2nd centuries is likely related to the large-scale militarisation of the northern frontier and the construction of Hadrian's Wall. The North-East reveals a slow but gradual increase in fish bone remains with a sudden peak in the 2nd to 3rd centuries, which relates to the recovery of hundreds of freshwater (cyprinid) and diadromous species remains at General Accident Site, York (Site 12). This is short-lived but soon replaced by the appearance of local processed fish products, both at York and Lincoln. The South-West region is one of the least represented, juxtaposed by the location of the Severn Estuary and countless freshwater resources. The South region is also scarce, but largely represented by marine resources. In contrast the South-East is one of the better represented regions with a comparatively consistent recovery of fish bone remains in all but the 3rd c. The sudden increase in the South-East in the 3rd to 4th and 4th centuries relates to a large number of eel remains from London and further inland, which may relate to improved recovery techniques of over-represented species, rather than intensified fishing practices.

9.5.3 Chronological Distribution of Predominant Species

Many of the seventy-one species identified for Roman Britain are represented by less than a dozen finds, such as the angler (*Lophius piscatorius*), John Dory (*Zeus faber*), sea scorpion (*Taurulus bubalis*), or sturgeon (*Acipenser sturio*), which derive from various regions, sites and chronologies. This prevents us from suggesting any chronological interpretations for many species of fish. There are, however, a small number of species that were recovered in large quantities and throughout Britain. By isolating these fishes, it is possible to elucidate on relevant chronological distributions (Figures 142-147), which may reveal patterns of fish exploitation related to fishing practices. Those chosen for this assessment constitute the most numerous groups: cyprinids (freshwater), salmonids, smelts, and eels (diadromous), clupeids, gadids and flatfishes (marine). Only the smelt and eel are isolated species, as the remaining groups constitute families with several species sharing similar behavioural and environmental traits.

Salmonids include the Atlantic salmon (*Salmo salar*) and the brown trout (*Salmo trutta*). Both species share an almost identical physiology and, though trout can live permanently in freshwater, they can share migratory, spawning, and feeding habits with the salmon. Although salmonids produce comparatively smaller assemblages, a consequence of the delicate and often absent cephalic bones (Wheeler and Jones 1989), the large volume of mass per individual, which could reach 1.5 m in length (in the case of the Atlantic salmon), make them significant alimentary sources in comparison to other species. The northern regions appear to be the predominant habitat for these species (Locker 2007, 152), and this is reflected in the updated archaeological remains (Figure 142). Salmonids are most numerous in the 1st and 2nd centuries and see a rapid decline in the 3rd century, which is consistent with an overall decline of fish bone assemblages in the north. As the majority of salmonid remains derive from the North region in the 1st to 2nd centuries, it is plausible that they were the target of military fisheries during the northern expansion. Throughout the rest of Britain this fishery seems small but consistent, suggesting they were not a targeted species of large-scale fisheries but rather the remains of individual catches.

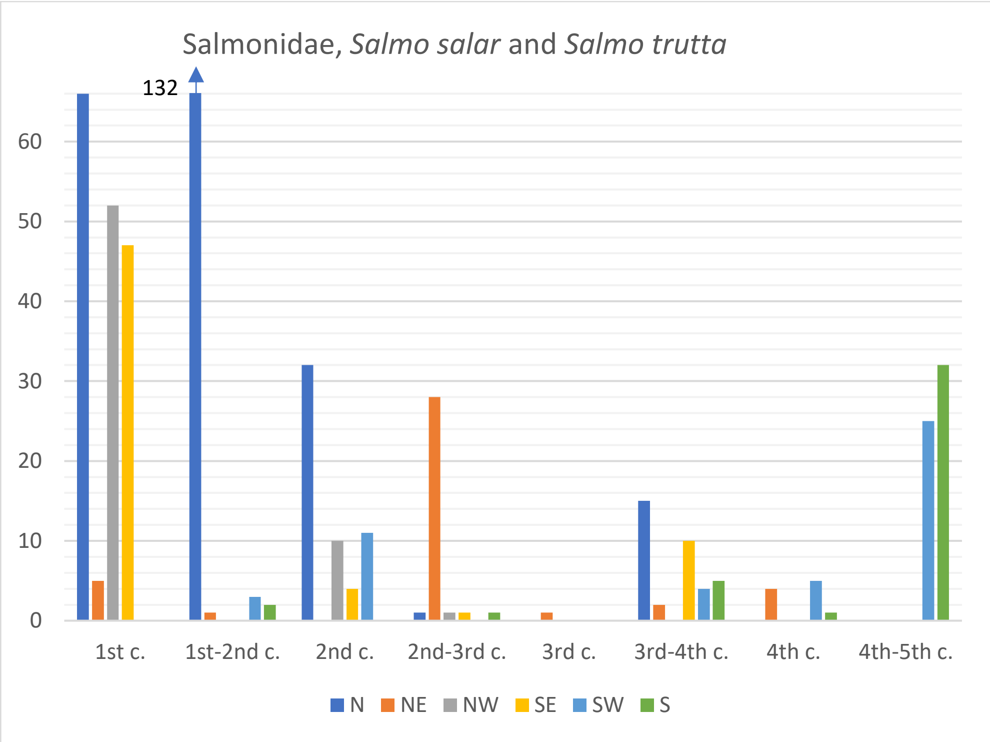


Figure 142: Chronological and regional distribution of Salmonids, measured by NISP per century.

Cyprinids dominate the freshwater species that were caught in Britain. This broad family is composed of tench, roach, rudd, bream, silver bream, bleak, dace, chub, bitterling, gudgeon, barbel, and crucian carp (see Appendix B, Part 2 for full descriptions). London has produced the largest collection from Fish/Monument Street (Site 59), dating to the late 1st century, following the Boudican revolt and rebuilding of Londinium. While the NISP figures are small, there is a general consistency in cyprinid numbers throughout the North-East and South-East regions during the 2nd to 3rd centuries, and in connection to urban centres; this would suggest the presence of local urban fisheries at some level. As shown above, Accident Site, York (Site 12), is a significant case study of a potential cyprinid fishery within the settlement, soon replaced by potential processed marine products. There is very little evidence of the military consumption of this fish during the western and north-western expansion in the first century, when diadromous species may have been caught in similar environments. This would reflect a general avoidance of cyprinids.

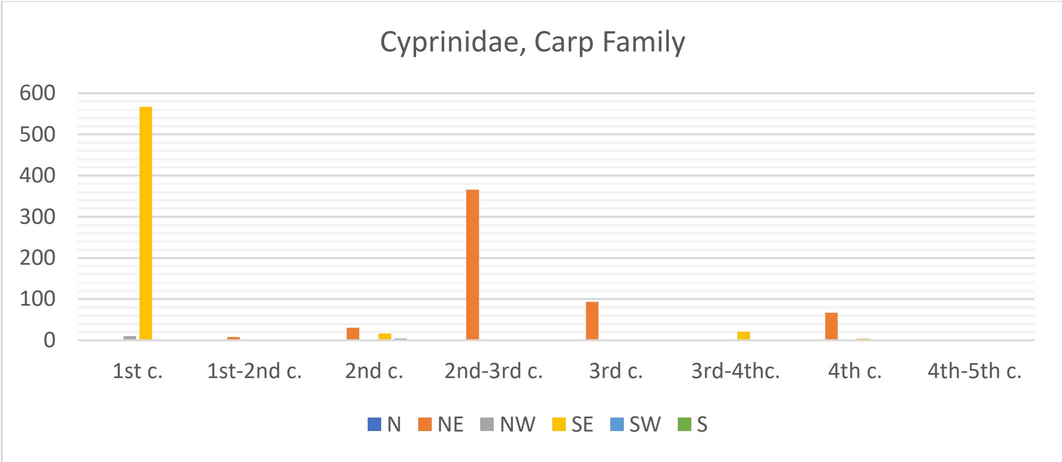


Figure 143: Chronological and regional distribution of cyprinids measured by NISP.

Osmerus eperlanus, the smelt, was once considered a species of the Salmonid family, but has since been assigned its own classification within the Osmeridae, a family composed of 10 species (Wheeler 1978); smelt is the only species present in Britain. Like its salmonid cousins, it has very similar breeding and migrating habits, as well as physiology; the primary difference lies in the size, which does not exceed 30 cm. If the figures of smelt are compared with those of clupeids (Figures 145), a similar pattern is visible in the 2nd to 3rd century peak in the South-East region. These remains are primarily from the site of Stanford Wharf (Site 123) and suggests both species were targeted for processing with salt. Also, of interest is the general absence of this species throughout the rest of Britain, with the exception of sparse remains from Chester.

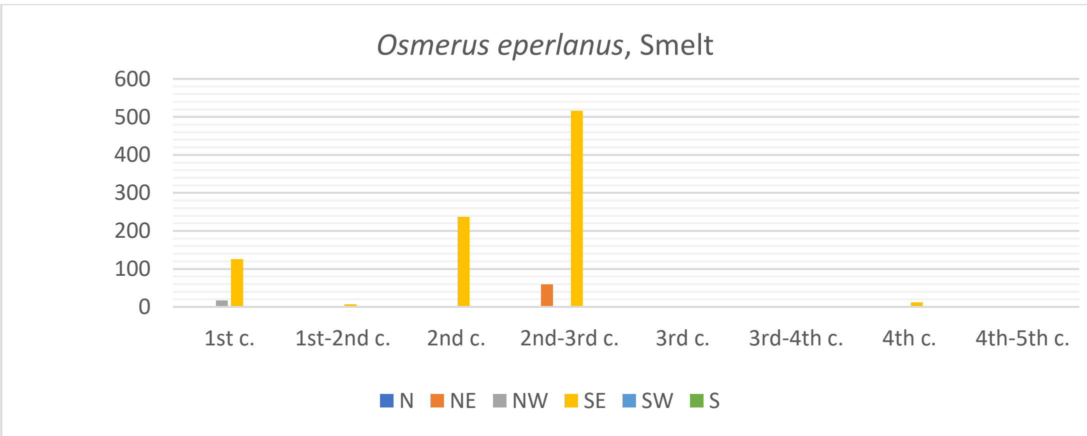


Figure 144: Chronological and regional distribution of Osmerus eperlanus, measured by NISP.

The clupeids consist of herring (*Clupea harrengus*), sprats (*Sprattus sprattus*), and shads (*Alosa sp.*). These small marine species migrate in large numbers and funnel into low saline environments to feed and/or spawn, making them prime targets for large-scale fishing. Unsurprisingly, they constitute the primary family within the fish bone assemblages of processing sites. Although we do not have accurate figures for those recovered at Peninsular House, London, and Dorchester Hospital, the partial assessments reflect tens of thousands of remains. Also of interest are the sites where these remains are minimal, which appear to relate in date and distribution to the regions where processing took place (Figure 145). Small assemblages of clupeids may therefore reflect the consumption of local fish products; however, the alternative is evidence of small-scale extractions of these species. This appears to be the case for the North-West, North-East, and South-East regions in the 1st century, when there is no evidence of processed goods, but several assemblages containing clupeids. The small figure, even at Chester where other species were recovered in bulk and dated to the 1st century, may illuminate the location or methods of capture that would have excluded or restricted the capture of these species.

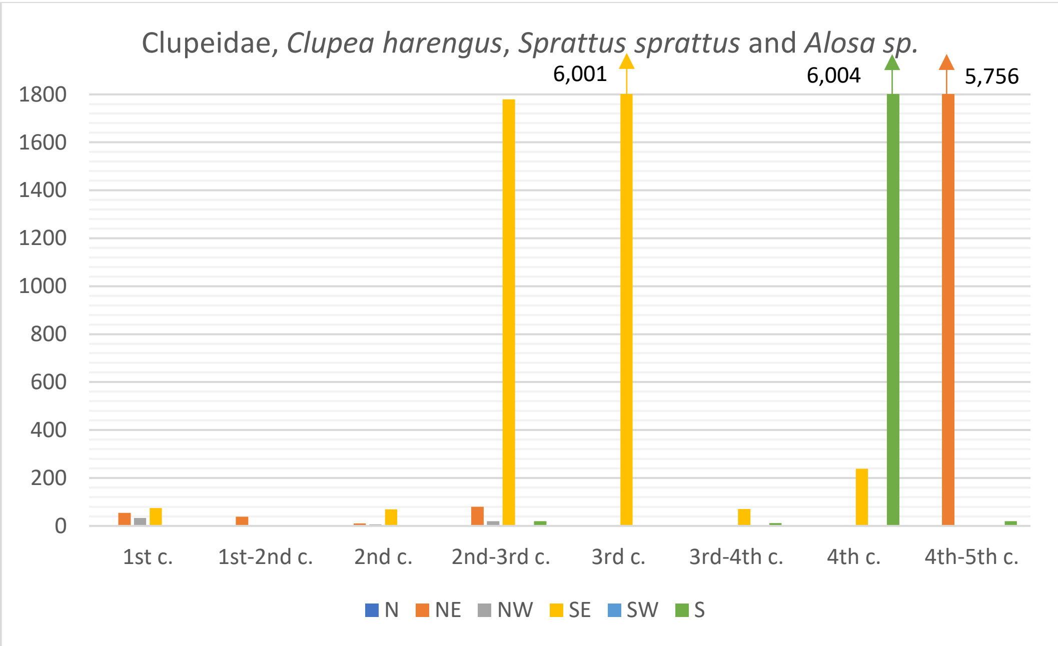


Figure 145: Chronological and regional distribution of Clupeidae, measured by NISP.

Flatfishes are here represented by three families: *Pleuronectidae* (Right-eyes fishes), *Scophthalmidae* (Left-eyed fishes) and *Soleidae* (the soles). The numerous species include the flounder, plaice and dab, the turbot and the Dover-sole, respectively. Other than the flounder, flatfish are primarily marine species, though they are often found in tidal estuaries. Their physiology makes them ideal bottom feeders, with only a few species hunting in mid water; as a result, these fish are susceptible to only a few of the tools used for the capture of other species. With this in mind, it may not be surprising that their average figures are consistently low, with only a slight peak in the South-East during the 2nd and 3rd centuries. Nevertheless, such a consistency in the South-East (predominantly London) and the North-West regions demonstrates the importance and popularity of this fish as a regular food source. The over 1,000 fragments recovered from Chester are a singular occurrence dating to the 1st century; if this is not a consequence of the improved sampling methods of this recent excavation (Harland 2017), then the implications may suggest a far more significant and efficient fishery, specifically targeting these and few other fishes. The South and South-West regions, which generally have a low number of fish bone remains, see an increase in flatfish assemblages towards the end of the Roman occupation. This may reflect a decline of alternative food sources on land, a change in fishing techniques, and/or the restriction of fishermen and settlements to aquatic habitats where these species are predominant.

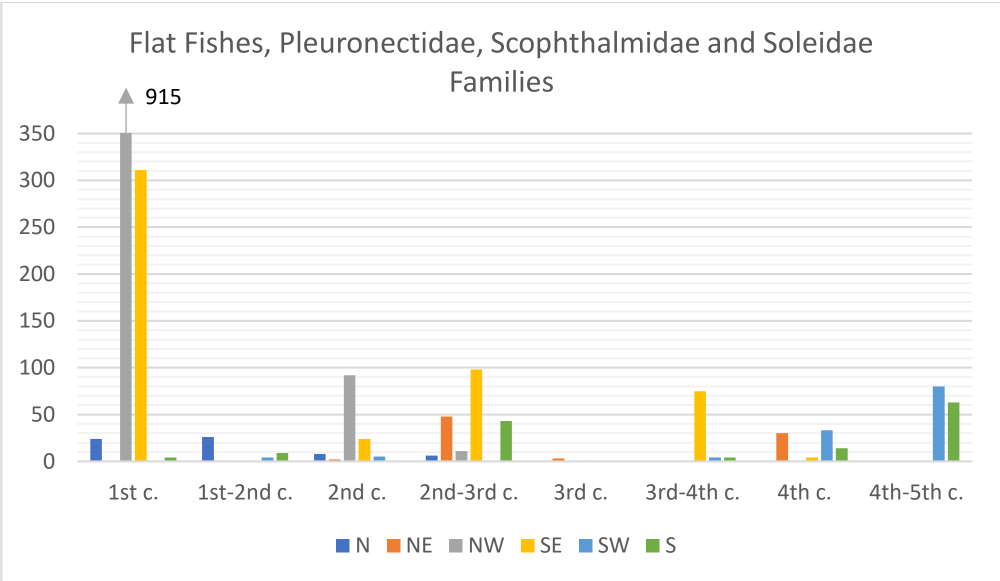


Figure 146: Chronological and regional distribution of flatfish, measured by NISP.

Anguilla anguilla, the European eel, is one of the most common species recovered at archaeological sites. Though small, the vertebrae are robust, easily diagnostic, and numerous enough that there is greater probability for their recovery. This diadromous species enters freshwater habitats as a juvenile and returns to the sea as an adult to spawn. It is therefore one of the most pervasive species and a rich source of food throughout the various aquatic ecosystems it inhabits. If caught while a juvenile, the bones are unlikely to survive, and yet these large shoals are a rich source of food and accessible at locations common for the previously mentioned clupeids. The theoretical volume of such a food-source aside, the archaeological evidence reveals a large and consistent volume of larger eels for most regions (Figure 147).

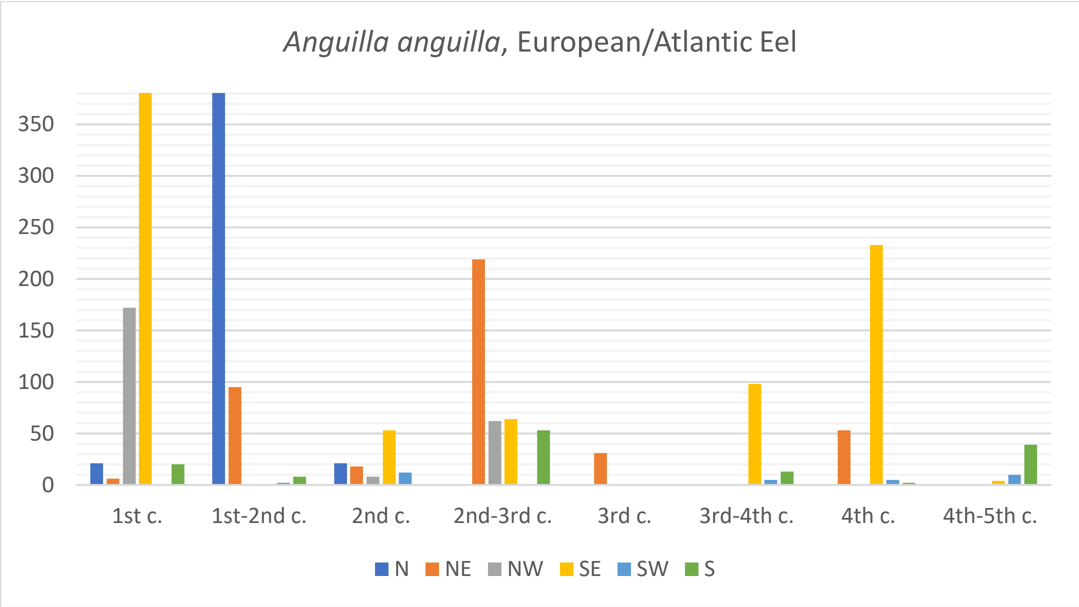


Figure 147: Chronological and regional distribution of Anguilla anguilla, measured by NISP.

The South-East region (primarily London) has provided the most remains, with the largest NISP in the 1st and 4th centuries. The figures are lower during the 2nd to 3rd centuries, which is when there is the greatest evidence for processed fish. In the North-East region similar patterns to those previously highlighted are visible, such as the late start of fish bone deposition in the 2nd century, a peak in the 2nd to 3rd centuries, which is consistent with the peak of freshwater fisheries at York, and a gradual decline in the 3-4th centuries, when there is evidence of processing clupeids at Lincoln and York. The North-West region has a relatively high number during the 1st and 2nd century, reducing thereafter, which directly parallels the assemblages from Chester amphitheatre. The South-West region remains an underrepresented region, with sparse fragments from assemblages, consistent throughout the Roman occupation. Meanwhile the South region is also consistent throughout the four centuries, though with larger numbers of NISP than the South-West.

9.6 Interpretation

The assessment of the ichthyofaunal remains has been limited by the disparate quality and quantity of available data. What this study cannot offer is a comprehensive assessment of species size, seasonality, pathology, nor, for many assemblages, chronology; these are aspects that have also eluded previous work on the subject (Locker 2007) and that require a more representative record than is provided under current archaeological and environmental techniques. Nevertheless, a region-wide assessment of the data, regardless of how limited many assemblages may be, can reveal patterns in species distribution that allude to the environments that were exploited, and which may provide more tangible evidence with which to compare the artefactual data.

9.6.1 Predominant Species in Roman Britain

The predominant species have been highlighted via two quantifiable methods, number of individual specimens (NISP) and number of occurrences. Viewed collectively (Figure 148), the figures highlight trends that have been identified for individual sites and that are currently accepted as representative of the British record, namely, the prominence of the European eel and flatfish species, as well as evidence for the large-scale exploitation of shoaling fish, namely clupeids, for the production of a processed product (Locker 2007; Nicholson 2013, 67; Hamilton-Dyer 2014, 113; Maltby 2015, 187); these sources also agree on the juxtaposition of the general sparsity of fish bone remains from Roman sites. The remaining species are empirically less significant and, whether this is a result of halieutic bias, requires elucidation.

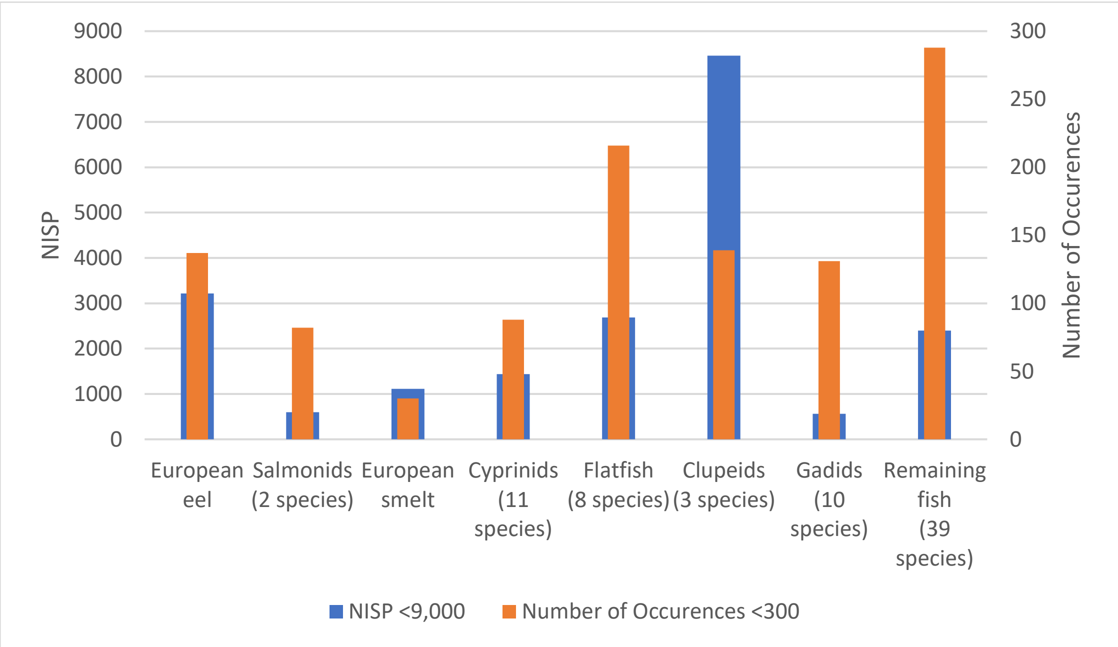


Figure 148: Predominant fish by NISP (blue) and Number of Occurrences (red). Only the European eel and the smelt are viewed individually; the remaining figures are based on families or, in the case of flatfish, general categorisation.

9.6.1.1 The European Eel

The eel is arguably the most widely distributed species in Britain. This is unsurprising if one considers the diadromous nature of this fish, which can be found as a full-grown adult in oceans, estuaries, and rivers alike. Both large-scale and single catches of adults can occur throughout the various aquatic habitats, with up-river and down-river migrations depending on lifecycle; this reduces the ability to hypothesise on the fishery location based on size estimations of bone fragments. Juveniles are arguably representative of estuarine-based fisheries, as not only do they return to land after spawning in the sea, they also spend several years by shores, river-mouths, and estuaries (Wheeler 1978); however, with the appropriate technology, juvenile eels can also be caught in rivers. To hypothesise if certain eels were targeted, an improvement of the method of ichthyofaunal assessment is essential, whereby the inclusion of size estimations and MNI for a diverse range of sites may allow us to identify patterns in adult/juvenile distributions.

As discussed in earlier chapters, eels have a comparatively high number of vertebrae per individual, the so called 'eel-effect' (Locker 2007), this brings into question the number of individuals and subsequent significance of an assemblage. An individual eel can have up to 120 vertebrae; meanwhile, 119 of the 137 fish bone assemblages containing eel remains have fewer than 100 fragments (seventy-nine assemblages have fewer than ten fragments). In some cases, these remains have been recovered alongside more numerous species, suggesting those eels were bycatches of alternative fisheries; examples include York (Site 10), Chester (Site 13b), Dorchester (Site 98), and South Thanet (Site 128). In other cases, they are the only fish bone evidence from a site, raising the question of taphonomy and the possibility of natural deposition as opposed to fishing events (Nicholson 1991); such is the case at Bignor (Site 26), Castle Copse (Site 30c), London (Site 76), and Chester (Site 116e). In most cases, they are recovered from a range of deposits which do not often produce large quantities of bones, including layers, gullies, post holes, and ditches (e.g. Nicholson 1993; Jones 1997; Hamilton - Dyer 2014). These examples may reflect the ubiquitous but sparse consumption of eel throughout Britain and reveal little of the potential fishing methods.

The most significant examples are sites where eels are both numerous and the dominant species. There are only four sites where over 200 fragments of eels have been identified: The

Lanes, Carlisle (Site 3), Gorhambury (Site 37a), Fennings Wharf, London (Site 83), and County Hall, Dorchester (Site 97); they consist of 353 (74 % of the diagnostic material from that site), 206 (95 %), 201 (73 %), and 696 (87 %) European eel NISP, respectively. Gorhambury is the most inland location and has the highest percentage of eel remains relative to additional species. Although these fragments are too scarce to suggest a large-scale capture, it should be noted that Site 37 consists of three assemblages, all of which contain eel remains dating to the 1st, 2nd and 3rd to 4th centuries, suggesting a consistent exploitation. The most numerous eel assemblage from London (Site 83) consists of only 201 fragments, which, as with Gorhambury, suggests the small-scale capture of eel for general consumption. This site is not only the most numerous for London, but also for an estuarine environment, for which there appears to be no other ichthyofaunal evidence of eel exploitation. Carlisle has a substantial number of fragments for an early excavation of which we have no information of the sampling strategy (Nicholson 1993b). The same is the case for Dorchester, which is the largest collection of eel remains, although this site has an uncertain chronology and phasing which may further divide the assemblage into smaller collections. Both sites are located at freshwater riverine environments, but in proximity to the coast and estuaries where brackish water is funnelled into the river systems. These are ideal locations for the capture of migrating eels (both anadromous juveniles and catadromous adults), which could support large-scale fisheries; however, the current figures are relatively small and indicative of fisheries which were capable but not specialised at capturing these fish.

9.6.1.2 Flatfish

The most prominent flatfish are plaice (*Pleuronectes platessa*) and flounder (*Platichthys flesus*), found in near equal measure, but of which a greater figure is often recorded in fish bone assessments as the combined 'plaice/flounder' (and less commonly plaice/flounder/dab, with the addition of *Limanda limanda*), due to their morphological similarities. Plaice and flounder constitute 32 % of flatfish remains, which is the majority if we consider that over 63 % of bone fragments are undiagnostic beyond the sub-order of flatfish (*pleuronectiformes)*, let alone family levels (of which there are four for the British evidence: see Appendix B, Part 1). One important aspect with interpreting the fishing methods of these two species of flatfish is, although morphologically consistent, they are geographically distinct. Flounder is the only species of flatfish from Britain recorded as catadromous and therefore capable of living in freshwater systems (Wheeler 1998). Plaice can be found in brackish waters but is primarily a marine species. Although distinct, their habitats overlap, forcing the question of whether they were caught via the same method or whether they each represent distinct fisheries.

Current data reveals that both flounder and plaice have been recovered from predominantly riverine sites (Figure 149). The absence of plaice in freshwater habitats would imply that these deposits are evidence of a local import from coastal or estuarine fisheries, which, may be argued, is also the case for the flounder; however, on closer inspection, there is only a partial overlap of the sites from which the bones have been recovered. Almost half of the plaice assemblages are from Colchester and Chester, while the flounder remains are from a wider range of inland sites throughout Britain. One such site is Tanner Row, York (Site 12), where no plaice have been identified. At this site, the predominant species are freshwater and diadromous, such as cyprinids and eels, for which the original assessment had hypothesised on the presence of a local riverine fishery to supply the city (O'Connor 1988). This absence of a more consistent overlap between plaice and flounder does strengthen the potential for individual methods of capture and the capture of the latter from freshwater fisheries. In addition, flounder are less frequent at Chester and Colchester than their cousins, where numerous other marine species have been recovered, including other flatfish species. This highlights the potential for coastal fisheries supplying a demand for fish to these urban centres, where there appears to be an absence of more local freshwater resources.

The plaice/flounder remains (those undiagnostic to species level) related to estuarine environments are almost exclusively from London (twenty-four of twenty-six sites). Few diagnostic remains of plaice or flounder derive from the capital (two sites each), which questions the processes causing this result. Assessment restraints, such as insufficient budget or inadequate reference material, is a possibility, as is the degradation of the material due to more extreme post-depositional processes (soil acidity, urban development, etc.); one alternative is the impact of dietary practices on the resulting remains, either via the processing of the fish (for preservation) or its preparation and consumption. In contrast, the remaining examples from riverine sites are consistent with flounder remains. Only four examples are from Chester and Colchester, while the remaining sites include inland locations such as Leicester (Site 18), Worcester (Site 138), Ribchester (Site 7), and York (Site 12). From the previous observations of plaice and flounder distributions, one must highlight the equal potential of local freshwater fisheries capturing the migrating flounder, or otherwise, the import of coastal goods. Size estimations can help, as flounders are often found in freshwater habitats as juveniles only (Wheeler 1998); however, no such records exist at this time. Comparisons of species assemblages from the mentioned inland sites are unconvincing; on the one hand, Leicester (Site 18) reveals a collection of additional marine species that suggest imports of some kind, while on the other, Worcester (Site 138) primarily consists of diadromous species (the exceptions are a few herring remains), which may represent freshwater fisheries.

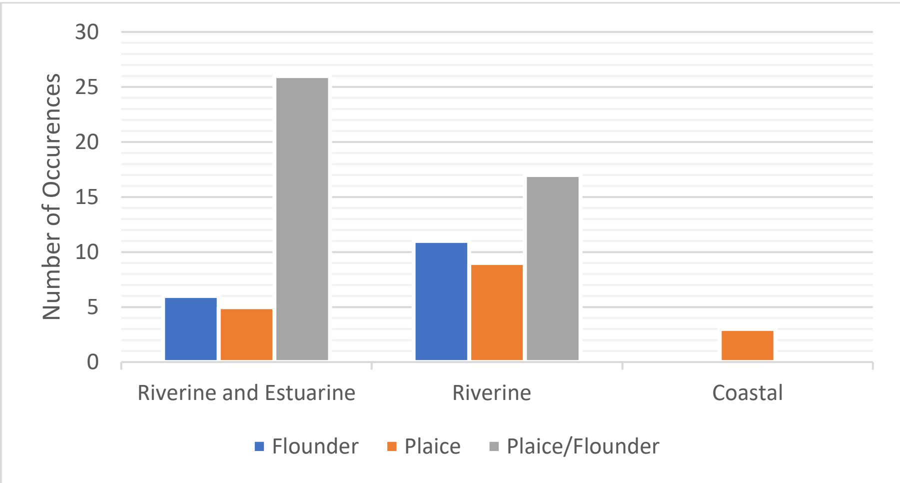


Figure 149: Number of occurrences of recorded plaice, flounder, and plaice/flounder by site (composite assemblages not included in the estimate). No riverine/coastal examples have been recorded.

9.6.1.3 Salmonids

Salmonids in the UK are primarily represented by the Atlantic salmon (*Salmo salar*) and the brown trout (*Salmo trutta*), both of which are anadromous; a third species (*Thymallus thymallus:* grayling) is a smaller cousin and a brackish and freshwater fish, represented by only two assemblages, at York (Site 12) and Leicester (Site 17). Salmonid remains are scarce for Roman Britain, especially those that are diagnostic to species level. The similarity of salmon and trout skeletons impede identifications, especially considering they can attain similar size ranges (up to 150 or 140cm respectively). Where identifications are possible are in the jaw and other cephalic bones, however, these structures are compromised by a hormone imbalance during spawning migrations into freshwater, facilitating their deterioration and destruction (Wheeler and Jones 1989, 156). This does not mean that diagnostic bones are more common in estuarine and coastal areas; the only diagnostic fragments have been recovered from riverine sites, which, alongside those assemblages diagnosed to genus level, constitute 75 % of salmonid sites (Figure 150). All but one (Site 119) of the riverine/estuarine sites are in London. The two riverine/coastal sites are isolated military locations in the North-West, at Lancaster (Site 6), and beyond the North region in Edinburgh (Site 5). One can therefore assume that salmonids were not particularly targeted in their migratory passes at estuarine and coastal location, nor, it appears, were they heavily exploited inland. The wide distribution of freshwater sites throughout the entire country that were later heavily exploited (Jenkins 1984, 240), point at low yields of salmon resources during the Roman period.

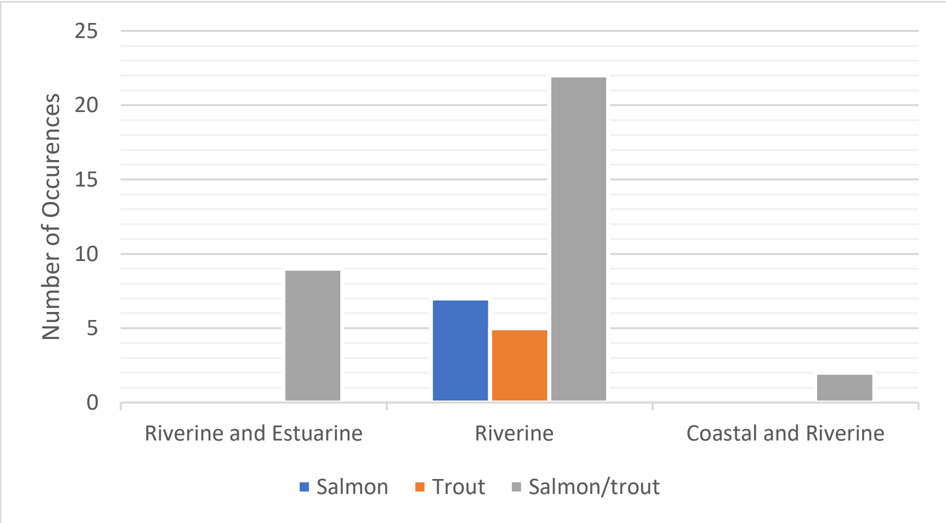


Figure 150: Number of occurrences of recorded salmon, trout, and salmon/trout by site (composite assemblages not included in the estimate).

9.6.1.4 Cyprinids

The cyprinids (family of carps) consist of eleven species identified in the ichthyofaunal record for Roman Britain. This diversity skews the numbers of occurrences when viewed as a whole (Figures 151). The most numerous are those recorded at family level only (*Cyprinidae*), consisting of a total of thirty-three sites. The prominent species are the roach (*Rutilus rutilus*) with nine sites, the chub (*Leuciscus cephalus*) with eight sites, and the dace (*Leuciscus leuciscus*) with six sites. These are relatively low figures, while the remaining species are represented by even fewer cases. The three most numerous species are known to frequent both brackish and freshwater habitats, while some of the remaining carps are restricted to freshwater habitats only. This highlights the potential that cyprinids were bycatches of alternative fisheries and therefore more frequently caught in brackish-water environments where more effective or intensive methods of capture were employed on other economically profitable species. This hypothesis is stunted by the fact that most remains have been recovered from riverine sites. The exception to the rule is London, which constitutes all fourteen estuarine cyprinid assemblages and additional roach and chub assemblages. However, one should not underestimate the allochthonous nature of captured, transported, and deposited fish bone remains, which may reflect the intentional capture of freshwater cyprinids further afield and imported to the city. For this to be possible it is necessary to highlight evidence of the desired consumption of these species.

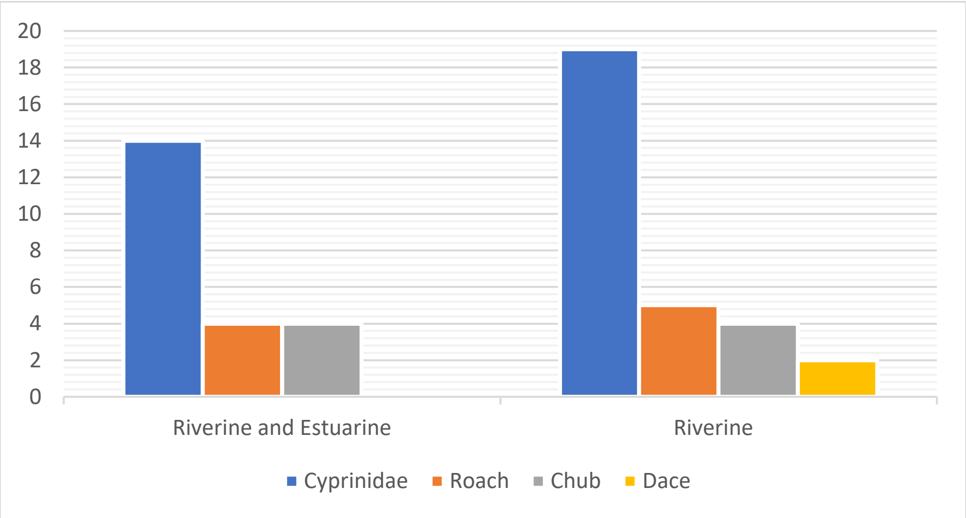


Figure 151: Number of occurrences of recorded cyprinidae, roach, and chub, and dace by site (composite assemblages not included in the estimate).

The most numerous combined cyprinid assemblages, by NISP, are at York (Site 12) and London (Site 59) with 355 and 560 fragments respectively. The next largest assemblage consists of ninety fragments (Lincoln, Site 19a, which increases to 150 diagnostic fragments if Site 19b is included). Site 59 comprises the potential 'restaurant' (Locker 2007) from Fish/Monument Street in London. This 1st century assemblage is large and diverse, containing over 800 diagnostic NISP that include hundreds of European eels, smelt, and flatfish and dozens of fragments from a diverse range of marine, brackish, and freshwater species. The diversity of species suggest a variety of fishing methods; however, the marine species represented, including haddock (2 NISP), Atlantic mackerel (6 NISP) and European sea bass (20NISP), are so few relative to the freshwater/brackish species, that one may infer a local supply with rarer marine bycatches or imported goods. Site 12 from York, General Accident Site, is a 2nd to 3rd century assemblage with a similar collection of species but with the added evidence of freshwater species such as Northern pike, grayling, and brown trout. The rarity of less gregarious marine species, such as sea bass, haddock, and flatfish (other than flounder), strongly supports a local riverine catch. York's greater distance from the estuarine environment of the Humber may explain the restriction of marine fish to shoaling species, such as clupeids and scads, identified as species used in processed fish products (Locker 2007). Cyprinids dominate both urban sites from London and York, which constitute a larger than average assemblage for the region (discounting processing sites), and this strongly supports the intended capture of these local fish, or the use of fishing methods which supported such catches.

These are not the only examples which favour a cyprinid fishery. The assemblages from Lincoln (Site 19a and Site 19b) and Dorchester (Site 97) are relatively smaller, but consistent in several aspects. Dates are not precise but estimated at 3rd (Site 19a), 4th (Site 19b), and 3rd or 4th centuries (Site 97). Accompanying species include eels (especially at Dorchester with 696 NISP) and unconfirmed flatfish of the Pleuronectidae family (right-eyed fish, including the flounder). Dorchester (in closer proximity to the coast) differs in the presence of marine species such as wrasses and breams, which is more consistent with London; while Lincoln (further inland) includes more freshwater species such as perch and pike, more consistent with York. Regardless of the proximity to more saline environments, both assemblages from Lincoln are dominated by cyprinid remains, while at Dorchester, they are only surpassed by the European eel. All four sites, if we include London and York, are prominent Romano-British urban centres; the recovery of large cyprinid remains may therefore indicate local riverine fisheries providing the city with supplementary food source. It should be noted, that all of these cities have additional assemblages with varied fish bone remains, for which the cyprinid catches are only a fraction of the greater picture. The remaining sites from Britain consist of small assemblages from inland locations, though Leicester stands out as having produced eleven assemblages from two sites and dating to the entire Roman occupation. Although the assemblages range from four to fifteen diagnostic fragments only (to family level), they support a consistent, albeit subsistent, exploitation of the local freshwater environment.

9.6.1.5 Gadids

Gadids (the family of cods) are represented by ten species (Figure 148). In contrast to the cyprinids, their number of occurrences appears to be related to the diversity of the family rather than their distribution, as they are represented by scarce ichthyofaunal remains (Figure 152. This scarcity is in direct contrast to the large-scale gadid fisheries that emerged in the 11th century in Britain based on offshore fishing (Orton et al. 2017) and which has continued to dominate modern British fisheries. That said, these marine species would have been caught in saline waters, with rare examples entering brackish estuarine environments. Only the burbot (*Lota lota*) is a freshwater gadid (now classified under the family, Lotidae), which is now believed to be extinct in Britain (Wheeler 1998, 386) but which has been recovered from a Roman context at Tanner Row, York (Site 12). The most numerous species of cod are the Atlantic cod and the whiting, with a combined NISP of 174 and just over seventy-two, respectively (whiting includes assessments with no empirical data). Remains identified to family level are more frequent, but with a similarly scarce NISP of around 265 (also including sites with no empirical data). The most numerous assemblage is from the Isle of Portland (Site 132), consisting of sixty-six gadid, sixty-seven Atlantic cod, seventeen pollack, and four fragments of other species; however, these bones are hand-collected from an unknown number of assemblages across the island and of uncertain Roman dates (Maltby and Hamilton-Dyer 2012). The next largest assemblage is the 2nd to 3rd century processing site at Stanford Wharf (Site 123), where, of the over 3,000 diagnostic fragments, there are only fifty-one gadid bones. Both sites are located on coastal environments, where gadids may be found in small numbers during non-spawning seasons of the year. The following most numerous sites are by estuarine environments, of which London constitutes 91 % of the gadid sites. The remaining two estuarine sites are from Elms Farm, Heybridge (Sites 35 and 119 a and b). These locations are well suited for accessing brackish and more saline waters where feeding gadids were likely caught as bycatch of more numerous species.

There are eighteen riverine sites with gadid remains (identified to species and/or family level) that must represent imported goods from coastal or estuarine environments. Most of these sites are urban settlements (Sites 2, 3, 10, 12, 13, 18, 22, 28, 32, 33, 34, 98, 99, 116, and 125) and eight of them have multiple assemblages from various phases of occupation with gadid remains. These scarce remains often accompany other marine species, namely clupeids. Two potential hypotheses may be proposed based on the current ichthyofaunal evidence; the first is that single gadid catches were a marketable but rare produce (likely a bycatch rather than intentionally caught) and were preserved and transported to inland cities or towns as a commodity; the second is that gadids were not marketed individually but included in blended processed products (salted, dried, or smoked) and therefore deposited alongside the more numerous clupeid remains which represent the basis of such goods. If these species were intentionally targeted, one would expect larger concentrations alongside other marine assemblages (such as the restaurant remains from Site 59 in London), or a larger concentration of one particular species at an assemblage, which would highlight a consistent and effective method of capture.

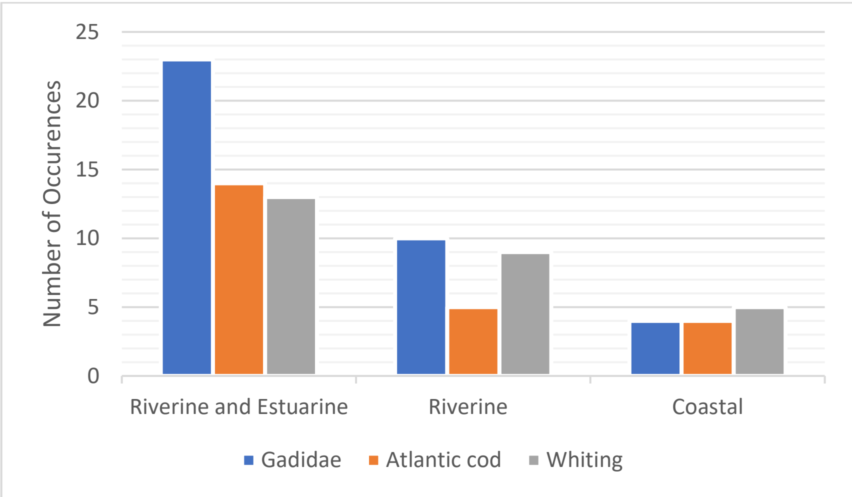


Figure 152: Number of occurrences of recorded gadidae, Atlantic cod, and whiting by site (composite assemblages not included in the estimate).

9.6.1.6 Clupeids, European Smelt and Sand-eels

Clupeids identified include the herring (*Clupea harengus*), the sprat (*Sprattus sprattus*), and the shads (*Alosa sp*.) and are known for forming large shoals that, as juveniles, frequent coastal shores and the brackish waters of estuaries. The European smelt (*Osmerus eperlanus*) and sand-eels (*Ammodytes tobianus*) are species with similar habits and have also been found in large assemblages. All five species (six if both shads are considered) can be caught in large numbers with the appropriate technology and, with the appropriate measures of preservation, could be used in the production of marketable goods. These fisheries would arguably be located in estuarine shores and in proximity to more saline transitional zones, although species such as smelt and allis shad can be found in freshwater environments. There are five potential processing sites from Roman Britain at Lincoln (Site 19 a and b), London (Site 65), York (Site 113), Stanford Wharf (Site 123), and Dorchester (Site 130 a and b). Herring and Sprat have been recovered from all sites. Size estimations of the herring at Peninsular House (Site 65) and

Stanford Wharf (Site 123) reveal they were juveniles (Locker 2007, 151; Nicholson 2012, 119), which is when such large shoals are recorded in coastal areas (Wheeler 1978, 67). The site of York suffers from an unconfirmed date of 3rd-10th century, but a Roman date is supported by the original ichthyologist (Jones 1988). Both Dorchester and London are in proximity to the brackish waters of the Wareham Channel and Thames Estuary respectively, while Lincoln and York are sufficiently inland that the provenance of the required fisheries are open to debate. The Humber Estuary is ideally situated between the two Roman settlements and is the largest brackish environment in the North-East region with Roman settlements at Hull, Brough, and Winteringham to which fisheries and subsequent inland markets may have been tied ; however, none of these shore-side settlements have produced any fish bone assemblages to date. Alternatively, the assemblages from York and Lincoln may derive from further south where a confirmed fish-processing installation has been found at Stanford Wharf (Site 123) on the Thames Estuary.

The 3rd century site at Stanford Wharf (Site 123) is a re-used Iron Age salt-production centre, known as a Red Hill (Biddulph et al. 2012). At this site, earth-cut ditches were found to contain salt encrusted fish bone remains, of which the numbers support the potential for a marketable product (NISP in Figure 148 is based on subsamples from two sites only; see Appendix C, Part 4). The absence of a neighbouring settlement suggests the product was intended to be distributed further afield, with one earlier suggestion being that processed fish could have been transported in the local coarse earthenware used for the shipment of salt (Mattingly 1990). The site benefits from a detailed ichthyofaunal assessment (Nicholson 2012c), not only highlighting the predominant clupeid remains, composed of sprats and juvenile herring, but also representing the accompanying bycatch. European smelt (*Osmerus eperlanus*) were also found in large numbers, followed by less frequent examples of pipefish (*Syngnathus sp*.), gobies (*Gobidae*), three-spined stickleback (*Gasterosteus aculeatus*), and pogge (*Agonus cataphractus*) and small cases of European eel (*Anguilla anguilla*), gurnards (*Triglidae*), flatfishes and juvenile European seabass. Rare examples include a few remains of a large whiting (*Merlangius merlangus*) and pike (*Esox luccius*), the latter of which is from a separate deposit (Ibid. 2-3). The recovery of a pike and various flatfish suggests the fishery could target the local freshwater systems (a series of small creeks only) and/or potentially the neighbouring brackish waters of Thorney Bay and the marsh-like coastal zone; here, other species such as the sticklebacks, gobies, eels, and even the European smelt, could be caught with traps or adequate netting equipment. The scarcity of large species, such as the whiting remains, and the juvenile sizes of the European seabass, suggests hooks were not being used, nor that large fish were being targeted further offshore for alternative methods of preservation or local consumption; indeed, cess remains found near the larger assemblages reveal fish were being eaten on-site, consistent with the marketed product remains (Ibid. 3). The likely method of capture was therefore shore-based net fishing with a fine-meshed net.

9.7 Summary

The fish bone evidence with which we must work is sparse and fragmentary. The noticeable absence of an industry akin to the long-established processing sites and fisheries of the Mediterranean seems an accurate supposition for Romano-British fishing when assessing the fish bone remains. Where intensive sampling strategies have been applied over the last three decades, fish have not always emerged in any significant quantities (e.g. at Beadle Street, London: Nicholson 2013b; Bath Road, Worcester: Pearson 2014; Healam Bridge: Ambrey et al. 2017). That said, the inconsistency in sampling and recording methods illustrated here have prevented an accurate interpretation of the fisheries that were in place. Indeed, the growing volume of large assemblages since the 1990s highlights the potential to recover more accurate representative data for future studies. The restructuring of discrepant and fragmentary data, provided in this chapter, has been an attempt to organise the information for a more accurate interpretation of the supplementary fisheries in Roman Britain. The division of the territory into six regions based on major watersheds and physical contact between aquatic environments has coincided with patterns of species distribution. Identifying the location of sites with diagnostic NISP within these regions illustrates concentrations of fish from various aquatic habitats, which supports identifications of local targeted and avoided species and highlights potential marketable goods, namely marine species transported further inland.

The most notable patterns from the ichthyofaunal record suggest estuarine fisheries were the most significant in the Roman period (e.g. where/based on what). Not only do the largest assemblages consist of marine clupeid species that access estuarine zones in seasonal migrations (those ascribed to fish processing), but the most diverse and numerous assemblages have also been recovered at large urban centres with links to estuaries where a mixture of freshwater, marine, and diadromous species have been found. There are indeed exceptions, such as the absence of data from the territories surrounding the Severn estuary and the dominance of marine species in the South region; nevertheless, the inland zone of the South-West region with links to the Severn is also represented by few freshwater assemblages, which highlights alternative reasons for a region-wide absence of ichthyofaunal data; meanwhile the South region is represented by fewer and smaller estuarine environments and the dominance of coastal habitats.

Potential patterns from inland sites include the dominance of diadromous species, namely eels and salmonids, which were probably targeted for local consumption at a subsistence level. Although the dominance of the salmonids in the northern regions has been highlighted (Locker 2007), their NISP figures are substantially low, making it difficult to indicate a fishery of commercial influence. The small figures of both number of fragments and number of sites suggest salmonids were the result of individual catches. The same might be said of the European eel, which, though more widely spread than salmonids, is represented by relatively sparse numbers per site. Their geographical dominance may reflect their capture by various methods and throughout various seasons, due to their diverse habitation of rivers, estuaries, and coastal zones year-round. The largest number of freshwater species do not derive from isolated inland sites but from the large urban centres of York and London, which suggests that targeted species were influenced not by their dominance within an aquatic environment but by the potential of a local market. Major urban centres share this aspect and reveal a diversity of fish from various environments. The sites of Leicester and Wroxeter are examples of isolated inland sites where a variety of species have been collected, indicating an import of coastal products.

The redistribution of sites into more numerous assemblages based on chronology has highlighted changes in species exploitation. The discovery of several 3rd to 4th century sites throughout the east coast with large assemblages of clupeids and other marine shoaling fish, suggest the foundations for large-scale fisheries. Only Stanford Wharf is indicative of local fishing, while the remaining sites represent holding or processing sites, further inland and within large urban centres. The potential processed fish recovered at Lincoln and York may indicate a largescale fishery in the Humber Estuary, akin to that of the Thames; meanwhile the site at Dorchester draws our attention to an alternative large-scale fishery on the southern coast, or alternatively, imports from further afield. These sites and the regions which encompass them, require further investigations. If we consider that two of the largest assemblages have only recently been discovered (Nicholson 2012; Harland 2017), we should not ignore the probability of further discoveries yet to come.

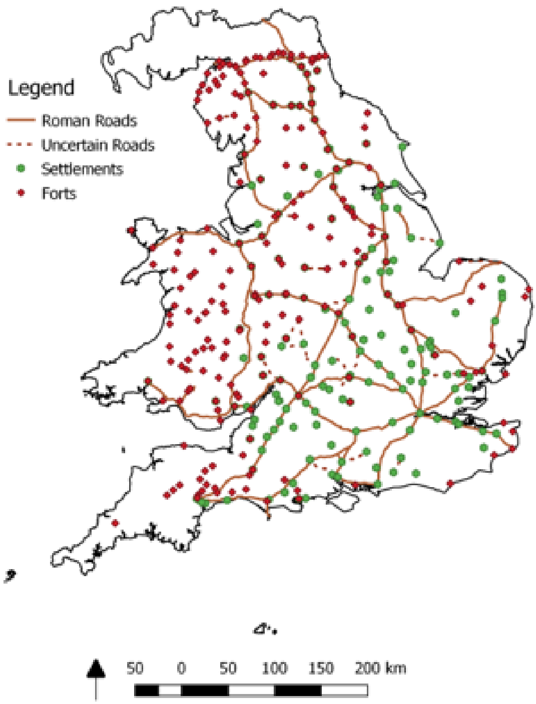
While geographical distributions are beneficial for identifying patterns of targeted species and dominant ecosystems for Roman fisheries, there is a palpable absence of significant ichthyofaunal data yet to be acquired; this includes species size estimations and MNI (minimum number of individuals). The undervalued significance of fisheries in Romano-British studies to date, alongside the constraints of post-excavation assessments (particularly for commercial projects), has stunted the collection of such data, to the extent that a more comprehensive ichthyofaunal project is necessary to re-assess past assemblages. It is hoped that this project may convince of the need and benefits of including such data in future assessments, and several recent publications have revealed an impetus to do so (e.g. Harland 2017). For the time being, the data that are available at this time may be of greater use when assessed in combination with the previously described fishing tool remains from Roman Britain.

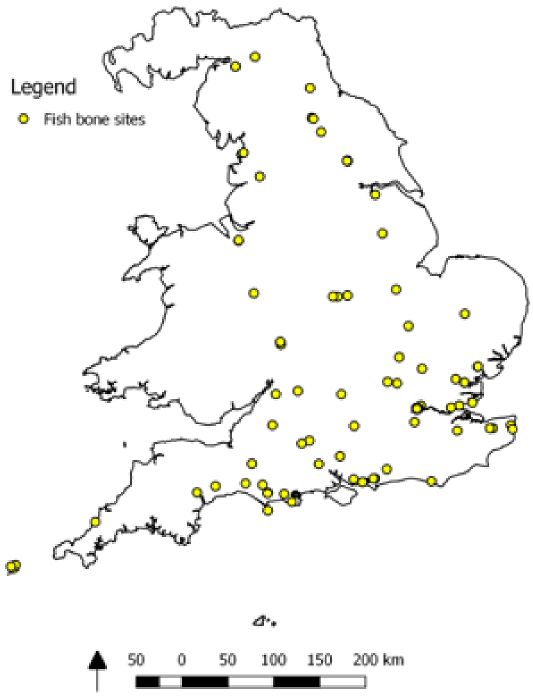
10. Synthetic Discussion

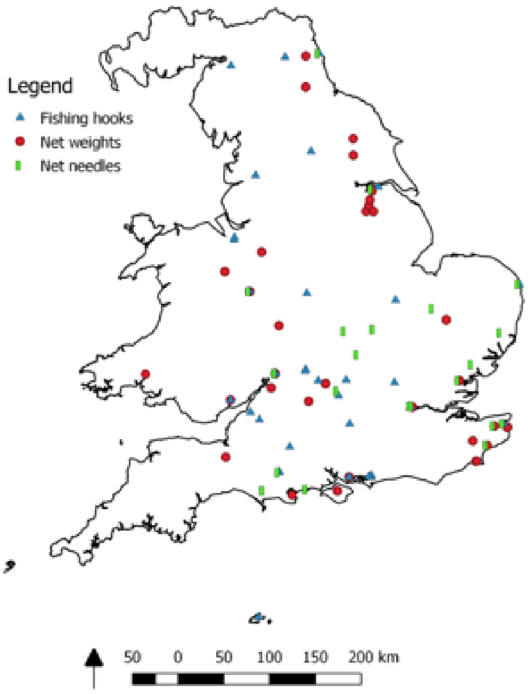
This chapter compares the previous ichthyofaunal and artefactual data to both augment the proposed interpretations and identify further distribution patterns that allow us to expand on the fishing methods of Roman Britain. The inconsistency of published data identified in the previous chapters has a notable impact on the ability to propose more tangible arguments of fishing methods. As this is a preliminary study, rather than concentrate on the most archaeologically represented sites, the following chapter also identifies areas considered to be ideal locations for Roman fishing and where further archaeological research is deemed necessary in order to identify further potential patterns. The final discussion elaborates on any current fishery patterns based on the cultural context of the archaeological sites. The potential consistency of fishing practices at military, rural, and urban sites are elucidated.

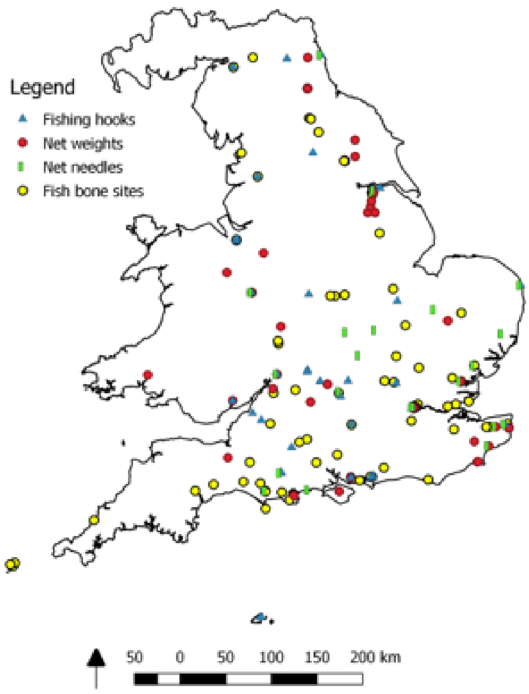
Most of the evidence for halieutic practices has been recovered from southern and eastern Britain where there is a concentration of civilian settlements, such as towns, colonies, and cities. A smaller yet visible concentration follows the distribution of military fortifications in the northern and western territories of the province, particularly along Hadrian's Wall. To this end, the evidence of fishing is consistent with previous studies of Romano-British economic and/or social distribution patterns (e.g. Green 1990; Jones and Mattingly 2002; Mattingly 2007; Allen et al. 2017), which reveal an economic divide between the northwest and the southeast (Figure 153). Large-scale fisheries, those evidenced by large fish bone assemblages (representative of fish preservation), have been found in the south and east of the country only. The largest concentration of fishing equipment is also restricted to the South-East region, with netting needles from the Essex coast, fishing hooks from London, and net weights from Heybridge and Lydd Quarry. This pattern supports the influence of population densities on the demand for aquatic resources. Meanwhile, the archaeological evidence of subsistence fishing is present throughout the country, regardless of the cultural context of the location, which strengthens the proposal that fishing was a common practice and questions whether a more successful market for processed fish was deterred by the proficiency and independence of individual fishermen and women, that is, an absence of demand for more intensive inland fisheries. The previous interpretations of the halieutic objects (Chapters 5 to 8) have proposed methods of assessment for a more complete catalogue of fishing equipment to encourage further studies;

yet, whether the current data is indicative of convincing patters is reliant on the correlation of the artefacts and ecofacts reviewed here.









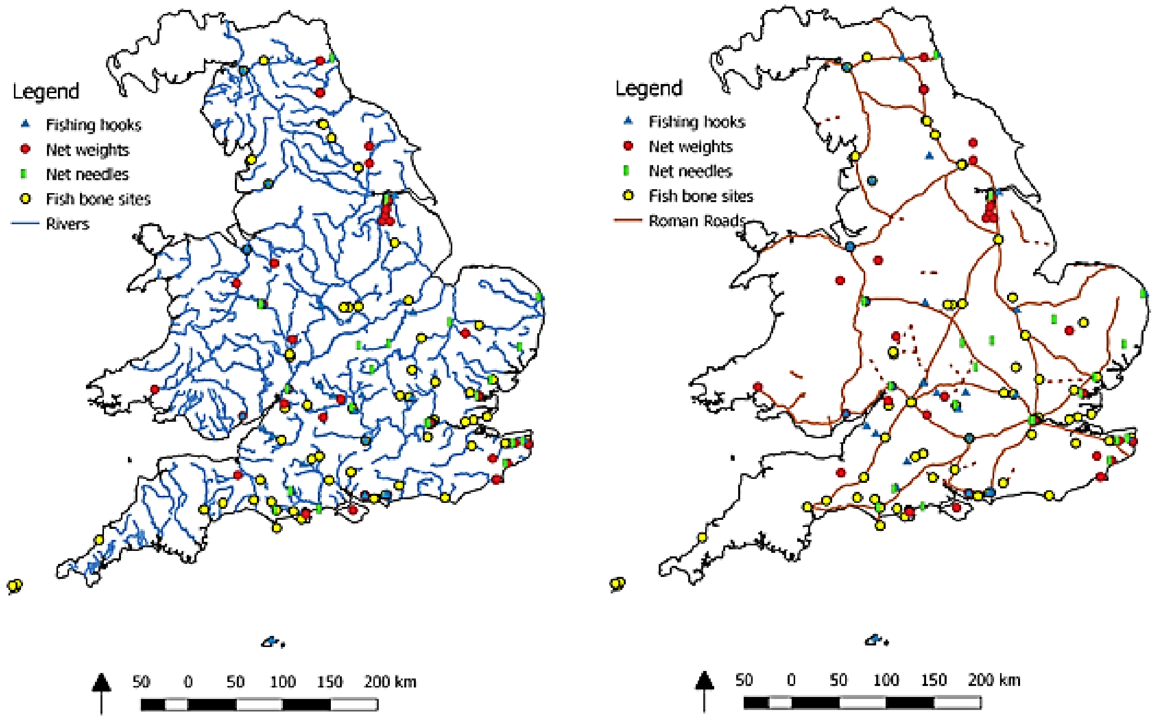


Figure 153:Distribution of Romano-British sites, divided into six maps which focus on settlement type (a), ecofact and artefact distribution (b-d and f), and prominent riverine environments (e). Data from Ordnance Survey Database and Roman site mapping https://osd

10.1 A Comparative Assessment

Correlating individual artefacts from various deposits merely by their function is a speculative approach, further complicated if there are incomplete records of their stratigraphic provenance. The current collection of fishing equipment and fish bone remains is fraught with discrepancies, for the former due to the absence of a guide for better practices in artefact recording, which has led to numerous items with no quantifiable data. The wide geographical distribution of the various halieutic resources is affected by their function in disparate environments, the allochthonous nature of both artefact and ecofacts, and the distribution of fish bone remains relating to the stage of either preservation, transport, or deposition. Thus, a comparative analysis should not aim to link the evidence to a single fishery; such an approach requires a greater collection of archaeological remains and is therefore only proposed for a few sites where there is the potential for large scale fishing. Instead, the artefacts are here viewed geographically and, where dates are unavailable, anachronistically, to determine patterns of artefact use and environment type. Several aspects may allude to the fisheries in place:

1. The distribution of different tools in relation to the environment.
2. The distribution of different tools in relation to the regional zone and cultural context.
3. The correlation of related artefacts (namely net weights and netting needles).
4. The size of fish bone assemblages in relation to artefact type.
5. The relationship of tool remains and fish species.

The preliminary regional divisions by major watersheds chosen for this assessment are used here to better divide and compare the evidence. As is illustrated below (Figures 154 and 155), there are notable regional discrepancies. The dominance of fish bone remains is expected as the practice of fishing with a marketable incentive functions on the basis of a maximum return for a minimum effort; if the fish bone remains exceed the expected capability of acquired fishing equipment, one may infer either a disparity in current archaeological evidence or the presence of consistent, albethey small fisheries. Only in the North region does the number of hooks almost equal the number of fish bone assemblages (Figure 155), which, if preservation and recovery discrepancies are consistent, may be interpreted as a dominance of subsistence fishing, as fish bone assemblages are more likely to equal the number artefacts recovered. Various criteria affect this theory, for which it is important to elucidate on the evidence first.

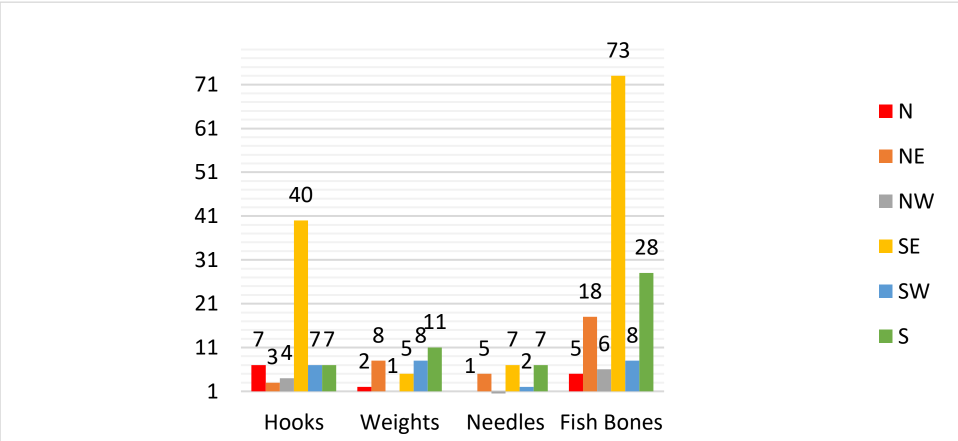


Figure 154: Number of sites of each archaeological remains per region. SE includes London sites.

There are twenty-three sites at which two or more halieutic remains have been recovered (Table 4). These artefacts do not derive from the same deposits, nor, in several cases, the same century. One must avoid the inference that various artefacts relate to a single fishery; nevertheless, the identification of discrepant fisheries is equally important for determining which methods of capture were used and which species of fish were targeted within a site or broader region. Artefacts can be recovered under a number of circumstances where fish bone remains are less likely to appear or be collected, such as metal-detected finds, chance finds by the public, archaeological watching briefs and evaluations where samples are not taken, or even small excavations with a poor or no sampling strategy; indeed, many of the subsequent objects have been obtained this way. It is therefore important to include a regional overview of the artefact and ecofact distribution, as it may be the only method of identifying a correlation.

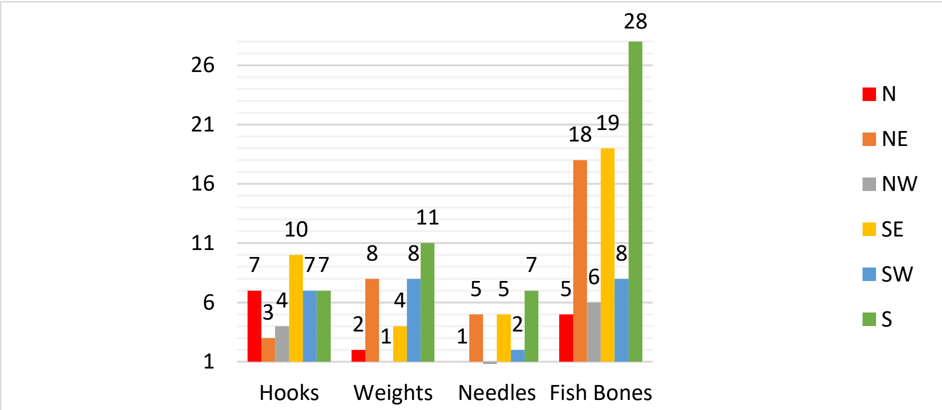


Figure 155: Number of sites of each archaeological remains per region. SE excludes London Sites

Fish bone remains dominate the archaeological record, though they are particularly scarce in the North and North-West regions where hooks are the most frequent fishing equipment. The North-East and South regions reveal a high number of net weights and netting needles, alongside numerous fish bone assemblages. The South-West region is relatively even, which is likely a consequence of the scarcity of published work outlined in the previous chapters. Finally, the South-East region (with and without the materials from London) reveal a dominance of fishing hooks, regardless of the evidence for large-scale fishing. The same patterns are less apparent with individual sites where various archaeological remains have been recovered (Table 4), with the exception of fishing hooks. Hooks appear more likely to be recovered in proximity to fish bone remains than weights or needles, which likely reflects the more allochthonous nature of the latter (especially needles if used by artisans as opposed to fishermen or women) and close relationship between the fisherperson and consumer (which may have been the same individual) with the hooks. This aspect, alongside the patters outlined in Figures 154 and 155, are more consistent with the observations made in the introduction and outlined in Chapters 5 to 9. The subsequent sections focus on the individual regions and elucidate on the identified patterns.

Table 4: The various locations in Britain with two or more types of halieutic evidence.

Location	Region	Hooks	Weights	Needles	Fish Bones
South Shields	N	H2-5		N1,2	
Carlisle	N	H7			FB2, 3, 114, 115
Binchester	N	H6	W30-33		FB112
Ribchester	NW	H9, 10			FB7
Chester	NW	H11, 12			FB13, 14, 116, 117
Caister-on-Sea	SE	H24		N7	
Colchester	SE			N13	FB32-34, 121
Heybridge	SE		W164-311	N14	FB35, 119
St Albans area	SE	H26			FB37
London	SE	H50-79	W21-22	N26-27	FB44-96, 138-139
Abingdon	SE			N15	FB24
Silchester	SE	H42			FB42, 122
Wroxeter	SW	H14-23	W75-101	N4-6	FB23
Caerleon	SW	H80	W11		
Dorchester	S			N19, 21	FB97, 98
Hod Hill	S	H39, 40		N17, 18	
Portchester	S	H41	W1		
Chichester	S	H43-45, 48			FB31
Fishbourne	S	H46, 47			FB31, 36
Ickham	S		W13	N24	
Saltwood Tunnel	S		W14	N25	
Dickson’s Corner	S		W55-74		FB 140
Richborough	S	H49		N22-23	

10.2 Distribution of Sites

10.2.1 The North Region

In the North region fish bone remains have only been recovered at Birdoswald (Site 1), Carlisle (Sites 2, 3, 114 and 115), and Binchester (Site 112) (Figure 156). Exact correlation with the tool evidence is largely impeded, this is due to the absence of fish bone data for the assemblage at Binchester and the absence of tool remains from Birdoswald. Only Carlisle has recorded evidence of both, though restricted to the recovery of a single hook (H7). The hook is a small iron J-shaped type with a sharpened barb and has been dated to AD 83-94 (Howard-Davis 2009, 751); this correlates in both date and proximity with two fish bone assemblages from (Sites 2 b and c). Both fish bone assemblages are composed of the same species, dominated by salmonids and the European eel, with a small number of plaice and flounder remains, as well as two fragments of hake (one per assemblage) (Locker 1985). One cannot confirm that the hook in the vicinity of the Roman military fortification on the river Eden relates to these assemblages, but it is likely representative of local riverine fishing, for which the salmon and eel are likely targets. No strictly freshwater species have been identified for this date or location, which may represent the absence of a continuous fishery throughout the year and the absence of fishing with nets or traps, which would produce a more diverse assemblage; furthermore, the eel remains are few (seventeen and thirty fragments respectively), surpassed by salmonid remains (fifty and forty-eight fragments respectively), which supports the likelihood of subsistence fishing with hook and line.

The continuation of these species among further assemblages at Carlisle in the 2nd to early 3rd centuries suggests a continuation of a small-scale initiative among the Roman soldiers of the fortification and/or adjoining settlement. These later periods include the addition of other very scarce marine species, such as wrasses (recorded to family only: *Labridae*), mullets (*Mugilidae*), and the Atlantic mackerel. Although mullets can be caught in freshwater environments, the mackerel and wrasses are potential catches off the British coast, albethey infrequent (Wheeler 1978). The assemblages suggest a connection to coastal imports, either in proximity or from further afield. As there is no evidence of military fishing extending beyond local subsistence activities (assumed to be for leisure only), the marine species may also indicate a civilian-led market of small catches being sold at the fortification.

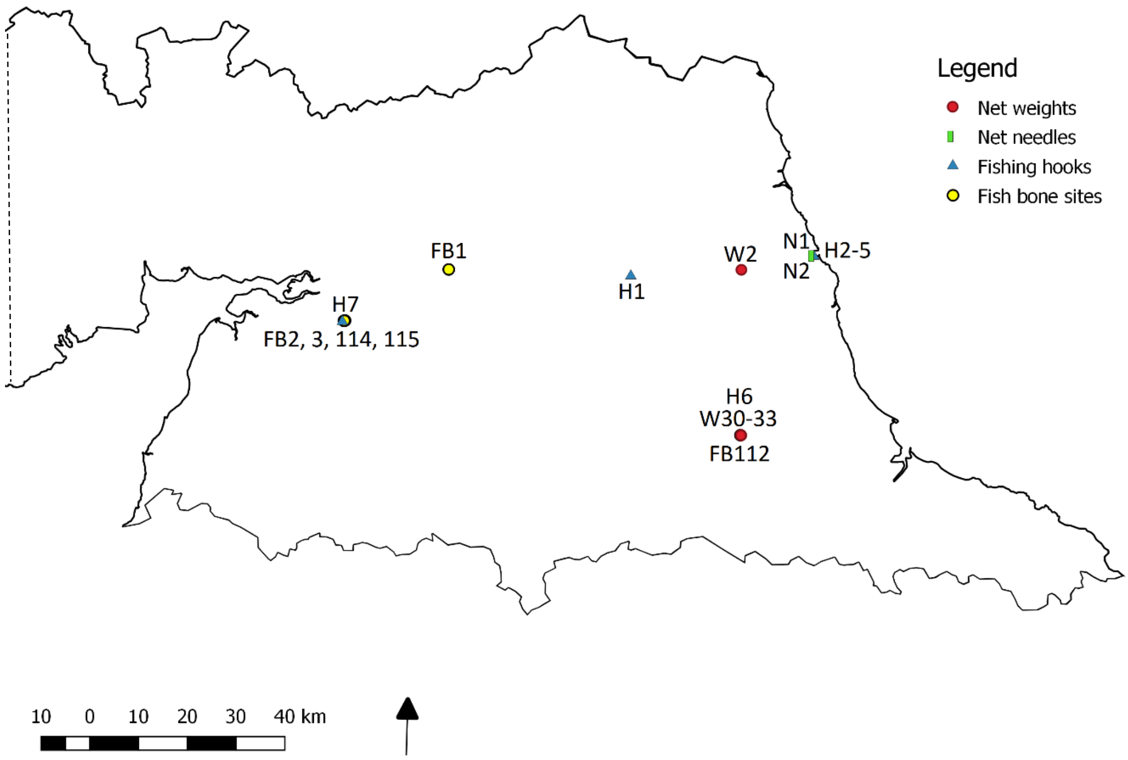


Figure 156: Distribution of archaeological evidence in the North region. Labelled by assigned artefact number for tools and site number for fish bone remains.

Of the remaining sites in the North region, only Binchester and South Shields have multiple tools. South Shields, located between the Tyne and North Sea, has produced two netting needles (N1 and 2) and four hooks (H2 to 5). No data are available on the latter at this time, but they have been recorded as deriving from the southeast corner of the military fort (unpublished, accessed museum records, see Appendix A Part 1); this coincides with the recovery of hooks within fortifications at Carlisle and Vindolanda. The needles, on the other hand, are from the vicus, outside of the South Shields fort (Allason-Jones and Miket 1984, 174-6). Vindolanda tablet 593, may be a request for a fishing net from a veteran (*Veteranus*; see Bowman 2008), also outside of the fort at Vindolanda, or from a separate location altogether if written at Vindolanda. A civilian production of nets would coincide with historical representations of military restrictions and the extent of acceptable leisure activities (Digest of Justinian, 49.16.12 (1)). Whether nets were produced at fortifications or not, there remains the potential for their use by military personnel, but this may only be evidenced for fishing via the recovery of net weights. The absence of weights from South Shields is important to consider in determining military fishing practices. A large number of undated weights have been collected by the museum, recovered along the coast (Unpublished, South Shields Museum), but with similar medieval examples identified throughout the northeast coast by the Portable Antiquities Scheme (e.g. SWYOR-653496, SWYOR-D2D488; DUR-E663EB), further examples with confirmed Roman dates are required.

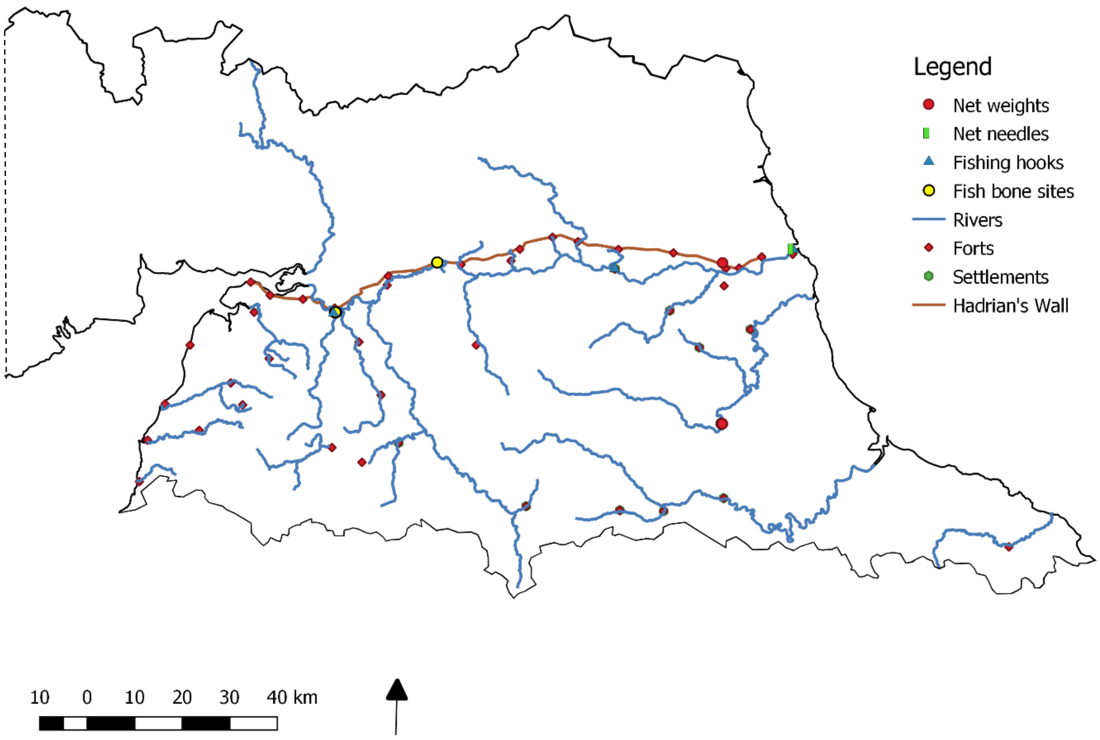


Figure 157: Distribution of halieutic remains, Roman settlements and fortifications, and river systems connected to known Roman sites.

Binchester has produced four fishing weights connected to the military fortification and dated to the late 4th to early 5th centuries (Northern Archaeological Associates, Forthcoming). All the weights have volumes below 15g, suggesting the sinking of a device with low buoyancy, such as a lead-line for a fine net, or potentially a cast net; however, the discrepancy of 11g between the lightest and heaviest examples is a significant gap that requires further investigation before suggesting a cast net was a possibility. In proximity to the military site, a large iron hook (H6) has been recovered (Ibid.), which, given the isolation of the fort and restriction to freshwater environments only, suggests the capture of large riverine fish. A recent discovery of fish bone remains from Binchester is pending assessment (Northern Archaeological Associates, Forthcoming) and may reflect which large species were being targeted with the subsequent hook, if they are indeed connected. The large size and volume of the hook suggests weights were not necessary for sinking the attached line, meanwhile the recovery of four weights, though a small figure, is potentially indicative of a combined use, such as for a net.

The evidence for Binchester is consistent with other sites in the North, this can be argued from the suggestion that various small-scale methods of fishing were used, many by military personnel. There is no evidence of net production within fortifications, but it is plausible nets were used by the same men who kept their fishing hooks within the forts. It is also plausible that these activities were conducted by slaves or civilians tied to the military dwellings, but there is no literary evidence to support this. The North region is here defined as the aquatic environments on the northern border of the province of Roman Britain; settlements are restricted to small villages adjoining military fortifications, as such, the demand for fish is highly restricted to the needs and desires of a small population. The current evidence suggests it is unlikely large-scale fishing will be identified in future; nevertheless, the tool remains, more than half of which have only emerged in the last two years, suggests there are environmental remains yet to be recovered that will elucidate on the halieutic practices tied to the Roman army at the edge of the empire and whether they represent a more viable subsidiary food source, as identified in the frontier of Germania Inferior (Dütting 2016).

10.2.2 The North-East Region

Although the North-East region has produced seventeen artefacts and eighteen fish bone sites, none of the halieutic evidence is directly associated. There are general concentrations of fishing tools south of the Humber Estuary (Figure 158), consisting largely of weights, from various sites and a netting needle from Winterton (N3). Only one hook (H13) has been recorded on the Humber, yet as is argued in Chapter 5, this is unlikely a fishing hook but rather a steel-yard or meat hook. The weights have unconfirmed Roman dates and include three examples (W17, 18, and 19) that more closely resemble curses (*defixiones*) rather than fishing implements (see Chapter 6). Although few, all the weights are chance finds by metal-detectorists recorded on the Portable Antiquities Scheme (see Appendix A, Part 2, for full records). It is therefore possible that W16 and 20 are fishing weights and representative of a larger buried assemblage. Both are similar in volume and size and consistent with the most common variety, the clasped type.

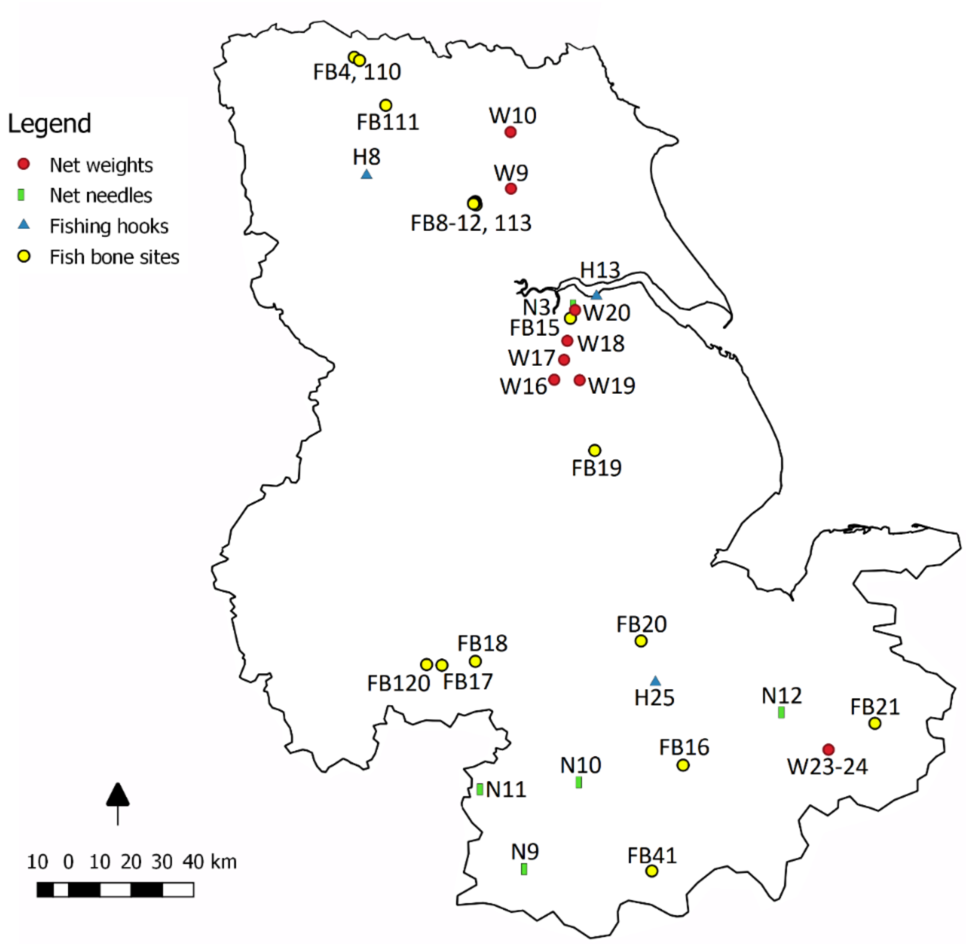


Figure 158: Distribution of archaeological evidence in the North-East region. Labelled by assigned artefact number for tools and site number for fish bone remains.

The reason for the general grouping of these artefacts and ecofacts, south of the Humber, is more clearly illustrated in Figure 159. The artefacts have been recovered along the river valleys and flood zones of Lincolnshire, in proximity to Ermine Street, a major Roman road, and between the settlements of Winteringham, Dragonby, Hibaldstow, Owmby, and Lincoln (north to south). The same pattern emerges further north and south as fish bone assemblages follow the distribution of sites on the route of Ermine Street. To the north, the exceptions (those archaeological remains at a distance from the major Roman road), are represented by artefacts only: a large iron hook from Beadlam (H8); and two chance find weights with unconfirmed dates (W9 and 10). The fish bone remains from Healam (Site 111) are awaiting assessment, meanwhile, those from Catterick (Sites 4 and 110) include marine species such as herring, red mullet, wrasse and Atlantic wolffish. The most numerous fish bone assemblages in this northern area of the North-East region are those from York, where a mixture of freshwater and marine species have been recovered alongside the potential fish-processing facility at St

Mary Bishophill Junior (Site 113). The general absence of evidence from rural sites, alongside the marine species identified as far inland as Catterick following the Roman road, suggest a marketable product deriving from the Humber Estuary. Once assessed, the fish bone remains from Healam Bridge may be consistent with this interpretation, composed of marine species from further south. The large quantity of clupeids from York, if indeed of Roman date (which remains under dispute: see Jones 1988), highlights the potential for a coastal fishery with the capacity to capture large shoals of inshore species. Currently, the only needle from this area has been found at Winteringham, which has access to the Humber. This is insufficient to suggest a large-scale fishery at this time; however, both Winteringham and the site of Brough, a larger settlement located on Ermine Street and on the northern shore of the Humber, appear the best candidates for the exploitation of the local aquatic resources and from where to provide the road- and river-side settlements of both Yorkshire and Lincolnshire with a supply of fish.

The southern half of the North-East region is dominated by the Wash, which, during the 1st-4th centuries, was a heavily flooded wetland, limiting rural activities along the coast and over 30 km inland (Mattingly 2007, 391). There is no evidence of occupation between the settlement at Skegness and the Roman fort of Brancaster, highlighting both the extent of the flooded region and the significance of the Humber Estuary to the north as the most profitable brackish environment that would have been accessible to Roman fisheries. On the western extent of the South-East region, the Pennines were an equally problematic terrain, which, although with substantial rivers connecting to both the Wash and Humber, reveal a limited Roman habitation, mostly restricted to fortifications. The halieutic evidence appears to be consistent with this pattern, once again following the major Roman roads of Ermine Street (heading south towards London) and the Fosse Way (heading southwest towards Gloucester). These archaeological remains are primarily represented by ichthyofaunal evidence at Lincoln (Site 19), Leicester (Sites 17 and 18), and Godmanchester (Site 16). In contrast to the previous assemblages, these settlements are dominated by freshwater species, including cyprinids, pike, and perch, alongside the ubiquitous European eel. In addition to this, all the assemblages include clupeid remains.

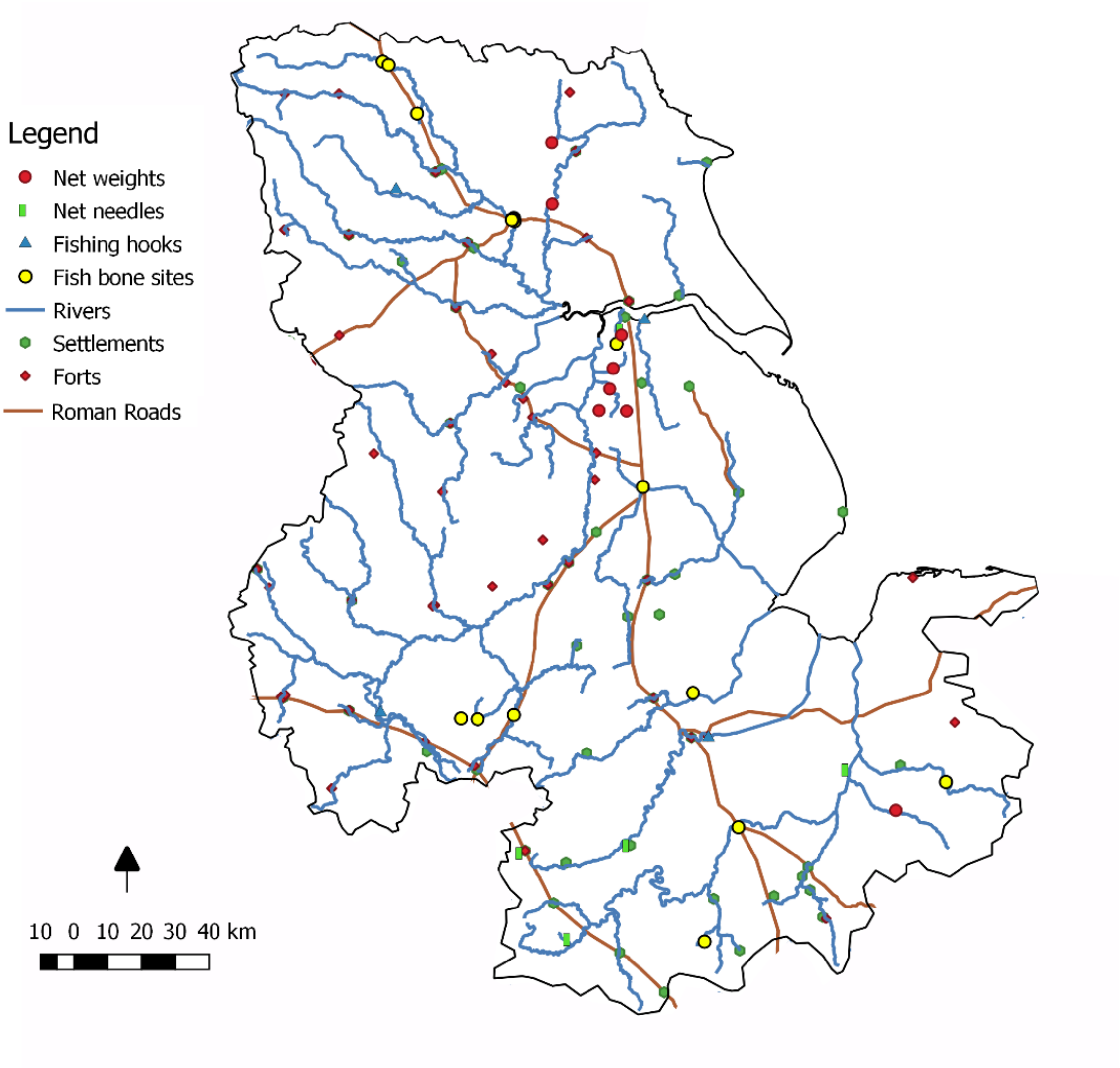


Figure 159: Distribution of halieutic remains, Roman settlements and fortifications, identified Roman roads, and river systems connected to known Roman sites in the North-East region.

The sites of Godmanchester and Lincoln have no other strictly marine species, as several flatfish fragments and those identified to plaice/flounder, may represent the diadromous flounder captured in a freshwater environment. The larger settlement of Leicester does reveal a more diverse marine species collection, with the addition of Atlantic mackerel and gurnard, but of which there are only a few fragments. The remaining assemblages from West Deeping (Site 20), Thetford (Site 21) and Meppershall (Site 41) are smaller assemblages but appear consistent with the dominance of freshwater species and sparse fragments of clupeids (only Site 20 is missing clupeid remains).

The only tool remains in relative proximity are netting needles N9 to 12, though these objects are questionable fishing implements. They all represent chance finds by metal detectorists that are unstratified and far from known Roman settlements or fortifications. Only N11 is in relative proximity to a Roman fort in Daventry (Northamptonshire), but it has been poorly recorded. The remaining examples reveal size estimates that are smaller than confirmed Roman averages (see Chapter 7). No other evidence of Roman fishing or fish consumption relates to these needles, which restricts any further interpretations, but they are likely later Medieval examples used for alternative non-fishery netting, as is suggested by the narrow eye diameters. Two weights recovered at Mildenhall, Suffolk (W23 and 24), are equally isolated and with insufficient data to compare to other examples. The Portable Antiquities Scheme has dated these chance finds between Iron Age and Medieval, although their relatively low volumes (of 19.5 and 6.6 g respectively) and short lengths (of 38.6 and 26 mm respectively) are consistent with the predominant Roman clasped variety identified in Chapter 6.

The North-East region, although one of the largest watersheds with interconnecting freshwater environments, flood zones, and a long shoreline, is sparsely represented by halieutic evidence. An important factor appears to be the absence of accessible estuarine environments, other than the Humber Estuary, around which the largest concentration of evidence is represented by fish bone assemblages recovered further inland. The evidence follows connected settlements following the northern and southern directions of Ermine Street, with substantial evidence of the consumption of both freshwater and marine fish at the major settlements of York, Lincon, and Leicester. Both York and Leicester have revealed a dominance of freshwater species that suggest local fisheries were supplying the urban centres. The diversity of species increases the likelihood of various fishing methods taking place, yet, absence of tool remains at any of these urban centres requires us to rely on the ichthyofaunal evidence alone. The absence of a dominant species, especially of the diadromous salmonids and eels, suggests there were no intentional large-scale efforts to target one species. The presence and dominance of either weirs, traps, or nets, would have produced more homogenous assemblages than those recorded. Until further discoveries are made, the most likely method of capture is the use of hook and line, supporting a more diverse yet sparse assemblage, such as is presented; nevertheless, small-scale applications of traps and nets are equally plausible but currently unsupported by archaeological evidence.

The most significant evidence is the scarce, yet ubiquitous, recovery of small clupeid remains, especially among inland sites and the smaller assemblages at a distance from Ermine Street. These are highly indicative of a marketed product imported from a shore-based fishery. As discussed, the Humber estuary is the most likely candidate for this fishery, with three settlements along the shore with the potential to maintain a local market for large-scale fishing and using nets to capture inshore shoals of clupeids. The potential processing facilities at Lincoln and (questionably) York, suggest a local variant of this commodity was sold or further processed in the large settlements for further distribution along the road-connected settlements of this region. The absence of tool remains at the Humber, bar a needle from Winteringham, is in need of scrutiny and further excavations. Meanwhile, the absence of tool remains further inland and away from the road network is comparatively indicative of a lack of more local subsistence fisheries. This is not only consistent with the absence of Roman settlements in this region, but of the scarcity of rural villas at a distance from the major road network (Mattingly 2007, 390-392) and the short-lived military presence (Ibid. 135).

10.2.3 The North-West Region

The North-West region is the least represented, with a total of five artefacts and six fish bone sites (Figure 150); nevertheless, Chester represents an anomaly, including the largest fish bone assemblage relating to fresh or alternatively preserved local fish products, as opposed to imported and processed by-products such as fish sauce. There is no evidence of the production of a by-product anywhere on the west coast of Britain, but that is not to say that the fish recovered from Chester were not preserved via some method (dry-salting, smoking, or in brine); alternatively, the assemblage represents a unique and significant distribution of fresh fish. The first assemblages at Chester were recorded in the early 2000s, Site 11 (Jacques et al. 2004) and Site 12 (Jones 2001), and are represented by sixty-nine and 116 diagnostic fragments respectively (with an additional 189 fragments at Site 11 dated to the 4^{th} to 9^{th} centuries). Both sites reveal a collection of salmonids and smelts, European eel, herring, and flatfish such as plaice and/or flounder; meanwhile, site 13 includes additional marine species such as European sea bass, mullets, and Spanish mackerel. Both assemblages are assigned to the garrison town but with no clear connection to military structures.

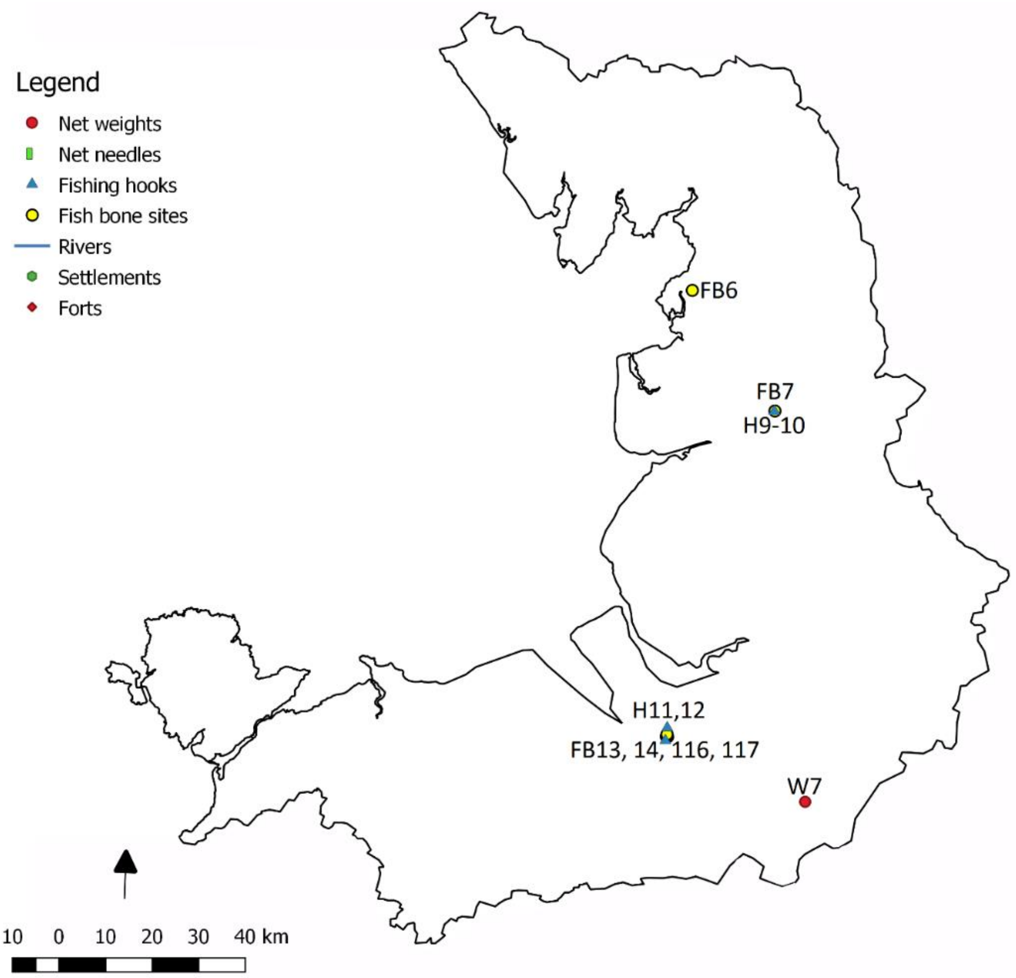


Figure 160: Distribution of archaeological evidence in the North-West region. Labelled by assigned artefact number for tools and site number for fish bone remains.

The largest assemblages at Chester derive from the recent excavation at the Amphitheatre (Harland 2017). More intensive excavation and recording techniques have identified six distinguishable phases of fish bone deposition dating from the 1st to late 3rd centuries. The assemblages consist of the same species identified in the previous sites, with the addition of a few cyprinid and gadid remains and singular fragments of a ray fish (family *Rajidae*), a loach (family *Cobitidae*), and Spanish and Atlantic mackerels (*Scomber japonicus* and *Scomber scombrus* respectively). The consistency of the freshwater, brackish, and marine species, identified throughout the Roman occupation, is highly indicative of established fisheries located further afield from the urban centre. On the one hand, the scarcity of the gadid and ray remains reduce the likelihood of off-shore fisheries; on the other hand, the cyprinids that frequent the surrounding freshwaters of the River Dee (Harland 2017, 17) are also scarce. The most dominant species are the diadromous salmonids and eels, with numerous flatfish remains including both the catadromous flounder and the marine plaice. All the evidence points to an estuarine fishery dominating the Chester market. The additional recovery of clupeid remains, draws attention to a potential large-scale capture of these shoaling fish within the estuarine zone, but this hypothesis is reliant on the ichthyofaunal evidence alone. The tool remains are sparse, with no weights or needles to indicate the use of nets. Only two hooks have been recovered (H11 and H12). The first is an elongated-J dated to the 1st century and found within the Roman fort; the second is of uncertain date and a chance find with insufficient evidence on provenance. Both hooks are poor indicators of a local freshwater fishery supplementing the significant markets indicated at Chester amphitheatre; indeed, H11 is another example of the potential leisure activity undertaken by military personnel. There is no further evidence for fishing in proximity to Chester, nevertheless, the success of fish as a marketable food product for a civilian population is indicative of a large market beyond the confines of the amphitheatre.

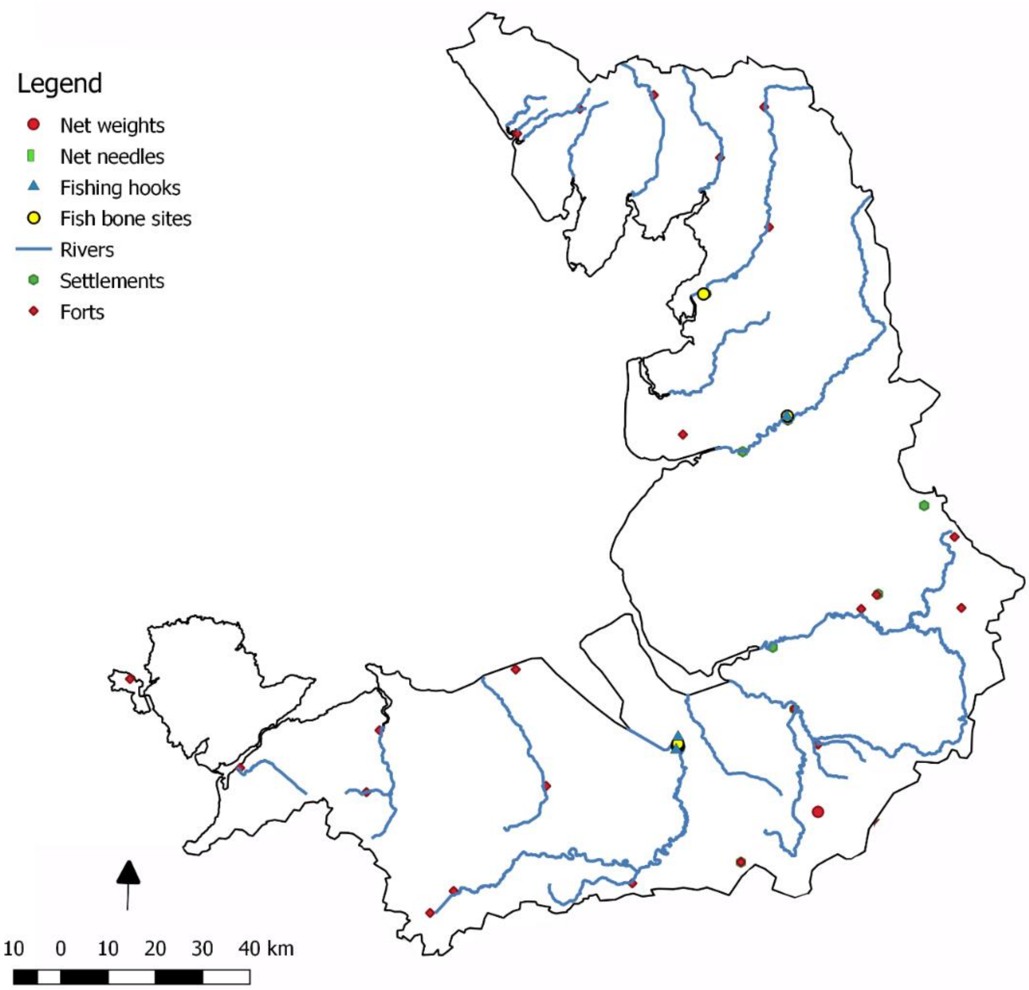


Figure 161: Distribution of halieutic remains, Roman settlements and fortifications, and river systems connected to known Roman sites in the North-West region.

The remaining sites include a single diagnostic element of a salmonid at Lancaster, which, due to uncertain dating may relate to either the military fortification or latter neighbouring settlement; and a single lead weight from Shavington Cum Gresty (W7), which, though described as also being a potential curse tablet (Portable Antiquities Scheme, file LVPL-85ADA3), is morphologically consistent with the small clasped variety net weights proposed here. At Ribchester, two hooks (H9 and H10) have been found in connection to the Roman fort, the latter of which is dated to the late 1st century. In addition, a fish bone site composed of six assemblages dated to the late 1st to late 2nd centuries have been recorded. The diagnostic elements are scarce, consisting of less than 10 % of the entire assemblage (Nicholson 1993) and including salmonids, smelt, eel, plaice or flounder, and a thicklip grey mullet. All these species (although, in the case of flatfish, flounder only) can be found in marine, brackish and freshwater environments and therefore allude to a range of capture. Evidence of individual catches via the use of hooks is supported by the scarcity of the remains; however, the hooks from Ribchester may not pertain to fishing and should therefore not be considered in this context? Furthermore, the use of hooks at this inland site and on the River Ribble would have supported the capture of freshwater species such as pike or cyprinids, in addition to the diadromous assemblage that was recovered; their absence suggests the recovered remains may have been imported products from an estuarine or coastal fishery. Chester is a distant candidate, yet alternative evidence for the North-West remains sparse.

Further halieutic evidence is required among the military fortifications that dominate the North-West region to support the potential for military-based subsistence fisheries, as identified in the North region. The fish bone remains from Lancaster and Ribchester are too few to suggest any local activity beyond single catches. Chester stands out, not only contributing fishing hooks and fish bone remains to the archaeological record but providing evidence of medium to large-scale fisheries. Whether the clupeids indicate a potential fish-salting installation somewhere in the vicinity of the Dee Estuary, is strictly hypothetical, nevertheless, they do support the use of nets for their capture. Further discoveries may elucidate on the method and location of capture and preservation of these fish.

10.2.4 The South-East Region

The South-East region has produced the most numerous artefacts pertaining to fishing. London has produced the most substantial collection of hooks and fish bone assemblages, yet the largest collection of weights derives from Graveney (W38 to W44) and Heybridge (W164 to W311). The remaining sites are predominantly inland and composed of sparse evidence. There are only seven sites with multiple archaeological remains at Caister-on-Sea, Colchester, St Albans, Silchester, Abingdon, Heybridge, and London (Figure 162). These derive from various environments, with the largest collections relating to the coastal and estuarine environments of the Thames, but the most numerous sites spread out among the Thames valley and notable tributaries (Figure 163). St Albans has produced a single fish bone site (Site 37), consisting of three assemblages dating to the 1st, 2nd, and 3rd centuries. The location relates to a villa complex, rather than the settlement or military fortification (Frere 1984), for which there have been no further discoveries. The species identified include various freshwater or diadromous fish, such as cyprinids, perch, salmonids, and eel, though *scombridae* (mackerel family) and herring have also been identified. In contrast, the accompanying hook may relate to the 5th century decline of the settlement (Frere 1984). The sparse remains are therefore indicative of local subsistence catches and, in the case of the sparse marine fish bones, the import of a fish preserve for the inhabitants of the villa. The absence of related pottery fragments with which to determine the origin of this product may highlight a local variant from the North Sea coast, rather than an Iberian import.

Oxfordshire has produced various remains which highlight an isolation from the large-scale fisheries of the coast. Although Barton Court Farm in Abingdon has produced the only multiple evidence with a needle (N15) and fish bone remains (Site 24), there are notable chronological discrepancies. The needle is an early Roman example (Miles 1984) but with no direct link to fishing nets. The later fish bone remains dated to the 3rd to 5th centuries (Wheeler 1984), suggest individual catches of local species, perhaps with a hook and line. Further evidence from this region includes various hooks, but several have been highlighted as potential non-fishery tools (H29 to H31 and H33). The only convincing evidence is from Gill Mill, where ten lead weights of the small clasped variety strongly support the use of fishing nets, potentially the cast net (discussed in Chapter 6). The remaining hooks are chance finds that have been poorly assessed, but as identified with other examples, are indicative of single catches by individuals.

At Silchester, the same observation can be made with the recovery of a single fishing hook (H42) dated to AD 117 to 161 (Fulford and Timby 2000, 371). The additional recovery of a fish bone assemblage from the 3rd-4th century (Site 122), highlight the import of marine fish, which would have required preservation prior to transport inland. Some clupeids are present, but rather than suggest a fish by-product such as fish sauce, the numerous European seabass, seabreams (*Sparidae*), and wrasse (*Labridae*), indicate preservation via dry-salting, smoking, or pickling in brine. The remaining freshwater species include pike and cyprinids that were likely caught closer to the settlement, and of which the figures do not indicate a substantial fishery. Though Silchester is far inland, it is a significant settlement creating a crossroads to other urban centres (Mattingly 2007, 142), for which one might expect the import of desirable products; nevertheless, the absence of local freshwater fisheries highlights the exclusivity of fish as a dietary subsidy for a minority of the population. This appears to be the general picture for the inland zones of Britain.

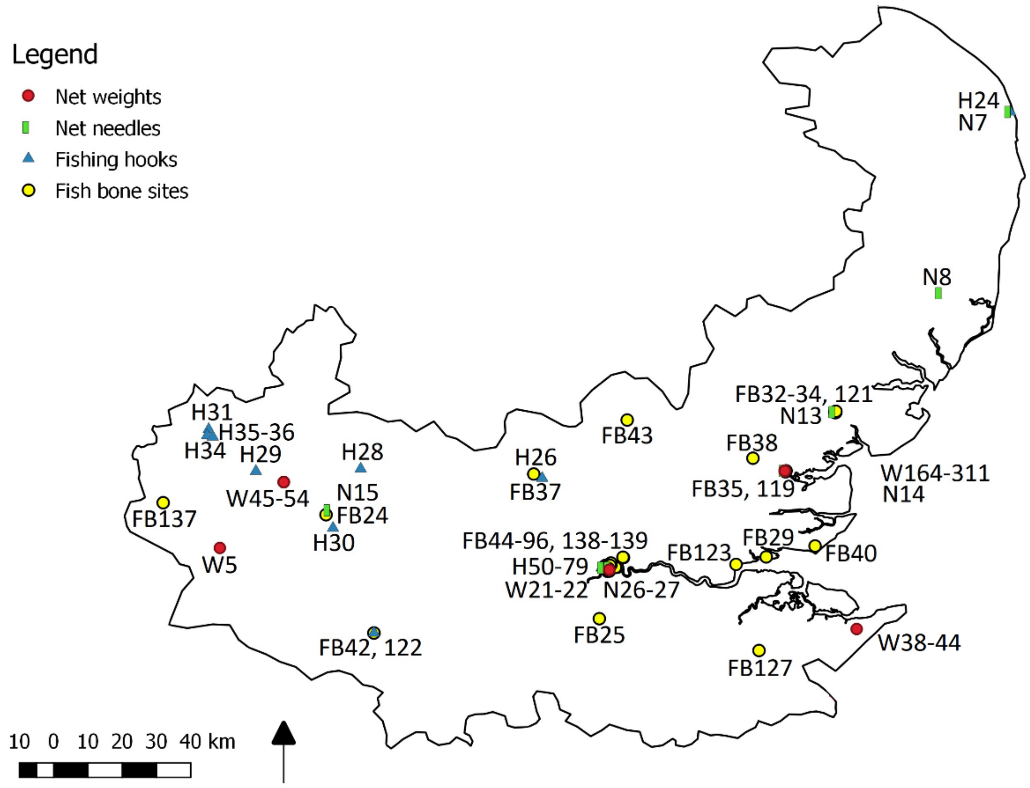


Figure 162: Distribution of archaeological evidence in the South-East region. Labelled by assigned artefact number for tools and site number for fish bone remains.

Caister-on-Sea is the most isolated case, located on the Norfolk coast in general isolation from the Roman settlements at Ayisham and Norwhich, which is due to its function as a late Roman

Saxon shore-fort (Salway 1988, 258). The two artefacts recovered include a netting needle (N7) and a hook (H24), the latter of which is the only dated artefact, to the early to mid 4th century, which is consistent with the military presence (Mould 1993). The hook suggests single catches by individuals, while the needle, though consistent in length with other examples, has very narrow and circular eyes, indicative of a fine mesh. One can rule out the production of large nets with coarser cord, as well as net bags, which have been found to be quite robust (Thomas 2010, 149). A range of fine meshed nets could have been produced with this needle, including the cast, gill, and fine seine. As with many Saxon shore-forts, early excavations have produced limited environmental samples, resulting in an absence of ichthyofaunal remains with which to identify the targeted species.

Colchester, like Gloucester and Lincoln, is a veteran *coloniae* that would have absorbed military veterans throughout the Roman occupation (Mattingly 2007, 192). Fish bone remains are numerous and dated from the 1st to 4th centuries, all of which include a diverse range of marine and brackish water species, such as gadids, herring, plaice and flounder, eel, salmonids, and Atlantic mackerel, which suggests that fisheries were well placed on the Colne Estuary and supplying the city, located up river. The additional recovery of three-spined stickleback (*Gasterosteus aculeatus*), alongside the clupeid remains, is indicative of the use of nets for the capture of these small species. Salmonid and eel remains are relatively scarce, regardless of ample sampling (Locker 1986; 1992), which, alongside the absence of freshwater species such as cyprinids, convinces of a strictly estuarine or coastal fishery. This is supported by the only tool evidence, netting needle N13. The needle, if used for the manufacture of fishing nets, highlights the potential for a dedicated supply of fish to the city of Colchester; however, the absence of weights from the surrounding coastline prevents such a confirmation, the resulting fish bone remains may also relate to the import of these fish from further afield. The next settlements along the coast, located at the mouth of the River Blackwater, where it meets the Blackwater Estuary, is Heybridge.

Heybridge has produced an almost identical assemblage of marine species from two sites (Site 35 and 119). Site 35 has been assessed as one assemblage (Locker 1998b), but has later been noted as consisting of three assemblages from the 1st, 3rd, and 4th centuries (Locker 2007); meanwhile, Site 119 consists of four assemblages dated to the entire Roman occupation (Locker 2015). Unlike Colchester, Heybridge has also produced a needle (N14) and the largest collection of lead weights to date (W164 to W311), combined, these resources indicate a large fishery in the vicinity. The 148 weights analysed in Chapter 6 are part of a larger lead assemblage that indicates the recycling of lead objects at Heybridge, but with an uncertain objective. The intended manufacture of fishing weights from scrap metal is a possibility; the alternative being the recycling of lead including weights on site. The fact that fish bone remains of species present in the Blackwater estuary were deposited throughout the entire Roman occupation strongly supports a steady supply of fish from neighbouring waters. The additional recovery of a needle is further convincing (Atkinson 2015), although it is a heavily truncated example from which to make further suggestions of net types. Further inland, the 3rd to 4th century villa site of Great Holts Farm (Site 38), has produced a fish bone assemblage with similar marine species (Locker 2003). Heybridge is in relative proximity, for which we must acknowledge the potential for this fishery supplying surrounding territories with fish. There is no evidence of fish processing to a comparable scale as that of Stanford Wharf (Site 123), but there is also an absence of surrounding settlements at which to expand such a market. The current evidence suggests that Heybridge could have acted as a medium-scaled fishery providing this food source to local villas and, perhaps, the neighbouring city of Colchester.

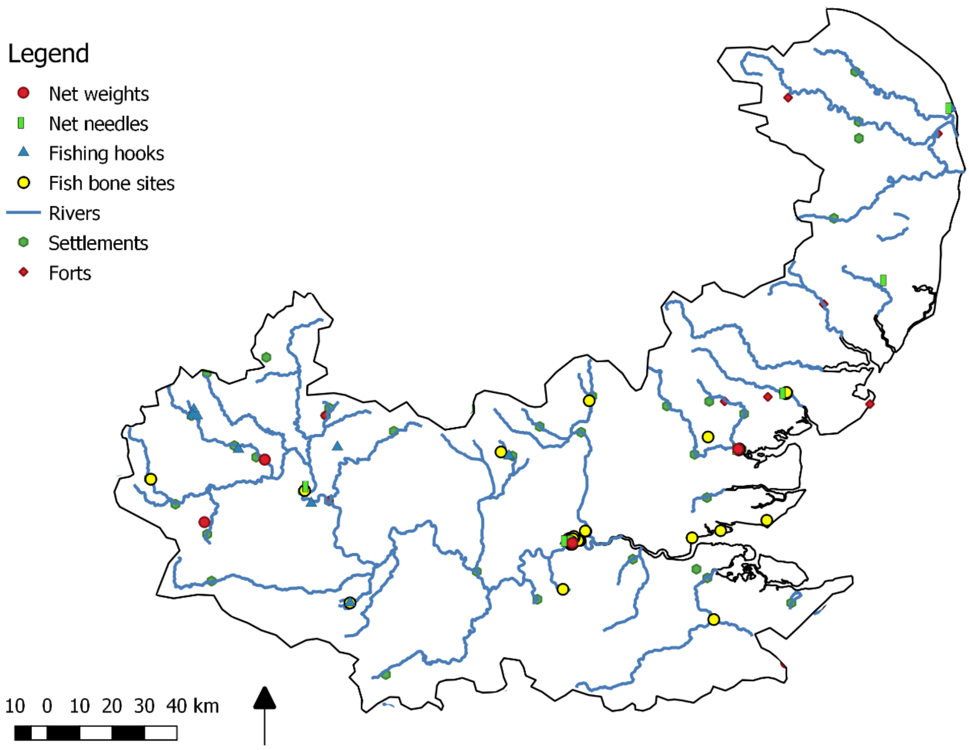


Figure 163: Distribution of halieutic remains, Roman settlements and fortifications, and river systems connected to known Roman sites in the South-East region.

London has produced thirty-four artefacts and fifty-five fish bone sites. As discussed in Chapter 9, the ichthyofaunal evidence reflects a diversity of fisheries providing the inhabitants of the city with freshwater, estuarine, and processed fish remains. The site of Peninsular House, though the result of a limited excavation, has produced a subsample of clupeid remains that suggest a processed fish product (Bateman and Locker 1982). The subsequent species would not have been caught at London, but within the more saline reaches of the estuary, such as at the processing site of Stanford Wharf. Further processing could have taken place within the city for the production of a marketable product that could take the form of a sauce (unlikely to leave an archaeological trace), or salted goods, which may be reflected in the recovery of small quantities of clupeid remains, as have been found throughout the entire city.

The tool remains from London must be treated cautiously due to the chance recovery of many of them from the River Thames. A Roman date is proposed for all the included artefacts, but few derive from stratified contexts. Convincing examples include the beaked type hook (see Chapter 5), which reveals a consistent morphology with an additional three hooks. Their recovery from separate contexts may relate to a skilled craftsperson and, thus, a supply of fishing equipment to individuals. This evidence, alongside more numerous hooks reveals a consistency of subsidiary fishing practices by a larger percentage of the population that is currently identified at other sites. The only evidence for fishing with nets is supported by two fishing weights recovered from a 4th to 5th century deposit at Guy's Hospital in Southwark. The expansive aquatic nature of this area has been revealed in geoarchaeological assessments (Cowan et al. 2009), suggesting ideal habitats for fisheries using traps and nets. Although, no confirmed traps have been recovered, the weights, consistent with the small clasped varieties (Taylor-Wilson 2002, 34), may highlight the use of a cast net for the capture of local species. The production of these nets is reliant on two potential, but unpublished, needles recovered from Billingsgate Market (N26: London Archaeological Archive) and Thames Bank (N27: mentioned in Ayodeji 2004). These are sparse remains, which combined with the two weights, suggest net fishing was present but not common. There is an additional resource of fishing traps, the only Roman examples of which are located on the Thames, but at a distance from the Roman city of Londinium. The only example from the city, at 117 Borough High Street (Cowan et al 2009,24), has been revaluated and dated to the Medieval period (Killock, Forthcoming). The identification of weirs further inland and on the Thames at Putney

(Greenwood 2008, 116) and Shepperton (Bird 1999, 105) are far enough that the transport of fresh or processed fish to London is untenable (at this time). The literary sources suggest eels could have been the primary target of such traps (Pliny HN 9.38.74), while ethnographic evidence highlights their successful application in the capture of salmonids (leading to the Salmon act of 1861: see Jenkins 1974, 26), both species of fish are relatively underrepresented in London. The current evidence suggests the inhabitants of Londinium were provided with a substantial influx of preserved fish from large-scale fisheries, some of which were likely located along the estuary; these appear to have been subsidised by the capture of local species with the hook and line method and smaller nets. The absence of traps or weirs from London may not be a result of archaeological bias, as species often targeted via these methods (namely migrating eel and salmonids) are not found in significant quantities.

10.2.5 The South-West Region

There are relatively numerous archaeological remains from the South-West region (fifty-seven artefacts and eight fish bone sites; Figure 154); however, this is a low number if we consider the ecological potential of this watershed. As with the South-East region, there are numerous river systems which funnel into the large basin of the Severn Estuary (Figure 155); the substantial coastline of this region supports numerous bays, brackish environments, and inshore flood-zones; meanwhile western and southern Wales supports a vast range of river systems with numerous successful fisheries established in later periods (Jenkins 1974, 31). The reasons for the absence of more direct evidence of fishing is thus a significant aspect to investigate, whether indicative of the cultural influence on local dietary habits, or, yet unidentified archaeological remains. The fact that there are only eight fish bone sites compared to the numerous tool remains draws attention to the reliability of these artefacts as indicators of halieutic practices. The most numerous tools consist of weights, which, due to the novelty of their assessment, are individually a limited resource for the interpretation of local fisheries.

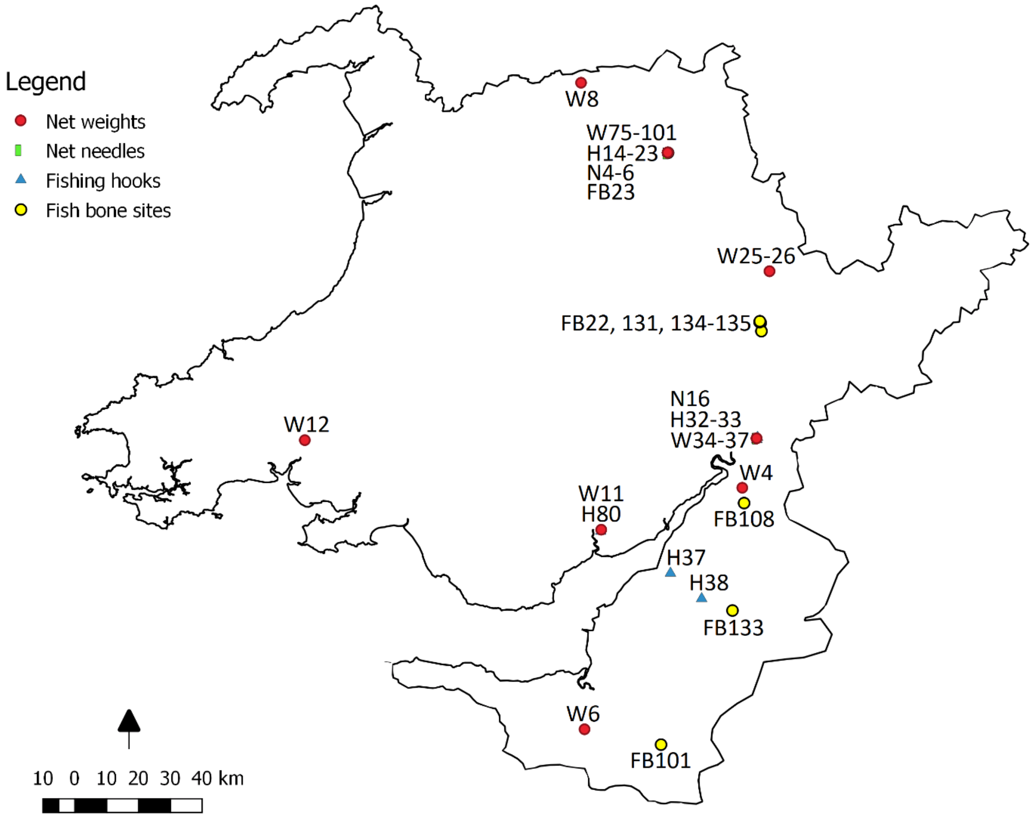


Figure 164: Distribution of archaeological evidence in the South-West region. Labelled by assigned artefact number for tools and site number for fish bone remains.

Of the individual artefacts, the weight from Camarthen (W12) is the most isolated, recovered from the fort and settlement on the River Towy. No volume of weight has been recorded, but the size suggests this would be the heaviest example of a clasped weight from Roman Britain. The absence of any comparative cases and the broad date range may relate to an alternative function, let alone period. At Durston, a rolled lead sheet of the overlapped type (W6), has a nail through it and is therefore considered here (by the previously identified criteria) a curse tablet. The remaining two individual examples (W4 and W8) are consistent in size with the small clasped types assigned to fine net fishing; the former from a 4th century deposit at Frocester and the latter from Oswestry in Shropshire. Two folded weights from Rushock (W25 and W26) are the heaviest examples from Britain and, as discussed in Chapter 6, are unlikely fishing implements; they are too heavy for the narrow cord that could be attached to their perforation, while their recovery 80 km inland by the narrow Hockley Brook, is inconsistent with the application of the large nets that would have required such a volume of weight, otherwise expected at a coastal site. Remaining isolated artefacts include two hooks from Sea Mills (H37) and Bristol (H38) but are too poorly recorded with which to make further suggestions.

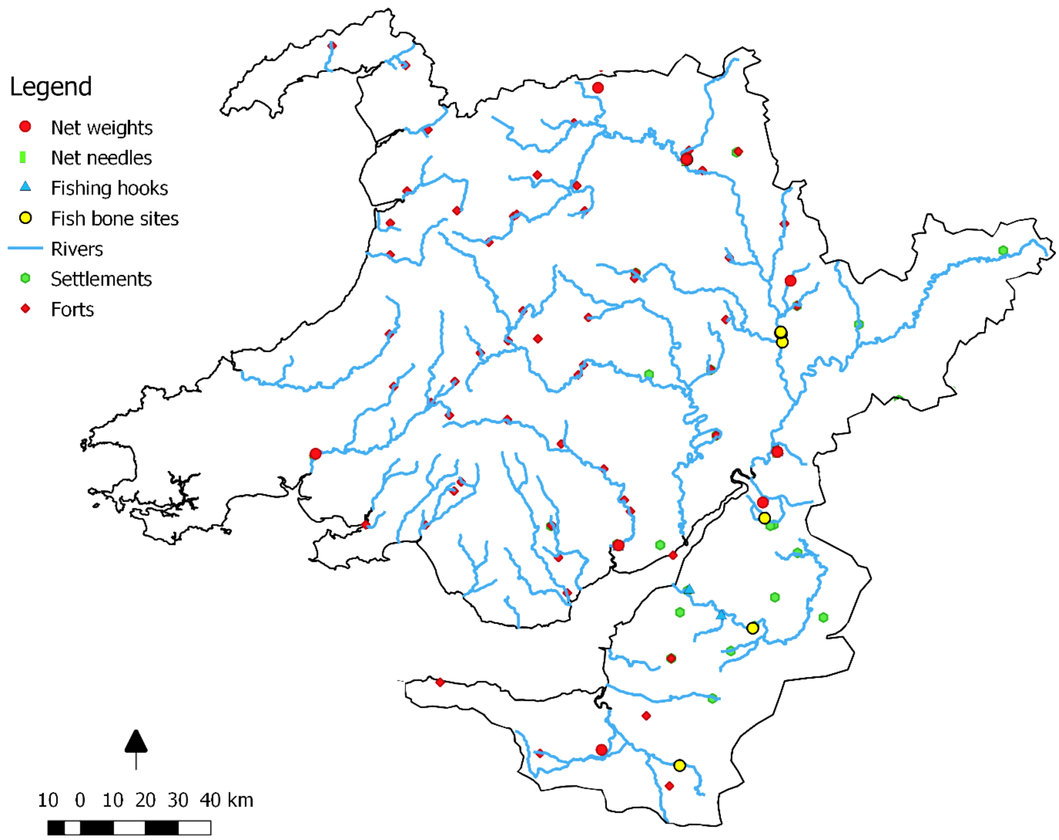


Figure 165: Distribution of halieutic remains, Roman settlements and fortifications, and river systems connected to known Roman sites in the South-West region.

Multiple artefact types for individual sites are restricted to Caerleon, Gloucester, and Wroxeter. At Caerleon, a single hook (H80) and weight (W11), have been recovered from separate contexts, though with dates relating to the military presence (late 3rd and late 2nd to late 3rd centuries respectively; see Brewer 1986; and Zienkiewicz 1986). The weight is large and with an internal diameter of 6 x 5 mm, which suggests an attachment to a thick cord, such as a lead line for a large net; however, the absence of fish bone remains prevents any further suggestion of net type. The hook is a standard small, barbed, and copper fishing hook, which is consistent with the subsistence fishing via single catches identified in the North region. Few fish bone remains are likely to be found if single catches with hook and line were the only method of fishing, which brings into question the fishery function of the large clasped weight.

At Gloucester, the absence of fish bone remains is juxtaposed by the recovery of weights, hooks, and a needle. Only two are from the same context (W35 and W36), which, though undated, derive from the military fortification. The hooks (H32 and H33) have unconfirmed contexts (Heighway), while the needle (N16) is also recorded as deriving from a military context and is the only dated artefact, with a 1st to 2nd century range (Rennie 1953). In line with Caerleon, Frocester, and the northern fortifications, there is evidence of a military-based subsistence fishery, reinforced by the absence of fish bone remains, regardless of the numerous archaeological interventions at Gloucester. The needle may represent the production of nets unrelated to fishing, but the weights are convincing as fishing implements. In the late 1st century Gloucester became one of only three veteran *coloniae* in Britain, maintaining a strong military presence and character (Mattingly 2007, 192). The occupation by Roman soldiers from the continent may explain the appearance of consistent Roman fishing equipment, albeit scarce, yet it is uncertain why there is not further evidence of fish consumption relating to imports, both local and further afield. The estuarine conditions would have supported large-scale fishing comparable to that identified at Chester and York, which were also military garrisons with substantial adjoining settlements (though not considered veteran *coloniae*: see Mattingly 2007, 192-3). It should be noted that much of the Roman excavations at Gloucester relate to the defences, preserved under Medieval extensions, and with few urban case studies. Future excavations within the Roman colony may yet reveal further evidence of fishing.

Wroxeter is located over 120 km inland on the River Severn and relatively isolated between the Cambrian Mountains to the west and the southern limit of the Pennines to the east. Wroxeter is the largest settlement between Gloucester and Chester, deriving from the initial military fortification, which was strategically located within this isolated valley, but evolving into a substantial civilian settlement with grand public structures funded by Hadrian (Salway 1988, 185). All other fortifications are at a distance and strategically distributed among the elevated terrain of the surrounding highlands. Regardless of the isolated nature of Wroxeter, it has produced the largest collection of fishing equipment from the South-West region. Forty artefacts, consisting of hooks, weights, and needles, constitute 70 % of identified fishing tools from the entire region.

Of the fishing hooks, only H14 has a more concrete date of 1st to 2nd century, which is consistent with one of the needles (N6) of the same date. The weights are divided in half, by those from a more recent excavation, dated to the 4th century (Barker et al. 1997) and an additional sixteen from earlier excavations and with no confirmed dates. Many of the artefacts were recovered in the first half of the 20th century (Bushe-Fox 1914; 1916; Atkinson 1942), reducing the likelihood of a more reliable stratigraphy or accompanying ecofact remains. The fish bone remains pertain to a later excavation at the Baths Basilica (Locker 1997) and have been divided into two assemblages, dating to the mid 3rd to late 4th (Site 23a) and late 4th to early 5th centuries (Site 23b). Though of similar date to some of the net weights, the latter may originate from a military context (Unpublished, museum records) and are too scarce with which to infer evidence of net-fishing. The recovery of two fragments of Atlantic mackerel draws attention to the import of some fish products that may relate to Iberian imports (e.g. Locker 2007), perhaps acquired from Chester, which has produced similar assemblages. Salmonid and European perch are present in both assemblages and the latter includes the Northern pike, a chub or dace (*Leuciscus sp.*), and a thinlip grey mullet, suggesting local freshwater catches, but highlighting the potential for single catches via hooks, rather than with nets. Only a few of the hooks have been published and none are currently available for further assessment (all subsequent data is courtesy of Cameron Moffett, English Heritage); nevertheless, both small and medium barbed examples confirm some level of subsistence fishing.

The netting needles (N4 to 6), if viewed individually, may relate to non-fishery products, either for fowling among the flood zones of the Severn Valley, or alternative net products; however, the lead weights are convincing as fishing implements. The twenty-seven examples (two, nine, and sixteen from separate contexts) are a large quantity by British standards and are consistent with the clasped type, most of which are small (bellow 30 mm in length). Although the use of the cast net this far inland is possible, these fishing methods are common in marine and brackish conditions, targeting schools of fish, rather than individuals; some freshwater species form small schools that could have been targeted with the cast net, such as the gudgeon (*Gobio gobio*), yet there is also the possibility of smaller river seine nets used for the capture of these and other species, as attested by Ausonius (Mos. 245-246). The recovery of nine and sixteen weights from individual deposits suggest the storage or discard of a net; if the former is the case, the cast net (as argued previously) would have produced a much more substantial number of weights. Alternatively, these weights may relate to a larger wall net (such as the seine), which would have required far less weights and smaller examples than the large weights used at coastal sites to counter the more buoyant and turbid saline waters.

10.2.6 The South Region

The South region has produced 111 artefacts and forty-two fish bone assemblages from thirty sites (Figure 166). Nine sites have provided a variety of archaeological evidence, at Dorchester, Hodhill, Portchester, Chichester, Fishbourne, Richborough, Dickson's Corner, Saltwood Tunnel, and Ickham. Hodhill, Portchester, and Richborough are military sites, while the evidence from Dorchester and Chichester derive from urban contexts. The site of Dickson's Corner in Kent may also relate to a nearby settlement (Parfitt 2000) perhaps by Richborough, which will require closer inspection as further discoveries are made. Though sparsely assessed and currently unpublished, at least twenty weights have been recorded at Dickson's Corner, dating to the mid 1st century (seven of which have unconfirmed dates) and revealed to be predominantly medium and large examples of the clasped variety (Parfitt 2000, 126; Parfitt Unpublished). As proposed in this thesis, these weights are too large for cast nets and are likely indicative of larger wall nets used from the shore. Some unrolled and partially opened examples may represent the recycling, removal or replacement of damaged weights, which highlights the possibility that the lead weights were brought to the site and are not representative of local fishing; however, fish bone remains have also been found in the area, and are stratigraphically correlated to the thirteen mid 1st century weights (Parfitt 2000), which, at first glance, supports the potential for a local fishery. To our disadvantage, the absence of sampling methods has relied on hand-collected bone fragments only, which have merely identified the large species of Atlantic cod (*Gadus morhua*). The early date of the finds suggests a fishery supporting the initial invasion of Britain, rather than related to larger and later settlements. At this time, the absence of the agrarian and livestock economy that would come to dominate the province (Green 1990) meant the invading forces were reliant on imported food, tributes, and available surrounding resources, of which fish were a viable alternative.

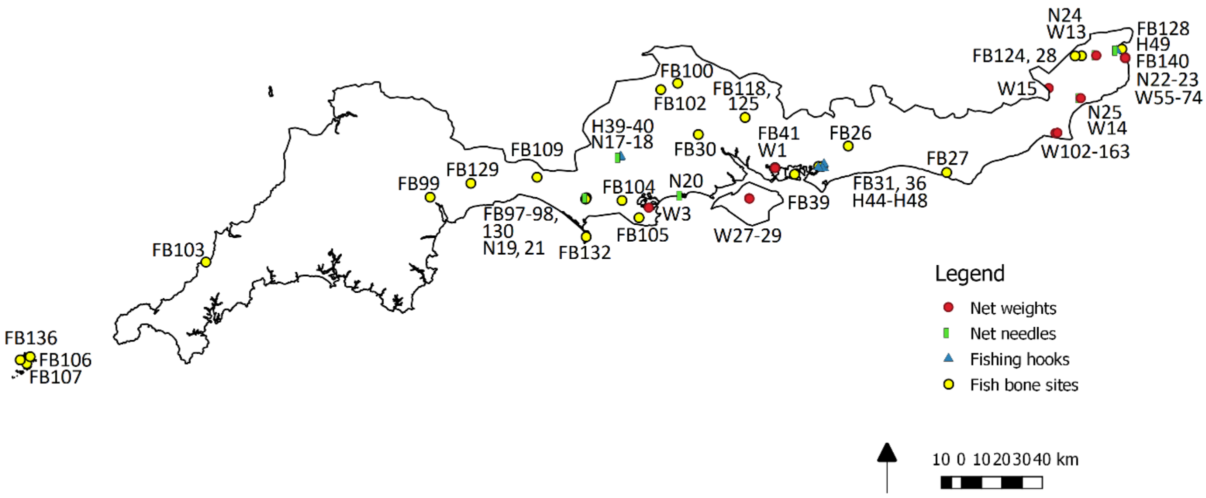


Figure 166: Distribution of archaeological evidence in the South region. Labelled by assigned artefact number for tools and site number for fish bone remains.

Further north on the cost of Kent, the military fort of Richborough has produced two netting needles (N22 and N23) and a fishing hook (H49). The earlier excavations by Bushe-Fox (1926; 1949) do not provide a stratigraphic chronology for N22 nor H49, while the hook is also unconfirmed as from the military fortification, though it is consistent with the morphology of other Roman hooks of medium size. The latter addition of N23 provides us with a narrow date range of AD 80 to 95 and is highly consistent in dimensions and form to N22. While the hook may corroborate the observations of individual catches via the hook and line method at Roman forts, the needles have been recovered within the fort and highlight a military production of nets, rather than deriving from the fort-side settlement. This draws our attention to the neighbouring site of Dickson's corner, with a similar date range, where weights (W55 to W74) have been recovered alongside hand-collected fish bone remains (Site 140), and a later site at South Thanet (Site 128). Site 128 has an uncertain mid-late Roman date, but has produced a diverse assemblage of marine species, including clupeids (Nicholson 2015), suggesting the use of a net. The continuity of Richborough as a military fort into the 5th century is archaeologically (Mattingly 2007, 242) and historically attested (see the *Notitia Dignitatum*), as is the presence of a neighbouring settlement. Excavation at this urban site has commenced in Spring of 2020 (Historic England), for which updated sampling strategies may reveal more about the significance of the local fishery and the methods of capture. At this time, the absence of fish bone remains or net weights from within the fortification does not negate the likelihood that the needles were used to produce nets with alternative purposes.

Two additional sites in Kent have produced a weight and needle each, at Ickham (N24 and W13) and Saltwood Tunnel (N25 and W14). The remains from Ickham have been stored with limited assessment (e.g. Mould and Riddler 2010), though reference is made to a further eight artefacts that may also be weights (Sutton 1998). Meanwhile, Saltwood Tunnel includes an assessed small clasped weight and substantially long netting needle (Riddler and Ager 2006). Both artefacts highlight a connection between needle and weight, which is convincing of the halieutic function of the latter, albeit conjecture with such limited evidence. Although data is unavailable for Ickham, it is of interest that this site is inland and by the freshwater environment of the Little Stour River, while Saltwood Tunnel is on the coast. The artefacts that pertain to fishing with nets are consistent throughout the country; on the one hand, this highlights the versatility of the equipment for targeting different species, further complicating the identification of specific fishing methods; on the other hand, there is a consistency in the equipment used during the Roman occupation that may further be reflected in a consistency of fishing practices.

If viewed as a whole, the numerous needles, weights, and fish bone remains recovered along the coast of east Kent strongly indicate local fisheries, as opposed to the import of fish caught further afield. The sites of Thanet, Dickson's Corner, Saltwood Tunnel, and Ickham, are supported by sixty-two weights recovered at Lydd Quarry (Priestley-Bell 2006; 2013), the second largest assemblage of rolled lead weights in the country; the site has produced two assemblages of thirty-seven and twenty five weights, dated to AD 70 to 150 and AD 40 to 160 respectively. Limited data has been provided by the lead archaeologist at this time, but weight averages of 20 g per artefact for both assemblages (Ibid.) are consistent with the small to medium clasped weights identified throughout Britain. Kent appears to have supported numerous fishing locations along the coastline but is currently reliant on sparse ichthyofaunal data from which to determine the targeted species or scale of fishing activities. The type of net weights suggests various shore-based activities using medium to large nets, while relatively consistent dates of mid-1st to 2nd centuries, highlight the possibility of multiple contemporary fisheries along the coast, drawing attention to a potential market. As planned excavations continue further evidence is expected.

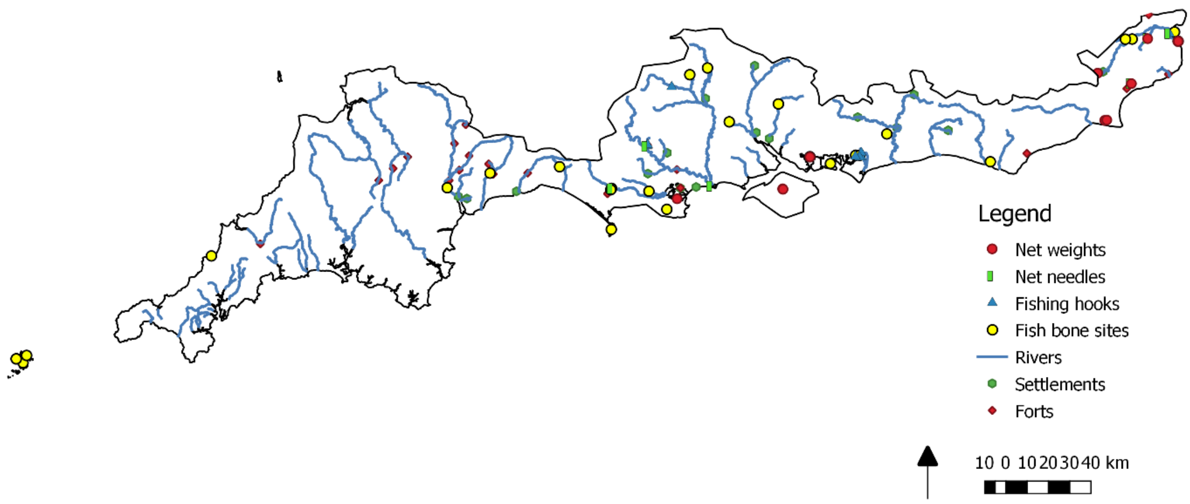


Figure 167: Distribution of halieutic remains, Roman settlements and fortifications, and river systems connected to known Roman sites in the South region.

The western extent of the South region, consisting primarily of Cornwall, bears some similarities to the rest of the South region, in terms of short river courses and an expansive coastal zone; however the evidence for fishing is represented by seven sparse fish bone assemblages that reflect subsistence fisheries at fortifications or small settlements. The central area of the South region seems comparatively rich, with four sites containing multiple archaeological remains relating to fishing, at Dorchester, Hodhill, Portchester, and Chichester; nevertheless, much of the evidence is sparse and precarious, not only due to the limited assessment the artefacts and ecofacts have received, but also the uncertainty of some artefacts as pertaining to fishing.

At Portchester, the Roman fort has produced one clasped lead weight (W1; Webster 1975), consistent with the length averages of that type, but with a larger perforation that suggests it was attached to a substantial cord or lead-line of a net. In addition, a medium sized J-shaped hook (H41; Webster 1975) convinces that members of the garrison were taking advantage of the local aquatic resources. Once again, a subsistence catch is all that can be suggested at this time. At Hodhill, the evidence is more precarious. The recovery of two well preserved needles (N17 and N18) highlight the production of nets at the fortification; however, the hooks (H39 and H40) are not convincing due to the poor record of H40 (Brailsford 1962), and the identification of H39 as a barbless double hook, which more closely resembles scale hooks (discussed in Chapter 5). The absence of fish bone remains, and the uncertainty of the hooks highlight the potential non-fishery function of the netting needles, which were likely used for the production of other net products.

Chichester includes four fishing hooks from various locations throughout the city (H43-45 and H48), dating to the 3rd to 4th, late 1st to late 2nd, 1st to early 5th, and 2nd centuries respectively (Down 1981; 1989). The hooks are all well preserved J-shaped types, small, of Cu. alloy, and with flattened terminals, demonstrating a continued morphology within the settlement and throughout the Roman occupation. The accompanying ichthyofaunal evidence, however, consists of a single diagnostic element of a sprat (*Sprattus sprattus*), which alone is insufficient to suggest human deposition, let alone fishing. In proximity to Chichester is the site of Fishbourne palace where an additional two fishing hooks of similar morphology have been recovered alongside fish bone remains, the latter of which has produced a larger assemblage. The diadromous species are accompanied by marine fish such as hake (*Merlangus merlangus*) and European seabass (*Dicentrarchus labrax*), which highlights the capture of fish in the Chichester Channel that could have been achieved with hook and line. The fish bone assemblage from the villa complex is dated to the 1st century (Ingrem 2004) and the hooks have recently been reassessed and their date changed from the initial suggestion of late 3rd century (Cunliffe 1971) to the late 1st (Allen 2011). The evidence suggests the inhabitants of the villa ensured their own supply of fresh fish, rather than purchasing from a local market; it has been argued that such evidence may relate to the leisure activity of the elite (Alcock 2006, 105), or a subsidiary food ensured by the estate's servants (Locker 1990, 104).

Lastly, Dorchester, located 11 km inland, has produced two fish bone sites and two artefacts. The tools are both netting needles (N19 and N21) and dated to the mid-1st and late 1st to 2nd centuries, respectively. N19 has been described as a potential mollusc pick (Trevarthen 2008, 20), perhaps due to the narrow width of the eyes, but is consistent with other netting needles; as previously discussed, the narrow width may indicate the intentional production of a narrow mesh diameter. The second needle, N21, though truncated reveals characteristics that are also consistent (Smith 1993, 31). The absence of weights accompanying the needles should not infer a non-fishery function, as the location of production rarely coincides with the location of use; indeed, the two fish bone assemblages from Dorchester consist of numerous marine species, suggesting the fisheries which provided the city were located on the coast or the more distant estuarine conditions of the Wareham Channel. The most significant assemblage has been recovered at Dorchester Hospital (Site 130), where fish processing appears to have taken place (Hamilton-Dyer 2008). The site consists of three assemblages, yet to be assessed, though subsamples have revealed clupeids in large quantities at 130a and 130b, dating to the 2nd and 4th centuries respectively (Ibid.). The capture of numerous clupeids would have required net fishing and would have been a shore-based activity. If the needles are considered an extension of this practice, one might assume a fishery linked to the city, rather than an independent processing site, as identified at Stanford Wharf; nevertheless, it is unlikely that further evidence of large-scale fishing may be present at the intended market of the product, beyond the recovery of fish bone remains. The apparent continuity of fish processing at Dorchester over a period of two centuries may be followed by a permanent fishery based on the coast, where archaeological investigation must continue. Evidence of the use of large nets, as appears to have been discovered at Lydd Quarry in Kent, is necessary to suggest that the assemblage form Dorchester is indeed a result of a local fishery and not an imported product; inversely, Kent is yet to produce a fish bone assemblage that correlates to the numerous weights recovered on the coast. Although the current evidence greatly restricts the identification of large-scale fishing methods, there are clear signs of large shore-based fishing activities that supplemented the requirements of large urban centres and which will benefit from further investigations.

10.3 Military Sites

The story of Roman Britain is a military one; the two invasions in the 1st century BC and 1st century AD were followed by a territorial expansion on the island lasting until the mid 2nd century, followed by a strongly defended frontier zone in the northern reaches and western coastline, finalising with a re-militarisation of internal settlements and the southern and eastern coastline in the 3rd to 5th centuries (Mattingly 2007, 132). Military fortifications were dotted around Britain (see Figure 153a), some developing into urban settlements, but many remaining fortified garrisons with defensive and administrative purposes (Ibid. 128). This long-lasting martial presence would have had some notable interaction with the available aquatic resources, which the archaeological evidence has demonstrated was the case. The question now is how these two entities interacted. Was fishing common practice among soldiers? Did the invading force bring such practices over from the continent? Was it considered a subsidiary food supply for certain garrisons? Is there any evidence of an economic value to the military-based fisheries?

Although the distribution and supply of meat among Roman military sites has been identified as influenced by native practices (Thomas 2008, 45), fish has been identified as a rare resource in Iron-Age Britain (Dobney and Ervynck 2006). Instead, the tool remains suggest the capture of fish was conducted by military personnel, such as at South Shields, Hodhill, and Richborough, from which we may infer that these objects and methods were brought in by the invading forces. Thereafter, fishing at military installations continued throughout the entire Roman occupation, although representing individual catches and, at the most, the use of small nets at a minority of the identified sites (e.g. Portchester). No large fish bone assemblages have been found at fortifications, nor artefacts relating to larger fisheries. This contrasts with evidence from the Netherlands, where more substantial practices appear to have been used at Roman forts to supply the garrison with food (Dütting 2016, 398).

Whether there are any regional patterns in the distribution of military fishing practices is a more complex question, influenced by both a data-bias of less frequent excavations in such rural locations, and by the higher density of military sites in the boundary zones of northern and western Britain. There is a visible absence of evidence from Cornwall, Cumbria, the Pennines, and Wales. These regions are dominated by a military presence, which, although with known freshwater environments and the potential for successful fisheries, are less traversable elevated terrains, warranting the establishment of defensive positions but perhaps inadequate for civilian settlements. A relative absence of modern settlements in these regions supports the observation of a low population density influencing fishing practices, although, this isolation may also have impacted the potential for further archaeological discoveries, where fewer modern construction projects have resulted in fewer archaeological interventions. One would expect more data to emerge from the various military-based settlements in Wales, due to the numerous aquatic resources and the more limited interaction with inland markets and, thus, influx of alternative food resources. In the case of Wales, the tendency to under-research post-prehistoric archaeology (Brown 2013, 250), may indicate an academic bias rather than an accurate representation of the archaeological remains. All such isolated rural locations need further archaeological research, especially in the recovery of environmental samples.

A focus on the distribution of military sites with halieutic remains reveals a collection of well-known and researched archaeological sites, either within highly urbanised modern cities, or due to particular and well-established archaeological interest: Carlisle, Corbridge, Vindolanda, Birdoswald, Newcastle and surrounding fortifications, Lancaster, Ribchester, Chester, Wroxeter, Gloucester, Bristol, Portsmouth, and Caister-on-Sea; the latter three of which are in the southeast but are Saxon Shore forts. Chronology plays a significant role, both where military fortifications were later closely related to adjoining civilian settlements, or where fortifications were absorbed into an established colony or later settlement; regretfully, many artefacts and ecofacts lack an accurate chronology. This civilian connection has been identified at some of the mentioned military sites (e.g. Vindolanda, Carlisle, Chester, Gloucester, and Wroxeter). It is also important to note the previously mentioned regions where there is an absence of halieutic evidence and (perhaps related) an absence of civilian settlements, which draws attention to the potential role of local populations in providing garrisons with fish. Alternative research of archaeobotanical remains have highlighted this disparity, differentiating internal from external samples at military fortifications (Van der Veen et al. 2013, 25), the latter as a potential deposition by civilian rural activities. The stark contrast of available data for halieutic remains prevents such an assessment at this stage (with few exceptions), but it is important to recognise that the current evidence for fishing at military sites may relate to closely tied civilian influences. On the one hand, the recorded banning of fishing and hunting among the legions (Digest of Justinian, 49.16.12) may be contradicted in Britain by Vindolanda tablet 593 (2nd century AD), which reveals a request for both fishing and fowling nets. On the other hand, Vindolanda had a well-established adjoining civilian settlement and the tablet itself may be a request to a veteran, rather than a legionary (Bowman et al. 2008). This would defend the role of fishing as a supplementary resource, marketed to, but not controlled by, soldiers.

Artefacts have been found at sites with potential civilian contexts adjoining the military fortifications, such as at Carlisle (Howard-Davis 2009, 751), Ribchester (Howard-Davis and Witworth 2000), Binchester (Unpublished, accessed by EAA Heritage), Chester (museum collection), Wroxeter (Bushe-Fox 1916; Unpublished, accessed by English Heritage), St Albans (Frere 1984), and Gloucester (Heighway 1983, 186). In direct contrast, tools have been found within fortifications at South Shields (museum collection), Vindolanda (Birley, Forthcoming), Chester (Newstead 1928), Caister-on-Sea (Mould 1993), Peterborough (Frere and Joseph 1974, 29-30), Hod Hill (Brailsford 1962), Portchester (Webster 1975), Binchester (Unpublished, courtesy of Northern Archaeological Associates), Wroxeter (Atkinson 1942), and Gloucester (Museum collection). The examples from Binchester, Chester, Wroxeter, and Gloucester reveal evidence of fishing equipment both outside and within military fortifications, which highlights a potential connection between the two. Those few artefacts that have been dated reveal that this was not a temporary aspect, but one that existed throughout the occupation, from the 1st century (e.g. Wroxeter: Atkinson 1942) to the 4th century AD (e.g. Caister-on-sea: Mould 1993).

None of the fort-side *vici* or *canabae* have revealed evidence of large-scale fishing. Although the record is clearly impacted by the archaeological bias of early excavations (of which large military fortifications were prime targets), the small scale of these settlements and the general geographical isolation convince of the absence of a market for large numbers of fish. The dominance of hooks identified for the North and North-West regions is therefore consistent with the capture of individual fish for a small population or with no marketable value (self-provision); meanwhile, potential fishing nets, identified by few netting needles and net weights, highlight small-scale catches with restricted marketable value. The absence of traps is noteworthy, as this has been highlighted in the Netherlands as a method for extending beyond single-catch fisheries to a subsistence food supply for Roman fortifications (Dütting 2016, 396). Although impacted by the poor level of preservation of organic materials, these methods of capture would also be indicated by the dominance of migratory species such as eels and salmonids (Locker 1985), of which there is insufficient ichthyofaunal evidence at this time with which to substantiate or refute this theory.

Fishing appears to have been a familiar practice for several of the men serving in the Roman army. The provenance of the legions serving in Britain from Germania, Gaul, and Iberia (see Bédoyére 2003; Mattingly 2007; Dando Collins 2012; Russell and Laycock 2019), alongside the ethnic diversity of the Roman invaders (see Eckardt 2010; Leach et al. 2009; Laycock 2019), prevents us from confirming where in Europe certain fishing practices derived from. The general scarcity of fishing in Britain may be indicative of a wider cultural diversity via which only a few practices were introduced or adopted; alternatively, the potential introduction of various small-scale fishing methods may have removed the market-gap for large-scale fisheries and subsequent productive fishing methods. Nevertheless, those artefacts recovered reveal a consistency with tools identified throughout the Mediterranean (e.g. Bekker-Nielsen 2005; Vargas Girón 2020), while the absence of similar or different items during the Iron Age, strongly supports the argument that various methods of small scale fishing were introduced to the province by the Romans, for which the military is a strong candidate.

Fishing by forts appears to have been conducted primarily with a hook and line, suggesting there was limited species bias and no discernible economic value. These methods may have been used by soldiers off-duty as a leisure activity, or to supplement the diets of individual military units. The former is supported by the additional recovery of imported processed fish (Locker 2007), highlighting the gastronomic value of aquatic products to some individuals, potentially those senior officers with greater ties to familiar Roman diets and with greater economic resources to ensure their purchase. Meanwhile, the latter is supported by the consistency of this evidence at various forts throughout Britain and dating to the entire occupation, including sites where imported goods are absent; this may highlight a shared practice for acquiring an additional food source when alternative imports were scarce during certain seasons of the year.

10.4 Civilian Sites

Large-scale fisheries required both a sustainable aquatic resource and a successful market. Investment would have been necessary for the purchase of equipment and maintenance of a labour-force dedicated to catching and preserving the highly perishable product (Marzano 2013, 49). Large-scale fisheries were therefore both directly and indirectly tied to either local markets or reliable trade-links to markets further afield. The latter is attested for the various processing sites in the Mediterranean, with trade links spanning the Roman empire (e.g. Trakadas 2005, 52) and an output beyond the requirements of local consumers. Britain, however, has revealed no evidence of an exported fish product; this is unsurprising if one acknowledges the contemporary appearance of numerous local variants of salted fish goods in the 2nd to 3rd centuries, in northwest Spain (e.g. Suarez Piñeiro 2003), western Gaul (Bromwhich 2014), and potentially northern Gaul (Van Neer et al. 2005). These local products appear to have been produced during a decline in southern Iberian and Mauritanian production (Trakadas 2005, 54, 65-66) and would have saturated the regional markets for traded fish commodities. Thus, large-scale fisheries in Britain appear to have been depended on local markets only. One question that must be addressed is whether the current evidence is empirically representative of local population density. In addition, it is important to elucidate on the smaller fishing practices that are evidenced by both artefacts and ecofacts at civilian settlements. What small-scale fishing methods were present? And is there a discernible distinction between subsistence fishing and small-scale fisheries?

The civilian settlements of Great Britain, located primarily in the south and east, were the catalyst for large-scale fishing. Large-scale events up to this time were primarily shore-based activities targeting the influx of migrating pelagic species (Morales 2010, 26, 35), namely clupeids such as herring, which would require some form of preservation due to their rapid putrefaction (Nicholson 2011, 12). Preservation, as previously discussed, could have taken the form of smoking, drying, dry-salting, pickling, or via the production of a sauce or paste. There is no direct evidence of the production of a fish sauce, such as processing vats or various pottery containers; nevertheless, the clupeid species targeted by large-scale fisheries at Dorchester, London, Stanford Wharf, Lincoln, and potentially York, indicate some form of preserve. The salt-encrusted bones recovered at Stanford Wharf (Site 123) confirm salting or dry-salting (such as a *salsamenta*), which is likely the case for all five sites. These products would have required large fishing events taking advantage of shoaling fish in proximity to the coast. All the mentioned sites are in relative proximity to major brackish environments, namely estuaries, where clupeids could have been found in large numbers and would not have required the use of sea-faring boats (Burnley 2006, 64), but at most, a small vessel working from land (Morales 2010, 39). The use of a seine or surround net is strongly supported by archaeological and ethnographic evidence, identified in the consistency of clupeid remains at all five sites, the by-catch of small marine species (previously discussed), the various assemblages of lead weights also in the South, South-East and North-East regions, and the continued use of this method into the 20th century (Burnley 2006, 64).

Weights appear to be the only tool remains that may indicate large-scale events, for which it is important to highlight that none have been recovered from the potential processing sites. Only Heybridge (Sites 35 and 119) has produced both a large number of weights and accompanying fish bone remains that are consistent with the local estuarine species; nevertheless, the fish bone assemblages are too few to indicate a large-scale event or processing of any kind. Alternatively, the processing sites (excluding Stanford Wharf) are probably examples of a re-distributed product, caught and salted at the shore-based fishery sites, but further processed and sold inland at the large urban settlements where they have been recovered; this method of re-distribution and potentially further processing has been identified with fish sauce at Pompeii (see Bernal et al. 2011a, 132-133). Such a system might be indicative of a larger fishery supplying various markets within a settlement or multiple settlements, currently only partially indicated by the potential sites at Lincoln and York in connection to a Humber estuary fishery. The absence of pottery used for the trade of this commodity may indicate organic materials used in the transfer from fishery to market only, such as baskets or wooden barrels. The disconnection between fishery and market, makes it extremely difficult to locate sites where both capture and processing could have taken place. Stanford Wharf is indeed a likely case study, but no lead weight assemblages were recovered at the excavation. It is strongly advocated that the large collection of weights from Heybridge are indicative of a local processing facility comparable to Stanford Wharf, yet to be discovered. The same is advised for the Humber estuary, which remains a prime candidate for a large-scale fishery supplying the settlements of York and Lincoln.

Most of the evidence is indicative of smaller fishing events. Small-scale fisheries are not a result of limited archaeological data, but of the types of tools and species identified. Hooks from Britain constitute the least effective method of capture as they are limited to a single catch per use. Large hooks can theoretically provide a larger volume of fish, as can multiple-hook lines, yet, the majority of the artefacts recovered are small and medium sized. There is currently no evidence for the use of multiple-hook lines in Britain, where it became a more common practice with the inclusion of off-shore fishing vessels in the Medieval period; a potential cause for this delay may be the very gradual slope of most shallow British beaches restricting long-line or multiple-hook lines from shore (Burnley 2006, 38). The absence of such fisheries may account for the scarcity of marine species often caught via hook and line on rocky or deep coastlines, such as sea breams and wrasse (Wheeler 1978). Without vessels, hooks would have enabled the capture of a range of species from various inshore and inland environments, which appears to be the case for Roman Britain, as evidenced by the ichthyofaunal remains. Hooks were used at all settlement types, from villa complexes to large cities. The ichthyofaunal remains highlight the sparse yet consistent recovery of cyprinids, salmonids, pike, eel (found in both large and small numbers), and indeed wrasse and sea bream (restricted to a few coastal sites, notably in the South region); all are too few to indicate the use of a net in their capture.

On the one hand, the isolated nature of these tools and fish bone assemblages, is indicative of single catches, either for leisure or diet, but with little evidence for a marketable resource; on the other hand, viewed as a whole, hooks highlight a subsidiary resource at an individual level, providing households with a small but consistent food supply. London is an important case study in identifying this trend, due to both the recovery of fish bone assemblages that reveal a diversity of fish likely captured via hook and line (as at Sites 59 and 85), alongside numerous examples of fishing hooks that highlight the popularity of this activity in the city. If a significant number of the population fished locally, there would be a reduced market for alternative fresh fish from larger fisheries. Evidence of single-catches or small-scale fishing may therefore, when viewed as a whole, indicate a significant trend in the capture and consumption of aquatic resources.

Of the fish bone assemblages, the site of Fish/Monument Street stands out as a potential "restaurant" (Burch and Rowsome 1992), or at least the remains of the large consumption of fish; the assemblage recovered from a refuse deposit in a re-used well, reveals a collection of large, medium, and small examples of salmonids, seabass, various cyprinids and flatfish. The diversity of species indicate a mixed provenance of freshwater, brackish-water, and marine environments, while the absence of small clupeids or other migratory and shoaling species, suggests that large nets were unlikely the method of capture (although smaller cast nets and as yet unidentified traps may have been used alongside hooks). Among the recovered hooks from London, H50, 62, 69, and 70 reveal a consistent morphology that is indicative of a local production of this hook type. As discussed in the proposed typology, there is the potential for a purpose made barb type (the related type 7: beaked, and type 5: notched). The facility with which the alternative type 3 (sharpened barb) could have been produced, highlights the intended manufacture of a more complex element that was either an aesthetic or functional inclusion. The former would support a market for fishing equipment by a local population keen to attempt the historically revered leisure activity from the Mediterranean (as discussed in Chapter 4); while the latter would indicate a professional construct aimed at acquiring particular species common in the tidal waters of the Thames at London. There are indeed numerous other hooks of both copper and iron with sharpened barbs and no peculiar characteristic, and these may indicate a more generic exploitation of local aquatic resources for private consumption.

Villa sites have provided ichthyofaunal remains that, though scarce, indicate the import of marine and brackish water fish, alongside scarcer freshwater species. The only villa site to provide both ichthyofaunal remains and fishing hooks is Fishbourne Palace (Site 36 and H46 and 47), where local brackish water conditions make it difficult to determine whether the identified species of seabass, eel, and gadids were imports or local catches. The additional herring remains support the potential for a fish preserve from further afield; nevertheless, the recovery of two hooks support the idea of fishing, either by the occupants of the villa or their staff. Fishbourne is uncharacteristically close to the coastline, while other villa sites with halieutic remains are inland; seabass are therefore the likely targets of fishing with hook and line along the coast. The remaining inland villas with ichthyofaunal remains suggest the capture of local freshwater species and migratory fish such as salmonids and eels. Although hooks recovered at other villa sites have no direct correlation to fish bone assemblages, they are likely indicative of local catches. As discussed above, the barb types include rare examples of needle (B1) and pinched (B2) varieties that appear to be amateur productions or alterations to previous hooks. Such a method of hook production highlights an isolated practice, rather than the standardised examples of sharpened barbs (B3) recovered at military fortifications and settlements. Thus, at villa sites, fishing appears to have been an irregular practice with cultural, rather than dietary, incentives; whether attempted by the elite as a leisure activity, or conducted by the household staff to provide the owners with a more varied aquatic diet, it appears to represent a local imitation of Roman practices (halieutic and/or gastronomic), as has been suggested to be the case with mosaic reproductions (Alcock 2001, 52).

It has been stated that the distinction between subsidiary and commercial fishing may not be traceable in the archaeological record (Bekker-Nielsen 2005, 137), but if a middle ground is to be identified, nets are the most likely candidates for a medium-sized fishery. Several net types can produce both small and large catches, as environmental and logistical variables are an important factor to consider. The cast net, for example, has been shown to provide 15 to 20 kg of fish per cast (Bekker-Nielsen 2005), if used on large and compacted shoals of fish; multiple uses, or a series of net casters dedicated to a single fishery, could therefore be classified as a large-scale enterprise as they would be able to capture a large volume of fish. Alternatively, more recent cast nets range in size, from a 2 to 7 m radius, which appears to impact profitability (Brandt 1984, 348-349). It should be noted that the pictorial sources allude small cast nets being used, if mosaics are to be considered reliable sources (see Chapter 4). Meanwhile the literary sources allude to both nets and hooks being used by the same fisherperson, depending on the visibly present fish (e.g. Lucian Pisc. 51; Ausonius Mos. 243-249).

These small nets could have been cast nets or small seine nets, of which it is difficult to distinguish. As has been discussed in Chapter 6, the type and volume of lead weight appears to correlate to the method of capture. Clasped weights have potential size ranges with consistent averages around 20 g; meanwhile, the internal diameter has been shown to be of significance, with a distinction between 1 to 5 mm suggesting attachment to a variety of cord thicknesses. It is possible that the cast net would have resulted in more compact weights as they were attached to the mesh directly, while other surround nets, such as the seine, used a lead-line that was thicker and necessary for manoeuvrability (Jenkins 1974). Further research is required, but preliminary observations highlight the abundant distribution of these weights.

First, brackish water environments have produced the most numerous lead weights of all three sizes; 42 % of small, 52 % of medium, and 76 % of large weights derive from a small number of estuarine sites. This is notably consistent with the largest fish bone assemblages, those relating to fish preservation via salting and suggests a diverse fishery exploiting the resources. If the recently recovered but poorly recorded weights from coastal sites at Lydd Quarry and Dickson's Corner are included, 40 % of small weights derive from coastal environments, representing 76 9+% of all coastal weights. This dominance of small weights suggests small nets were the dominant method of capture supporting the fish consumed at larger settlements. Large weights are sparse all-round, but it is possible that medium weights, those below 40 g, were sufficient for larger nets, such as full-length seines, gill, bag, and other surrounding nets.

Lead weights are therefore indicative of small and medium-scale fishing events. The current absence of any recorded stone and ceramic weights for the Roman period prevent us from suggesting no larger net structures were used in Britain, but it does suggest that lead was not the ideal material for such methods. At the same time, the recovery of a large number of small weights at coastal sites, as well as inland and by brackish waters, is indicative of small nets being used for the capture of the range of species identified in the archaeological record.

11. Conclusion

The thesis set out to illuminate the fishing methods used in Roman-Britain and the cultural and geographical discrepancies of the tool and fish bone remains that compose the archaeological evidence. To do so, a country-wide survey of published and unpublished artefacts and ecofacts has been essential to accrue sufficient data with which to attempt the comprehensive assessments advocated in Mediterranean research. The novelty of this approach within Britain, alongside the stark absence of a consistent method of valuation of the halieutic remains, has required the creation of catalogues and assessment criteria with which to acquire quantifiable data of interpretative value. The thesis has therefore contributed a preliminary classification of the most numerous fishing tools, intended, and encouraged to be superseded by further research in this field. With this evidence observations of species distributions have been paralleled to tool remains influencing the subsequent observations of fishing in Roman Britain.

11.1 The Fishing Methods

This study has demonstrated that there is a diverse body of evidence of fishing practices from Roman Britain. The most numerous halieutic remains consist of fishing hooks, lead net weights, netting needles, and fish bone remains, which have been the focus of this research. Miscellaneous artefacts and installations are also present but in far fewer numbers; this evidence is sparse and poorly recorded, with no confirmed contexts and chronologies for the gaff, trident, and gorges; meanwhile the potential fishponds have not been sampled for environmental remains, resulting in an absence of ichthyofaunal data with which to advance hypotheses of their function. The miscellaneous artefacts are consistent with recorded Mediterranean tools and installations and are therefore considered important inclusions in the thesis, to highlight the range of the potential Roman fishing practices that may be augmented by further discoveries; nevertheless, their influence on the subsequent interpretations have been minimal.

Currently, the evidence suggests that angling/hand-lining and net fishing were the predominant techniques employed in Britain. The recovered hooks reveal a ubiquitous artefact associated with discrepant settlement types and used throughout the Roman occupation. They are often found individually and in riverine environments, indicative of angling for local resources by individuals and with no discernible commercial application. The proposed typology has revealed some morphological consistencies in size, barb type, and terminal, that indicate a potential tradition in hook production. This is particularly observed in four consistent examples recovered from different sites within London; however, there are numerous morphological discrepancies that are indicative of unskilled or distinctly handcrafted versions, with no evidence for mass-produced hooks used for long-line fishing. This coincides with the broad geographical isolation of these artefacts, supporting a subsistence fishing practice used by soldiers, citizens, and for villa households alike.

The assessment of the lead weights, particularly the altered lead sheets into cylindrical objects, has revealed several morphological discrepancies that have been divided into subtypes in the proposed typology to determine their halieutic function. The folded, partially unrolled, and opened types are comparatively sparse, for which it has been suggested that they are the result of damage or alterations to either fishing weights or objects of uncertain function. Meanwhile, the classification criteria have highlighted numerous parallels between the overlapped subtype and recorded Roman curses (*defixiones*), from which it is proposed that these objects be excluded from halieutic interpretations. The clasped subtype has been shown to be the primary cylindrical weight. Numerous examples are found isolated, or in groups of under ten artefacts, which has made it difficult to confirm consistent size ranges, let alone suggest the type of nets to which they relate. Larger assemblages have shown a consistency of weights at under 30 g, which supports the hypothesis of an intended control of weight by the craftsperson. This is further supported by the consistency of weight in relation to numerous variations of length, width, and sheet thicknesses; however, how this weight relates to the type of net is yet unknown. The assemblages that may be indicative of large-scale events are those that have produced large quantities of weights in proximity to coastal and estuarine shores, all in the South-East of the country (Dickson's Corner, Lydd Quarry, and Heybridge). It has also been shown that inland examples tend to be smaller and lighter (<20g), which may indicate the use of smaller or finer nets in freshwater environments. Weights are indeed poorly researched, with numerous recovered examples lacking a date with which to include them in this assessment.

Accompanying the tools is evidence of the subsequent marketable product, the fish bone remains. Following previous methods of ichthyofaunal studies (Wheeler and Jones 1989), the various fish bone assemblages have been collated, extracting available data with which to compare the artefacts; however, Romano-British ichthyofaunal studies have received a mixed and limited analysis with which to ensure a comprehensive assessment. The size-estimation of individuals has not been possible at this time, an aspect that has proven useful for elaborating the provenance of species in other studies (e.g. Harland 2017). Even reliable chronologies are not available for numerous sites where multiple assemblages are a possibility, or where artefactual relationships remain unconfirmed. The assessment of fish bone remains has had to rely on the distribution of species and the current figures of NISP. The most numerous assemblages derive from inland sites where salmonids and the European eel are the most frequent fish; however, these species are represented by small assemblages, defending the presence of subsistence catches indicated by the tool remains. Only the large inland settlements of York and Lincoln have identified potential small-scale freshwater fisheries with commercial intent, represented by large numbers of cyprinids, though with unconfirmed methods of capture. Cyprinids appear to be the primary freshwater produce with commercial value, perhaps due to the shoaling behaviour of several species. To that end, cyprinids have also been found at large settlements closer to estuarine environments including London. Large towns between freshwater and marine resources appear to have successfully exploited a range of species. London, Dorchester, and Chester allude to the exploitation of freshwater, brackish water and marine species with commercial intent. The most numerous marine species in terms of both number of occurrences and NISP include flatfish and clupeids. The latter, including herring, sprat, and shads, are the only indicators of large-scale fishing events from Roman Britain due to their discovery in large numbers at the potential processing sites of London, Dorchester, Lincoln, York, and Stanford Wharf.

11.2 The Economic Potential of British Fisheries

The current evidence for both ichthyofaunal and artefactual distributions demonstrate a cultural choice among Romano-Britons to pursue or avoid fishing, regardless of the environment. As previously discussed, Britain offers numerous aquatic resources and with a consistent distribution throughout the island; estuaries, rivers, and coastal zones are accessible in all six major watersheds outlined here. Theoretically, the large-scale fisheries identified in the South, South-East, and North-East regions could have been replicated throughout the island, as could have the significant freshwater fisheries identified at Leicester and York. The notable scarcity of evidence from the Severn estuary, the riverine systems of the Pennines and Cambrian Hills, or the coastal zones of the North and North-West region, may therefore reflect a conscious avoidance of aquatic resources. The reasons for this are likely economic, with an insufficient market in Roman colonies, small towns, and military settlements, and due to the competitive markets of local livestock and meat production. Large-scale fisheries were therefore restricted to areas where a higher population density in proximity to estuarine conditions provided better prospects for marketable fish products: the Humber in the North-East region, the Thames in the South-East region, and Waymouth Bay or the Wareham Channel in the South region.

The distribution of sites relating to fishing practices primarily follows the distribution of settlements, the Roman towns, cities, colonies, and capitals that have been shown to dominate the eastern and southern areas of Britain (Figure 143). Beside the civilian centres, Britain was characteristically a military Roman province; it housed various legions throughout the entirety of the Roman occupation, mounting various offensives into the modern Scottish Highlands, while maintaining a defensive frontier in the northern and western extent of modern-day England and Wales. There is a notable presence of fishing events at a few military sites, not only in these frontier zones, but also among the refortified southern and eastern coasts towards the end of the Roman occupation, which highlights, at the very least, an acknowledgement of the aquatic resource available to soldier and civilian alike.

Britain is indeed an aquatic domain and one of only a few Roman provinces with access to fish resources within every and any political subdivision of the territory. The absence of deserts or uninhabitable mountain regions is juxtaposed by innumerable freshwater systems, a multitude of brackish water zones, and a vast coastline. At first glance, the relative scarcity of halieutic remains regardless of the available aquatic resources may be interpreted as an avoidance of fish; however, the ubiquity of aquatic resources can have a negative impact on the scale of fisheries. The success of subsistence fisheries is evidenced by numerous hooks and small fish bone assemblages recovered throughout the country, whereby any attempt to market a local fish product might not find sufficient demand. It appears that only large urban centres would have found a market for processed fish, and indeed, it is from these towns that evidence for fish processing derives.

There is some evidence for the consumption of more exotic species (those requiring specialised and isolated methods of capture or the result of rare bycatches), restricted to the remains collected from villa and other rural sites (e.g. the angler, *Lophius piscatorius*, from Site 103 in Cornwall; the guilthead bream, *Sparus aurata*, from Site 30d in Wiltshire; and whiting, *Merlangus merlangus*, from Site 36 in Sussex), or from urban settlements (e.g. the sturgeon remains from Sites 85 and 95 in London). Alongside pictorial representations that allude to the adoption of Roman eccentricities (as seen in Chapter 4), one may suggest that ichthyofaunal practices, as described in several literary sources (e.g. Pliny the Younger, Ep. 2.8; Martial Ep. 10.30), was one method by which British elites could adhere to the imperial trends of the capital; the recovery of fishing hooks from several villa sites has been interpreted as such (e.g. Alcock 2001, 52; Allen 2011, 329). It should be noted that these examples are the minority. The bulk of the evidence supports the ubiquitous capture and consumption of fish in low numbers throughout the Roman occupation, with larger markets supported by a few large settlements only.

The popularity and wealth of fish and fishing in the Mediterranean erupted from a diverse range of aquatic ecosystems and the equally diverse cultures and civilisations that exploited them. The Romans were, if nothing else, highly adept at marketing a desirable produce to the peak of its potential. The best garum from Iberia (Strabo Geo 3.2.7), or the largest mullets from the Red Sea (Pliny HN.9.31.68), are examples of culturally nurtured markets with an extensive clientele; even Britain had found a gap in the market for the export of Oysters, surpassing in quality those of the prestigious Oratian foundation, or so we are told (Pliny HN. 9.79). British fish, however, did not find equal support, both as an export and local commodity. The Iberian fish products maintained their dominance into the 3rd century, even within Britain, as is attested by amphorae remains (e.g. White 2000, 38; Locker 2007, 142). The reduction of Iberian exports in the 2nd to 3rd centuries (Campos and De la O 2004, 55), coincide with the production of local variants of salted fish in Britain. A production site at Stanford Wharf (Site 123), alongside potential processing or distribution facilities further inland at London (Site 65), Lincoln (Site 19), Dorchester (Site 98), and York (Site 113), coincide with the wane in fish imports and demonstrate the regionality of demand within Britain, being restricted to the more heavily populated areas of southern and eastern England. To date, the suggestion of these products finding a market further inland is supported by scarce ichthyofaunal remains. The absence of confirmed containers for transport, alongside the sparsity of literary sources, forces us to rely on the archaeological remains and await further discoveries. That said, the continuity of large-scale fishing for at least two centuries, as evidenced by these assemblages of fish bone remains, suggests that there was sufficient stability and demand for a market.

11.3 The Contribution of this Work

The primary contribution of this work is the outline of a methodology for the identification and assessment of the artefactual and ecofactual remains relating to the halieutic practices of Roman Britain. Many of the artefacts included are only partially assessed due to poor recovery, recording, and storing methods; while further work will continue to add to the catalogue, the thesis provides a clear structure which may ensure current and further discoveries have more detailed records and are more readily available for assessment in future.

The number of artefacts identified for this research have far surpassed the previously acknowledged figures recorded in any publication for Roman Britain (Liversidge 1973, 363; Alcock 2001, 47-53; 2006, 105; Allason-Jones 2011; Millet et al. 2016). The thesis has prompted the recovery and assessment of over 400 artefacts from across the UK, many recorded for the first time for the purposes of this study. The outlined methodology and proposed classifications have facilitated a recording method that provides more data with which to assess the artefacts and a resulting catalogue that will now be accessible for further research. Those interested in more regional environmental or economic studies within Britain may now access this data with greater ease.

The work conducted by Locker (2007) has also been updated following a similar method of assessment. The current catalogue has increased the number of assemblages from 109 to 140 sites. A further subdivision of sites into chronologically distinct assemblages has produced a total of 220 assemblages for Roman Britain. This division has highlighted further diminutive collections, dividing already small figures of NISP into only a handful of diagnostic fragments. On the one hand these may support the dominance of subsistence fisheries in Roman Britain; on the other hand, for many sites this is indicative of the impact of sampling biases on the recovery of ecofacts. Unlike the artefact remains, ichthyofaunal methodologies have advanced successfully, including an optimal quantity and quality of data, whereby it should be possible to avoid the pitfalls of past methodologies. Such has not been the case for most of the sites included here, for which reason it has not been possible to include data such as element type, species age, and estimated total length, at this time. It is hoped that further studies will pursue a stricter methodology.

The successful advancement of ancient halieutic research further afield has demonstrated and advocated the importance of regional investigations (Bernal et al. 2010, 345). Britain has played a limited role in broader studies of fishing in the Roman empire, which has equally limited external influence on British investigations. The thesis outlines the evidence for Britain following a familiar methodology to Mediterranean-based studies that will promote further collaborative work and will support research into the fisheries of the northern Roman provinces, further developing the proposed tool classifications.

The final contribution of this thesis is an initial interpretation of Romano-British fishing based on both artefactual and ecofactual remains. The reader should have a clearer understanding of the evidence for fishing in Roman Britain and the most significant tools and species therein. Several gaps in the archaeological evidence have been highlighted which should promote further research of this ubiquitous yet enigmatic economic sector of the fringes of the Roman empire.

11.4 Suggested Progression

The preliminary nature of this assessment has produced a logistical hurdle that requires further investigation with more comprehensive studies of the distribution of halieutic remains, especially alternative tools that have only briefly been discussed in this study. All the artefacts that have been included are metal, which have been subject to a greater level of recording and publication when compared to alternative materials used as fishing equipment. Tools made from organic materials are rarely preserved in British soil, but recorded examples may also suffer from limited interpretation that obscures their halieutic function in subsequent reports. The objects, be they gorges, projectiles, traps, or segments of large weirs, require a thorough investigation. In addition, stone and clay weights were equally used by the Romans on fishing nets (Bernal 2010, 104), for which no published research for Britain exists; the numerous parallels to be drawn with alternative tools such as spindle whorls or loom weights, have been highlighted, yet a more methodical assessment of these objects may reveal examples that, either stratigraphically or morphologically, are consistent with identified fishing equipment. Among the larger installations pertaining to fish farming or holding tanks, there is a notable absence of ichthyofaunal studies. Sampling strategies at potential halieutic sites are crucial for elucidating the function of relevant fishery installations, but they are also essential at any Roman sites where fishing tools have been recovered, as there are no direct links yet to be made.

The thesis has highlighted the range of topics and the interdisciplinary extent of the subject, each with distinct problems of poorly recorded and assessed data. It is hoped that future collaborations may develop, ensuring a more detailed investigation of the various subjects and, thus, a more complete comprehensive study of Romano-British fisheries.

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Appendix A

Appendix A is divided into three parts, containing four catalogues of the tool remains from Britain associated with ancient fisheries.

Part 1: Catalogue of Romano-British fishing hooks

Part 2: Catalogue of Romano-British cylindrical lead weights

And Catalogue of Anglo Saxon, Medieval, and Unstratified lead weights

Part 3: Catalogue of Romano-British netting needles

Classification criteria for the assessment of these tools is discussed in detail in Chapter 3 (Methodology) and in the associated chapters of the tool remains (Chapters 5 to 7). The following table is an example of the cataloguing system used in Appendix A (Parts 1, 2, and 3).

<table>
<tr><td colspan="3">[Table format example]</td></tr>
<tr><td>Id No.</td><td>Location
Site type
Local aquatic environment(s)
Small find or museum number
Date of artefact
Material (for hooks and needles only)
Measurements (all measurements in millimetres)
Notes
Reference</td><td>Picture
(for hooks and weights)</td></tr>
<tr><td colspan="3">Picture (for netting needles only)</td></tr>
</table>

The first datum is an identification number that has been assigned to each artefact, consisting of an initial (reference to the object type) and a number in order of addition to the catalogue. This identification number is used to reference the objects in the thesis. The hooks are labelled with the initial ‘H’ and numbered 1 to 80. The Roman weights are labelled ‘W’ and 1 to 244. The post-Roman or unstratified weights are labelled ‘UW’ and 1 to 75. The netting needles are labelled ‘N’ and 1 to 27.

Images have been included wherever possible, though many artefacts lack this record. Several photographs have been taken for this thesis, referenced in the catalogue. These images are property of the identified museums and should not be used for publication. The illustrations provided in Appendix A are not to scale.

The location references the town and county from which the artefact has been found and, where applicable, the name of the street or archaeological site. The addition of a site-code for commercial excavations is provided in the 'notes' section if available.

The site type references the cultural context associated with the artefacts. This may include one of three options: military, urban (civilian settlements of various sizes and administrative purposes not included here), or rural (in relation to unstratified countryside finds or rural villa complexes).

Aquatic environment has been included as one of three options: riverine, estuarine, or coastal. This is used to highlight the aquatic environment at or in proximity to the location of recovery of the artefact. References may be made to various aquatic environments in proximity to each other.

Wherever possible, the original small-find or museum-record number has been included.

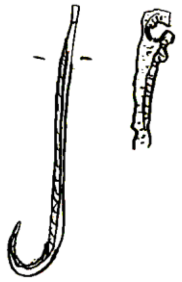
Specific dates are provided where possible, all of which relate to AD. Artefacts are otherwise titled 'Roman' for artefacts dated to the occupation between AD 43 and 410; if a Roman date has been proposed but is uncertain it is labelled '(unconfirmed)'.

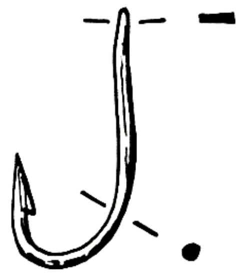
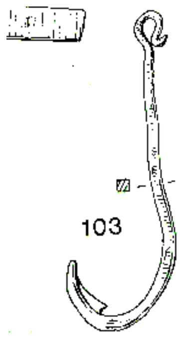
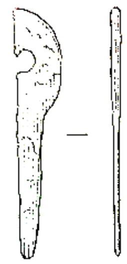
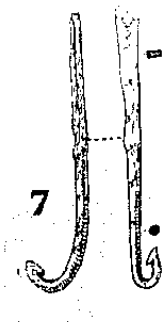
Material type is provided for hooks and needles only, as they can be either iron or copper. All of the weights included in Part 2 are lead. No stone or ceramic weights are included in this catalogue.

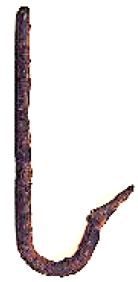
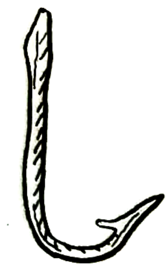
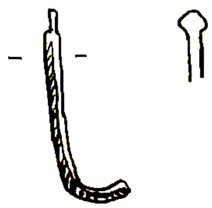
All tool measurements are recorded in millimetres and follow the order of maximum *length x width x thickness*, unless otherwise stated. Where a single measurement is provided it refers to the total length; this is due to a tendency of several publications to include this single datum. Weights are recorded in grams and labelled as such (g.) to differentiate them from other figures. Additional specific measurements are included for each artefact, proposed in the classification criteria outlined in Chapter 3. Hooks may include the additional measurement of the 'barb length' and the 'terminal diameter'. These are labelled as such where possible. The lead artefacts include the additional measurements of 'internal diameter', which is the diameter of the perforation within the cylindrical object; and the 'sheet thickness' , which is the maximum thickness of an individual layer of lead sheeting used to create the weight; their inclusion in the record is clearly labelled. The netting needles have a standard measurement based on the irregular profile of the object, presented as such: *total length* (including prongs) x *maximum width of the prongs* (if complete) x *diameter of the rod in profile*. Additional lengths are initialled 'RL' and 'IPD' and consist of: the 'rod Length' (RL), which is the length of the central rod, not including the prongs at either end; and the 'internal prong diameter' (IPD), which is the maximum diameter of the eye/opening (length x width). Both ends are provided where possible and labelled accordingly.

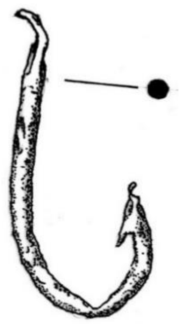
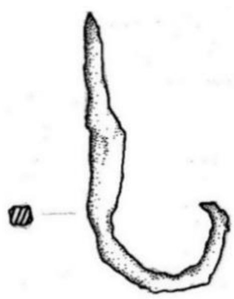
Any additional notes relevant to the artefact, including descriptions from the original reports are included alongside a reference to the source material. Where published examples have been collected, the standard in-text referencing system is used, and the full reference is included in the bibliography. Additional references include: the Portable Antiquities Scheme (https://finds.org.uk/database last accessed in September of 2020), which will include the item record number; museum collections accessed specifically for the thesis; and data acquired from archaeological units or museum collections provided by individuals.

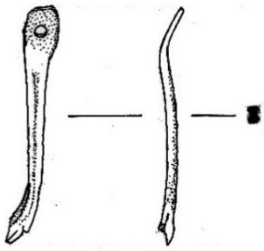
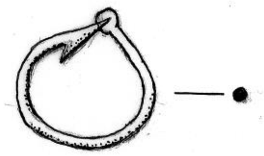
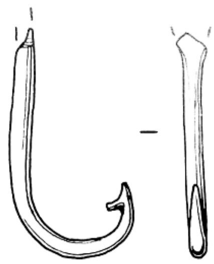
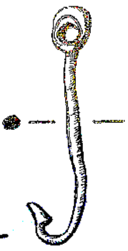
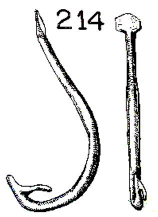
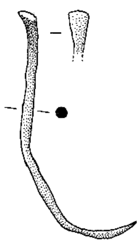
Appendix A, Part 1: Catalogue of Romano-British Fishing Hooks

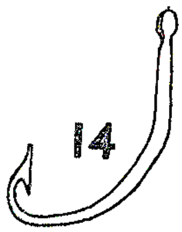
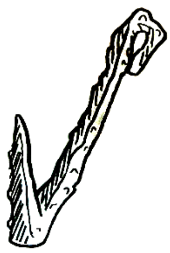
H1	Vindolanda, Northumberland Military site Riverine environment SF number 21200 AD 409 Cu. 35 x 5 x 1 <1g Unpublished, courtesy of Marta Alberti and the Vindolanda Trust (Illustration by L. Graña)	
H2	South Shields, New Castle, Tyne and Wear Military Fort, Southeast corner Riverine, in proximity to coastal environment Find number BR2 Roman (Unconfirmed) Courtesy of Alex Croom, Keeper of Archaeology at Arbeia Roman Fort and Museum	X
H3	South Shields, New Castle, Tyne and Wear Military Fort, Southeast corner Riverine, in proximity to coastal environment Find number BR3 Roman (Unconfirmed) Courtesy of Alex Croom, Keeper of Archaeology at Arbeia Roman Fort and Museum	X
H4	South Shields, New Castle, Tyne and Wear Military Fort, Wall of courtyard house Riverine, in proximity to coastal environment Find number BR500 Late 3^{rd} early 4^{th} C AD Courtesy of Alex Croom, Keeper of Archaeology at Arbeia Roman Fort and Museum	X
H5	South Shields, New Castle, Tyne and Wear Military Fort, Wall of courtyard house Riverine, in proximity to coastal environment Find number BR544 4^{th} C AD Courtesy of Alex Croom, Keeper of Archaeology at Arbeia Roman Fort and Museum	X
H6	Binchester, County Durham Unconfirmed (Proximity to military Site) Riverine environment Roman Fe. 143 x 41 x 8 Awaiting conservation and publication Unpublished (Courtesy of Chrystal Antinc, EAA Heritage)	

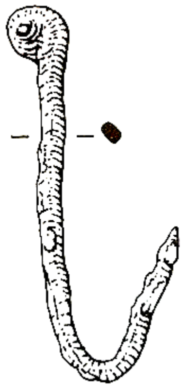
H7	Millennium Project, Carlisle, Cumbria Unconfirmed (Urban/Military) Riverine environment SF 3285 AD 83-94 Fe. 25 x 12 Period 3 construction trench for building 7394 Howard-Davis 2009, 751, fig.421	
H8	Beadlam, Yorkshire Rural, Villa Riverine environment LA/CR 705811 Roman Fe. 115 Not confirmed as a fishing hook, states as being a “potential steel yard hook”. Neal 1996	
H9	Ribblesdale Mill, Ribchester, Lancashire Military Fort Riverine environment SF 170 Roman Fe. 16 Recovered outside the fortification. Described as section of a Fish-Hook. No additional information. Howard-Davis and Witworth 2000	
H10	Ribchester (Bremetenacum), Lancashire Military Fort Riverine environment Record Number 6/5631/2 Oxf221 AD 89 Fe. 39 x 16 x 2 Described as a ‘barbless fish hook’ Howard-Davis and Buxton (Unpublished, ADS online resource produced 2003, 170, Fig. 74. Accessed November 2018)	X
H11	Deanery Field, Chester, Cheshire Military Fort Riverine environment 1st C AD Fe. 70 X 16 Recovered from the floor surface of a hearth in room 3A, block B Newstead 1928	

H12	Chester, Cheshire Unconfirmed (Urban/Military) Riverine, in proximity to coastal and estuarine ecosystems SF number 1884.245 Roman (Unconfirmed) Cu. Chester Museum collection	
H13	South Ferriby, Humber, North Lincolnshire Unknown site type Riverine and estuarine environment Roman KINCM:2006.11370 (Hull Museum record) Fe. 51mm Found in the early 20th century and described as Roman, no clear evidence for determining provenance or date. Paula Gentil, Hull Museum (02/06/17)	
H14	Wroxeter, Shropshire Unconfirmed (Urban/Military) Riverine environment 1st-2nd C AD Cu. 23 x 14 Recovered from refuse deposit, Sites VI & VII. "The shank [was] flattened and roughened for binding" Bushe-Fox 1916 (Illustration by L Graña)	
H15	Wroxeter, Shropshire Unconfirmed (Urban/Military) Riverine environment Accession Number 78000169 Roman Cu. Data courtesy of Cameron Moffett, English Heritage. (Poor-quality photo provided, illustration by L. Graña)	
H16	Wroxeter, Shropshire Unconfirmed (Urban/Military) Riverine environment Accession Number 775562 Roman Fe. 29 x 11 x 2 Flattened terminal measured: 3.5 x 5 Barb measured: 6mm length Data courtesy of Cameron Moffett, English Heritage.	X

H17	Wroxeter, Shropshire Unconfirmed (Urban/Military) Riverine environment Accession Number 7310052 Roman Fe. 28 x 14 x 3 “In-turned pointed tip” and “square profile of section” Data courtesy of Cameron Moffett, English Heritage.	X
H18	Wroxeter, Shropshire Unconfirmed (Urban/Military) Riverine environment Accession Number 7410422 Roman Fe. 67 x 27 x 4mm Described as having a “barbed tip” and a “square profile of section” Data courtesy of Cameron Moffett, English Heritage.	X
H19	Wroxeter, Shropshire Unconfirmed (Urban/Military) Riverine environment Accession Number 811028 Roman Fe. 37.5 x 18 Data courtesy of Cameron Moffett, English Heritage.	X
H20	Wroxeter, Shropshire Unconfirmed (Urban/Military) Riverine environment SF 4627 Roman Fe. 68 x 32 x 5 30mm barb height “Sharpened edge” and “circular profile” Data courtesy of Cameron Moffett, English Heritage. Image acquired separately from ADS Database (Cool et al. 2014)	
H21	Wroxeter, Shropshire Unconfirmed (Urban/Military) Riverine environment Roman Unknown SF number Fe. 59 x 30 x 5 Square profile Data courtesy of Cameron Moffett, English Heritage. Image acquired separately from the ADS Database (Cool et al. 2014)	

H22	Wroxeter, Shropshire Unconfirmed (Urban/Military) Riverine environment Roman 41 Data courtesy of Cameron Moffett, English Heritage. Image acquired separately from the ADS Database (Cool et al. 2014)	
H23	Wroxeter, Shropshire Unconfirmed (Urban/Military) Riverine environment SF 2394 Roman Cu. 12 x 12 x 1.5 Cool et al. 2014	
H24	Caister-on-sea, Norfolk Military Fort Coastal environment SF2959 Early to Mid 4th c AD Cu. Recovered from Room 4 of the fortification Mould 1993	
H25	Longthorpe, Peterborough, Cambridgeshire Military Fort Riverine environment AD 60 Cu. 25 x 6.5 4 mm Bite length, 5x4 mm eye platform, 2 mm eye perforation. Circular profile. Recovered from a pit of unclear function. Frere and Joseph 1974, 29-30	84 
H26	St Albans, Hertfordshire Urban/Military site Riverine environment 5th C AD Cu. Frere 1984 (fig 23, no214)	
H27	Heybridge, Elms Farm, Maldon, Essex Urban Settlement, Area N, Pit [10953] Fill (10922) Riverine to Estuarine environment (River Chelmer and Blackwater) SF 5786 Late 2nd – early to mid-3rd century Cu. 30 x ? x 3	

	Barbless hook with a distorted profile caused by bending. Circular profile shape. Tyrrell 2015	
H28	Woodeaton, Oxfordshire Rural (proximity to Villas at Beckley, Headington and Wheatly) Riverine environment Roman (Unconfirmed) Cu. 19 x 14 x 2 Found with other Roman material in a field, but no definitive context. Christopher Hughes Collection. Joan (1949)	
H29	Worsham, Oxfordshire Rural, Villa Riverine environment AN1948.209 Roman Fe. 32 Described as having been discovered in a "fox hole" Ashmolean Arthur E. Peake Collection	
H30	Appleford, Oxfordshire Rural Riverine environment AN2009.1068.a 4th C AD Hook Fe., Weight Pb. 120 x 95 (Approximately and including the weight) 245.6 g Recovered from a gravel pit. Ashmolean Arthur E. Peake Collection	
H31	Lower Slaughter, Farnworth, Gloucestershire Uncertain site type Riverine environment Museum record number A24353 Roman Fe. Recovered from a gravel pit It is potentially the example referenced by Field (2000), otherwise unpublished. (Illustration by L. Graña)	
H32	Eastgate Street, Gloucester, Gloucestershire Unconfirmed (Military fort and urban centre) Riverine environment 1974.46.i.77/353 Roman (Unconfirmed) Cu. Recovered from the East Gate. Data provided by David Rice, Gloucester Museum	X

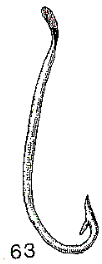
H33	Northgate Street, Gloucester, Gloucestershire Unconfirmed (Military fort and urban centre) Riverine environment SF 58; Museum record number 1974.46.i.77/353. L 4th century Cu. 33 x 13 x 2.5 From context 6B2 at the North Gate. Tight spiral eye-terminal. No visible gap. Heighway 1983, 186, fig.107.9	
H34	Bourton Bridge, Bourton-on-the-Water, Gloucestershire Riverine environment Museum record 1977.37/471 Roman Cu. Gloucester Museum record only	X
H35	Santhill, Gloucestershire Riverine environment AD 337-350 Cu. One of two hooks from the site. Additional find includes an Fe. gaff. Referenced by Timby 1998 (Exc. at Kingscote and Wycomb); see also O'Neil 1977, 28-30/ 1961, 29; RCHME 1976, B. on the W. (4)	X
H36	Santhill, Gloucestershire Riverine environment AD 337-350 Cu. One of two hooks from the site. Additional find includes an Fe. gaff. Referenced by Timby 1998 (Exc. at Kingscote and Wycomb); see also O'Neil 1977, 28-30/ 1961, 29; RCHME 1976, B. on the W. (4)	X
H37	Sea Mills, Bristol Urban site Riverine environment (North banks of the river Trym as it joins the River Avon; In proximity to coast and Bristol Channel) 1st-2nd century, (unconfirmed, a potential continuation to 5th century according to original report) Fe. Unknown measurements Displayed at Bristol Museum. Dobson (1931), 158	
H38	Keynsham, Somerset Villa site Mid-3rd to mid-4th century Cu. 25.4 Described as "a barbed copper fish hook 1" in length" Bulleid and Horne 1926, 132	X
H39	Hod Hill, Blackmore Vale, Dorset	

Military Fort
Riverine environment
1892.0901.581
Roman
Cu.
52.9 x 50 x 1.9
7.1g
1.2 thick barbs, internal terminal width 3.1
Point1: 22.9, vertical angle, almost parallel with shank
Point 2: 18.9, slight outward angle
Hook has a Cu. wire/leader still attached to the looped terminal, which is 60 x 1.6-0.8
Frank’s House Collection (BM). Photo by L. Graña

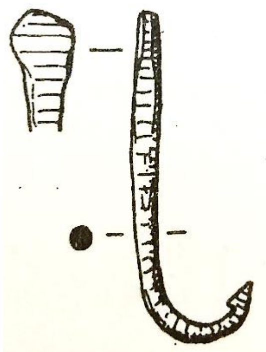
H40 Hod Hill, Blackmore Vale, Dorset
Military Fort
Riverine environment
SF F139
Roman (Unconfirmed)
110
Described as a “single J hook”
Brailsford 1962

X

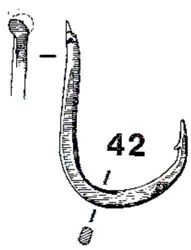
H41 Portchester, Hampshire
Military Fort
Coastal environment
SF 1293
Roman
Cu.
53 x 16 x 2.5
Recovered from a trench (91).
Display item at Portchester Museum. Webster 1975

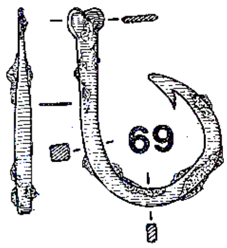
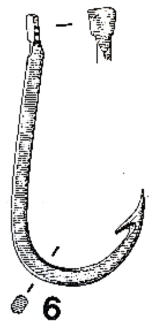
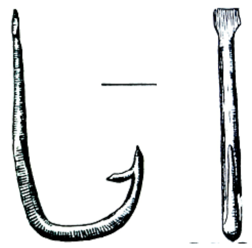
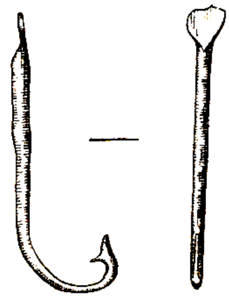


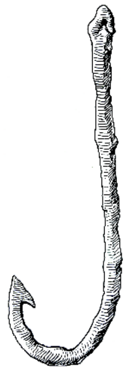
H42 Silchester, Hampshire
Urban
In proximity to riverine environments
SF 2639
AD 117-161(Period 6.14: Hadrianic to Antonine)
Fe.
45 x 15 x 4
Circular profile of shank
9mm flattened circular terminal, perpendicular to barb
Fulford and Timby 2000, 371-372, F172; additional hook referenced by Boon 1974, but may be the same find.



H43 Cattlemarket, Chichester, West Sussex
Unconfirmed (Urban/Military)
Riverine and estuarine environment (proximity to coast)
SF 1182
3rd to 4th C AD
Cu.
27 x 18
From deposit B58, a disused road surface
Down 1989



H44	Cattlemarket, Chichester, West Sussex Urban/Military Riverine and estuarine environment (proximity to coast) SF 469 Late 1st to mid-late 2nd C AD Cu. 23.5 x 19 x 2 From Cess Pit A 54 Down 1989	
H45	East Pallant, Chichester, West Sussex Urban/Military Riverine and estuarine environment, proximity to coast SF 221 Roman (unconfirmed) Cu. 42 x 20 Hook described as Roman, however it is also described as from Pit A54, which is described as Medieval. Down 1989	
H46	Fishbourne, Chichester, West Sussex Villa (Palace) Riverine environment (proximity to estuary and coast) Late 3rd to early 4th c AD (according to Cunliffe); AD 70-100 (according to Allen) Cu. 31 Recovered from a robber trench (places uncertainty on chronology) Cunliffe 1971; Allen 2011	
H47	Fishbourne, Chichester, West Sussex Villa (Palace), Robber trench Riverine environment (proximity to estuary and coast) Late 3rd to early 4th c AD (according to Cunliffe); AD 70-100 (according to Allen) Cu. 33 Cunliffe 1971; Allen 2011	
H48	Northwest Quadrant, Chichester, West Sussex Unconfirmed (Urban/Military) Riverine and estuarine environment (in proximity to coast) Record Number 27 Mid 2nd century Cu. 15 x 9 x 1.5 Context (219), site zone X 3c Down 1981, 168, fig.8.31	

H49	Richborough, Kent Unconfirmed (potential military site, but unstratified) Riverine and coastal environment (River Stout) SF F348 Roman Fe. 68 x 21 x 4 7mm length barb Square profile. Flattened terminal. “Iron-fish hook of size suitable for sea fishing” Bushe-Fox 1949 PL XII	
H50	Greater London Thames, unknown Roman excavation Riverine Environment 1884.11.43 Roman (Unconfirmed) Cu. 30 x 10 Donated to Pit Rivers from Bousfield collection. Recovered from excavation but with no further details. Pit Rivers museum collection.	
H51	Greater London Thames, unknown Roman excavation Riverine Environment 1884.11.44 Roman (Unconfirmed) Cu. 30 x 33 Donated to Pit Rivers from Bousfield collection. Recovered from excavation but with no further details. Pit Rivers museum collection.	
H52	London Urban Riverine Environment (proximity to estuarine environment) 1950.10.2.81 Roman Fe. 107.3 x 32.1 x 4.5 Head 12.1 width 19.2 length (to start of taper) Barb 12.3 (truncated) Terminal facing in the direction of the barb Dimples on the shank. BM Group Collection Photo by L. Graña	

H53	London Urban context Riverine Environment (proximity to estuarine environment) SF 96.5-1.38 Roman Fe. 92.1 L x 2.9 Round profile of shank BM Group Collection Photo by L. Graña	
H54	London Urban context Riverine Environment (proximity to estuarine environment) 1950.10.2.82 Roman Fe. 102.9 x 27.3 x 4.2 Barb is 7.2 (truncated) Head 90° twist to barb angle Square profile of shank Dimples on shank may be bites BM Group Collection Photo by L. Graña	
H55	London Urban context Riverine Environment (proximity to estuarine environment) 1950.10.2.83 Roman Fe. 65 x 27.3 x 3.7 Barb 9.1 Square profile of shank Head perpendicular to barb. Partially truncated head but potentially rounded/sub-rounded. BM Group Collection Photo by L. Graña	
H56	London Urban context Riverine Environment (proximity to estuarine environment) SF 58.9-16.67 Roman Fe. 67.6 x 23.9 x 3.6 Barb 12.1 Square profile of shank Head is truncated where it starts to tapper, most likely flattened but cannot confirm the absence of a perforation. The barb is facing 45° to the right side (intentional?) Head is perpendicular to the barb. BM Group Collection Photo by L. Graña	

H57 London
Urban context
Riverine Environment (proximity to estuarine environment)
SF 58.9-16.66
Roman
Cu.
35 x 13.9 x 2(at widest thickness) to 1.5 (at base)
Barb 6.9, head 4.7 x 5.3
The head is slightly truncated but seems to square off. The shank goes from square to circular around the middle of the shank.
Head is perpendicular to the barb.
BM Group Collection
Photo by L. Graña

H58 London
Urban context
Riverine Environment (proximity to estuarine environment)
SF 58.9-16.68
Roman
Fe.
28.4 x 23.9
Barb 11.9
Square profile of shank.
Very badly worn hook, the barb is barely identifiable and seems to be fused to the shank which has been truncated quite low down.
BM Group Collection
Photo by L. Graña

H59 London
Urban context
Riverine Environment (proximity to estuarine environment)
58.9-16.69
Roman
Fe.
37.7 x 17.4 x 3.2
Square profile of shank.
Very corroded and unclear. The head is missing, and the barb has rusted and fused to the shank.
BM Group Collection
Photo by L. Graña

H60 London
Urban context
Riverine Environment (proximity to estuarine environment)
58.9-16.70
Roman
Fe.
49.6 x 19.1 x 3.3
Barb 5.9 truncated tip
Square profile of shank
Slight corroded
BM Group Collection
Photo by L. Graña

H61 London
Urban context
Riverine Environment (proximity to estuarine environment)
1943.1001.19
Roman
Fe.
60.4 x 26.8 x 3.5
Profile is irregular with visible hammer blows and twists.
Terminal is perpendicular to the barb
Barb is fused to the shank and offset (unintentionally?)
BM Group Collection
Photo by L. Graña

H62 London
Urban context
Riverine Environment (proximity to estuarine environment)
1896.0501.32
Roman
Cu.
27.1 x 11.4 x 1.4
Barb 7.3. Terminal 6.7 x 3.9
Terminal is perpendicular to the barb
Slightly truncated terminal though rounded to sub-rounded sides.
The barb is a small projection at the base leading to a long point.
BM Group Collection
Photo by L. Graña

H63 River Thames, London
Urban context
Riverine Environment (proximity to estuarine environment)
1865.1203.10
Roman
Cu.
22.94 x 12.67 x 1.19
Barbed 3.38 x 2.07. Flat sub-circular terminal 3.26 x 2.65 x 0.07
Circular profile of shank
Flattened terminal is perpendicular to the barb
Frank's House Collection (BM)
Photo by L. Graña

H64 Hammersmith, London
Urban context
Riverine Environment (proximity to estuarine environment)
WG1766 (Ref 22/02 1)
Bronze Age-Roman (Unconfirmed)
Cu.
25.37 x 12.32 x 2.28 (at thickest base of shank)
Truncated terminal, but appears to have been an eye (pierced)
Ext. terminal width 1.35, Int. terminal width 0.99
Sub-square profile of shank, barbless hook
Uncertain but appears to have a terminal perpendicular to point
0.7g
Frank's House Collection (BM)
Photo by L. Graña

H65 Lombard Street, London
Urban context
Riverine Environment (proximity to estuarine environment)
1896.0501.34
Roman
Cu.
41.77 x 19.40 x 2.02
Looped terminal with a left direction, perpendicular to barb: Ext. terminal width 6.68, Int. terminal width 3.03
1.5g
Inward curve to shank and with a circular profile throughout
Frank’s House Collection (BM)
Photo by L. Graña

H66 Tokenhouse Yard, Lothbury, London
Urban context
Riverine Environment (proximity to estuarine environment)
189.0501.30
Roman
Fe.
85.99 x 32.60 x 3.37
Circular profile of shank. Looped terminal with a left direction, perpendicular to the barb: External diameter 10.35 x Internal diameter 4.26. Barb 14.74
7.4g
Frank’s House Collection (BM)
Photo by L. Graña

H67 Tower Street, London
Urban
Riverine Environment (proximity to estuarine environment)
1896.0501.31
Roman
Cu.
51.45 x 74.13 x 2.40
Terminal: External diameter 16.71, Internal diameter 12.20
Barbless points, P1 31.30, P2 30.66
Circular profile of shank with irregularities that may be hammer or damage marks. Uneven shape to the terminal.
7.9g
Frank’s House Collection (BM)
Photo by L. Graña

H68 River Thames, London
Urban context
Riverine Environment (proximity to estuarine environment)
1856.0701.1258
Roman
Cu.
24.69 x 12.60 x 1.70
Flattened terminal, 3.49 x 3.99, perpendicular to the barb.
Barb is worn and very small. Circular profile of the shank. 0.6g
Charles Roach Smith/ Frank’s House Collection (BM)
Photo by L. Graña

H69 London
Urban context
Riverine Environment (proximity to estuarine environment)
1856.0701.1256
Roman
Cu.
26.93 x 8.63 x 1.21
Flattened rectangular terminal 2.40 x 1.68, perpendicular to barb
Elongated barb with a low-lying blade 5.63mm. Circular profile of the shank.
0.4g
Frank's House Collection (BM)
Photo by L. Graña

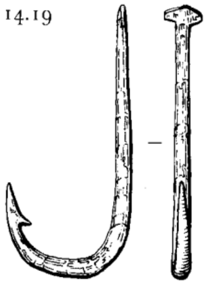
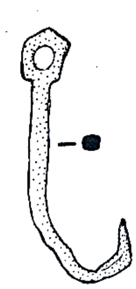
H70 River Thames, London
Urban context
Riverine Environment (proximity to estuarine environment)
1856.0701.1257
Roman
Cu.
26.48 x 7.55 x 1.25
Circular flattened terminal 3.19 x 3.26, perpendicular to the barb.
Square profile of the shank.
Frank's House Collection (BM)
Photo by L. Graña

H71 River Thames, London
Urban context
Riverine Environment (proximity to estuarine environment)
1838.0220.18
Roman
Cu.
24.40 x 5.81 x 2.25
Quadruple barbless hook made from a split and S-twisted single piece rod. Square profile where visible.
0.8g
Frank's House Collection (BM)
Photo by L. Graña

H72 River Thames, London
Riverine Environment (proximity to estuarine environment)
1864.0903.3
Roman
Cu.
34.38 x 7.19 x 1.78mm / 5.58 (wrapped body)
Quadruple barbless hook composed of three pieces; two double hooks joined by a twisted Cu. wire coil.
Frank's House Collection (BM)
Photo by L. Graña

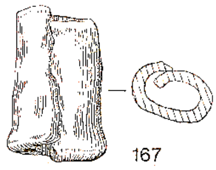
H73 River Thames (suggested but unconfirmed), London
Urban context
Riverine Environment (proximity to estuarine environment)
1864.0903.2
Roman

	Cu. 43.61 x 14.01 x 1.71mm A double hook in the style of a quadruple hook with four circular decorations joined by Cu. coils and a 4x4mm Cu. bead 1.3g Frank's House Collection (BM) Photo by L. Graña	
H74	Tokenhouse Yard, Lothbury, London Urban context Riverine Environment (proximity to estuarine environment) 1896.0501.28 Roman Cu. Rounded flattened and perforated terminal, ETW 5.51 / ITW 2.68 51.34 x 33.30 x 2.54mm. 3g Circular profile of the shank. Frank's House Collection (BM) Photo by L. Graña	
H75	Lombard Street, London Urban context Riverine Environment (proximity to estuarine environment) 1896.0501.33 Roman Fe. 66.97 x 22.90 x 4.75 Barb 9.47 4.3g Truncated terminal. Square profile of the shank. Frank's House Collection (BM) Photo by L. Graña	
H76	Tokenhouse Yard, Lothbury, London Urban context Riverine Environment (proximity to estuarine environment) 1896.0501.29 Roman Fe. 90.1 x 34.2 x 2.9 Looped terminal to the left Circular profile of shank Frank's House Collection (BM) Photo by L. Graña	
H77	Wallbrook, London Urban context Riverine Environment (proximity to estuarine environment) SF 19176 M1st-M2nd century Cu. 21 x 17 x 1.5 Flattened semi-circular terminal. Rayman (1960, 8)	

H78	St Magnus House, London Urban context Riverine Environment (proximity to estuarine environment) SF 178 Early to Mid-3rd C Fe. 79 x 33 x 3.5 From 2-6 Lower Thames Street, EC3 excavations, Context [269], Site code SM75 Dyson 1986, 238 14.9	14.19 
H79	Billingsgate Market, Lorry Park, London Urban context Riverine Environment (proximity to estuarine environment) SF 3529 Roman Cu. Record found on London Archaeological Archive, no publications or images. Context [183]. Site code BWB83. Artefact could not be retrieved for further study.	X
H80	Caerleon, Gwent, Wales Military Fort, Drain Riverine environment Late 3rd C AD Cu. 22 Drain group 4, filled in in late 3rd C with refuse Brewer 1986	

Appendix A, Part 2: Catalogue of Romano-British Lead Weights

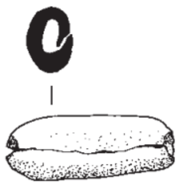
W01 Portchester, Hampshire
Roman fortress
Coastal environment
AD 270-317
34 X 20 X 14
Context 2655, Pit 48, Layer 14
Webster 1975



W02 Grange Road, Fenham, Newcastle
Riverine environment
26 x 11
9g
Courtesy of Chrystal Antink, Northern Archaeological Associates

W03 Ower, Dorset
Riverine environment (proximity to estuarine environment)
Record number 243
1st -2nd century
36.5 x 18 x 20
Internal diameter 4.5 x 11
Sheet thickness 3
From soil accumulation.
Cox 1987, 99; Woodward 1987

W04 Frocester, Gloucestershire
Riverine environment
Record number 5
4th century
33 x 12.5 x 9
Internal diameter 4 x 7
Sheet thickness 3
Price 2000, 88, fig.4.1



W05 South Marston, Swindon, Wiltshire
Roman to Medieval (Unconfirmed)
SF WILT-745597
14.34 x 12.97
Internal diameter 5 x 3.5
Sheet thickness 2-2.5
14.68g
Described as “potential curse tablet”
Portable Antiquities Scheme

W06 Durston, Taunton Deane, Somerset
Riverine environment
SF WILT-EE1C84
Roman
30.13 x 32.14 x 25
Internal diameter 17 x 5
Sheet thickness 1.84
121.17g
Described as “potential curse tablet”
Portable Antiquities Scheme

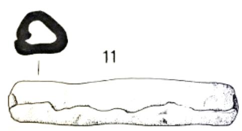
W07
Shavington Cum Gresty, Cheshire East, Cheshire
Riverine environment
SF LVPL-85ADA3
Roman
25.46 x 7.86 x 7.84
Internal diameter <1
Sheet thickness 1.5
3.4g
Described as "potential curse tablet"
Potable Antiquities Scheme

W08
Oswestry, Shropshire
Riverine environment
SF LVPL-DEA234
Roman
26.21 x 9.85
Internal diameter 4 x 2
Sheet thickness 3.5
10.7g
Described as "potential curse tablet"
Portable Antiquities Scheme

W09
Skirpenbeck, East Riding of Yorkshire
Riverine environment
SF YORYM-50E11C
Roman to Medieval (Unconfirmed)
25.28 x 12.87
Internal diameter 4.5
Sheet thickness 3.5
17.7g
Portable Antiquities Scheme

W10
Barton-le-Street, Ryedale, North Yorkshire
Riverine environment
SF YORYM-0346A3
Roman to Medieval (Unconfirmed)
34.8 x 10.9
No image or scale of internal diameter and thickness.
21.9g
Described as potential curse tablet
Portable Antiquities Scheme

W11
Caerleon, Wales
Legionary Fortress
Riverine environment
L2nd to L3rd centuries
50 x11 x 9
Internal diameter 6 x 5
Sheet thickness 2.5
Zienkiewicz 1986, 190, fig.65.11



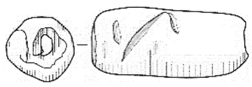
W12
Carmarthen, Wales
Urban
Riverine environment
SF 1300
Roman

85 x 20 x 10
Internal diameter 15 x 5
Sheet thickness 3mm
Context 12, 505, Notched at either end.
James 2003, 341-2, fig.8.13, n.10

W13 Ickham, Kent
Coastal environment
Late Roman
Sutton (1998) Description of one fishing weight among analysis of Roman pewter and lead artefacts from Ickham. Potential collection of 8 weights of uncertain function. "Additional sheets of lead and pewter" with no descriptions.
See Mould 2010; Sutton 1998

X

W14 Saltwood Tunnel, Kent
Coastal environment
SF ON583
Roman
26 x 11
Internal diameter 3
Sheet thickness 2.5
18g
Riddler and Ager 2006



W15 Ashford, Great Chart, Kent
Riverine environment
SF KENT-2E8965
Roman (Unconfirmed)
17.32 x 13.8 x 22 (unrolled length)
No internal diameter
Sheet thickness 1-2mm
22.6g
Described as "potential curse tablet".
Portable Antiquities Scheme

W16 Blyton, West Lindsey, Lincolnshire
Riverine environment
SF NLM-6CECC7
Roman
23.7 x 8.2
Sheet thickness 1
5.8g
Described as "potential curse tablet".
Portable Antiquities Scheme

W17 Scotter, West Lindsey, Lincolnshire
Riverine environment
SF NLM-EA50C0
Roman
45.1 x 16
Sheet thickness 2
63.53g
Described as "potential curse tablet… neater than the often-rough fishing weights". Marks on the fold are caused by an attempt to unravel the artefact when discovered.

	Portable Antiquities Scheme	
W18	Bottersford, North Lincolnshire Riverine environment SF NLM-7C6EA5 Roman 34.6 x 11.5 x 8.1 Sheet thickness 1-2 13.33g Described as "potential curse tablet". Potable Antiquities Scheme	
W19	Blyborough, Lincolnshire Riverine environment SF NLM-92F452 Roman 27.9 x 15.4 Internal diameter 2 Sheet thickness 1.7 35.44g Described as "potential curse tablet" Portable Antiquities Scheme	
W20	Roxby cum Risby, North Lincolnshire Riverine environment SF NLM-017218 Roman 28.4 x 9.4 Sheet thickness 0.6mm 7.32g Described as "potential curse tablet". Portable Antiquities Scheme	
W21	Hunt´s House, Guy's Hospital, London Southwark Riverine environment (proximity to estuarine environment) SF 350 4th-5th 15 x 10.5 9g "Cylindrical net weight with narrow perforation. Made by rolling up a short thick rectangle of lead". Site code HHO97 Taylor-Wilson 2002, 34; Crummy, Unpublished report courtesy of Victoria Ridgeway (PCA)	X
W22	Hunt´s House, Guy's Hospital, London Southwark Riverine environment (proximity to estuarine environment) SF 468 4th -5th 14 x 12 10g Site code HHO97 Taylor-Wilson 2002, 34; Crummy, Unpublished report courtesy of Victoria Ridgeway (PCA)	X

W23 Forest Heath, Mildenhall, Suffolk
IA-Medieval (Unconfirmed)
SF 379644 (1 of 2)
38.65 x 16.82 x 8.07
19.52g
Portable Antiquities Scheme

X

W24 Forest Heath, Mildenhall, Suffolk
IA-Medieval (Unconfirmed)
SF 379644 (2 of 2)
26.09 x 9.32 x 5.27
6.61g
Portable Antiquities Scheme

X

W25 Rushock, Wyre Forest, Worcestershire
Riverine environment
SF WMID-B20138
Roman
51.9 x 39.1 x 5.99
Sheet thickness 3
103.4g
Described as "potential curse tablet".
Portable Antiquities Scheme

W26 Rushock, Wyre Forest, Worcestershire
Riverine environment
SF WMID-B21774
Roman
45.1 x 39.5 x 21.3
Sheet thickness 4
249g
Folded three times to form four layers.
Described as "potential curse tablet".
Portable Antiquities Scheme

W27 Isle of White, IoW
Coastal environment
ID IOW-76D368
Roman
12.39 x 10.69 x 7.51
Sheet thickness 2.3
7.08g
Metal Detector find, recorded as "potential curse tablet"
Portable Antiquities Scheme

W28 Isle of White
Coastal environment
SF IOW-F3FB7A
Roman to Medieval (Unconfirmed)
15.1 x 12.7 x 10.2
Internal diameter 1
Sheet thickness 1-1.5
11.84g
Described as "potential curse tablet"
Portable Antiquities Scheme

W29 Isle of White

	Coastal environment SF IOW-3366C7 Roman to Medieval 12.4 x 10 x 8.6 Internal diameter 0.5 Sheet thickness 1.5-2 6.88g Described as "potential curse tablet" Portable Antiquities Scheme	
W30	Binchester, County Durham Riverine environment L4th – E5th century 12.5 x 9 3.3g Context BCP18 Courtesy of Chrystal Antink, Northern Archaeological Associates	
W31	Binchester, County Durham Riverine environment L4th – E5th century 11.5 x 8 2.6g Courtesy of Chrystal Antink, Northern Archaeological Associates BCP18	
W32	Binchester, County Durham Riverine environment L4th – E5th century 28 x 13 14.6g Context BCP18 Courtesy of Chrystal Antink, Northern Archaeological Associates	
W33	Binchester, County Durham Riverine environment L4th – E5th century 24 x 11 (17.5 where severely flattened) 7.3g Context BCP18 Courtesy of Chrystal Antink, Northern Archaeological Associates	
W34	Gloucester, Gloucestershire Riverine environment SF 9 Roman 39 x 17 x 15 Sheet thickness 4 55g Courtesy of Gloucester Museum Site code 31/87 Context 61	

W35 Gloucester, Gloucestershire
Military
Riverine environment
SF 2750
Roman
35 x 11.3 x 8.8
Sheet thickness 3
15g
Courtesy of Gloucester Museum
Site code 9/83

W36 Gloucester, Gloucestershire
Military
SF 2413
Roman
44.5 x 12 x 10.6
Internal diameter 5.8
Sheet thickness 2
20g
Courtesy of Gloucester Museum
Site code 9/83

W37 Gloucester, Gloucestershire
Riverine environment
SF A8314
Roman
60.1 x 20 x 14.6
Sheet Thickness 0.95
54g
Courtesy of Gloucester Museum
Site code 51/66
Context 64

W38 Blacklands Villa, Graveney, Kent
Rural villa site
Riverine environment (in proximity to coast)
Roman
42
Internal diameter 5-6
20.1g
Trench 3, Context (19). 1 of 7 artefacts.
Rolled cylinder, widened lightly at one end.
Green and Branch (2013)

X

W39 Blacklands Villa, Graveney, Kent
Rural villa site
Riverine environment (in proximity to coast)
Roman
41.1
Internal diameter 5-6
22.1g
Trench 3, Context (19). 1 of 7 artefacts.
Rolled cylinder, lightly curved in profile
Green and Branch (2013)

X

W40	Blacklands Villa, Graveney, Kent Rural villa site Riverine environment (in proximity to coast) Roman 44.5 Internal diameter 5-6 19.9g Trench 3, Context (19). 1 of 7 artefacts. Rolled cylinder, widened at one end Green and Branch (2013)	X
W41	Blacklands Villa, Graveney, Kent Rural villa site Riverine environment (in proximity to coast) Roman 47.1 Internal diameter 5-6mm 27.6g Trench 3, Context (19). 1 of 7 artefacts. Rolled cylinder, widened at both ends. Green and Branch (2013)	X
W42	Blacklands Villa, Graveney, Kent Rural villa site Riverine environment (in proximity to coast) Roman 47.5 Internal diameter 5-6 24.4g Trench 3, Unstratified. 1 of 7 artefacts. Rolled cylinder, seam running along one side Green and Branch (2013)	X
W43	Blacklands Villa, Graveney, Kent Rural villa site Riverine environment (in proximity to coast) Roman 43.6 internal diameter 5-6 20.3g Trench 3, context 05/019. 1 of 7 artefacts. Rolled cylinder (Clasped), widened at one end Green and Branch (2013)	X
W44	Blacklands Villa, Graveney, Kent Rural villa site Riverine environment (in proximity to coast) Roman 35.2 Internal diameter 5-6 20.1g Trench 4, Context (127). 1 of 7 artefacts. Rolled cylinder Clasped), tapering lightly towards one end Green and Branch (2013)	X
W45	Gill Mill, Oxfordshire	

	Riverine environment SF 524 Mid-3rd-4th century 38 x 8 Internal diameter 3-4 8g Context 3017C Occupation Layer. Site code DUGM. Courtesy of Paul Booth, Oxford Archaeology	
W46	Gill Mill, Oxfordshire Riverine environment SF 530 Mid-3rd-4th century 62 x 9mm 18g Context 3017C Occupation Layer. Site code DUGM. Courtesy of Paul Booth, Oxford Archaeology	
W47	Gill Mill, Oxfordshire Riverine environment SF 531 Mid-3rd-4th century 41 x 10 Internal diameter 3 12g Context 3017C Occupation Layer. Site code DUGM. Courtesy of Paul Booth, Oxford Archaeology	
W48	Gill Mill, Oxfordshire Riverine environment SF 532 Mid-3rd-4th century 37 x 7-8 Internal diameter 3 7g Context 3017C Occupation Layer. Site code DUGM. Courtesy of Paul Booth, Oxford Archaeology	
W49	Gill Mill, Oxfordshire Riverine environment SF 533 Mid-3rd-4th century 24 x 7 Internal diameter 3 4g Context 3017C Occupation Layer. Site code DUGM. Courtesy of Paul Booth, Oxford Archaeology	
W50	Gill Mill, Oxfordshire Riverine environment SF 534 Mid-3rd-4th century 24 x 8 Internal diameter 2-4 6g Context 3017C Occupation Layer. Site code DUGM.	

Courtesy of Paul Booth, Oxford Archaeology

W51 Gill Mill, Oxfordshire
Riverine environment
SF 535
Mid-3rd-4th century
20 x 9
Internal diameter 3
6g
Context 3017C Occupation Layer. Site code DUGM.
Courtesy of Paul Booth, Oxford Archaeology

W52 Gill Mill, Oxfordshire
Riverine environment
SF 537
Mid-3rd-4th century
41 x 8-9
5g
Context 3017C Occupation Layer. Site code DUGM.
Courtesy of Paul Booth, Oxford Archaeology

W53 Gill Mill, Oxfordshire
Riverine environment
SF 538
Mid-3rd-4th century
31 x 10
Internal diameter 3
8g
Context 3017C Occupation Layer. Site code DUGM.
Courtesy of Paul Booth, Oxford Archaeology

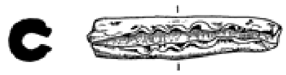
W54 Gill Mill, Oxfordshire
Riverine environment
SF 539
Mid-3rd-4th century
35 x 9
Internal diameter 3
9g
Context 3017C Occupation Layer. Site code DUGM.
Courtesy of Paul Booth, Oxford Archaeology

W55 Dickson´s Corner, Worth, Kent
Unconfirmed rural or urban context
Coastal environment
Temporary Number 1, Context 102
Roman (Unconfirmed but in proximity to Roman site)
23 x 17
Sheet thickness 4
24g
Courtesy of Keith Parfitt, Kent Archaeology Society

W56 Dickson´s Corner, Worth, Kent
Unconfirmed rural or urban context
Coastal environment
Temporary Number 2, Context 102
Roman (Unconfirmed but in proximity to Roman site)
52 x 22

4mm thick
78g
Courtesy of Keith Parfitt, Kent Archaeology Society

W57	Dickson´s Corner, Worth, Kent Unconfirmed rural or urban context Coastal environment Temporary Number 3, Context 102 Roman (Unconfirmed but in proximity to Roman site) 17 x 19 22g Courtesy of Keith Parfitt, Kent Archaeology Society	
W58	Dickson´s Corner, Worth, Kent Unconfirmed rural or urban context Coastal environment Temporary Number 4, Context 102 Roman (Unconfirmed but in proximity to Roman site) 38 x 39 Sheet thickness 1 25g Unrolled Courtesy of Keith Parfitt, Kent Archaeology Society	
W59	Dickson´s Corner, Worth, Kent Unconfirmed rural or urban context Coastal environment Temporary Number 5, Context 102 Roman (Unconfirmed but in proximity to Roman site) 41 x 32 Sheet thickness 1 22g Unrolled Courtesy of Keith Parfitt, Kent Archaeology Society	
W60	Dickson´s Corner, Worth, Kent Unconfirmed rural or urban context Coastal environment Temporary Number 6, Context 102 Roman (Unconfirmed but in proximity to Roman site) 47 x 12 20g Courtesy of Keith Parfitt, Kent Archaeology Society	
W61	Dickson´s Corner, Worth, Kent Unconfirmed rural or urban context Coastal environment Temporary Number 7, Context 102 Roman (Unconfirmed but in proximity to Roman site) 43 x 29 58g Partially Rolled Courtesy of Keith Parfitt, Kent Archaeology Society	
W62	Dickson's Corner, Worth, Kent Urban context Coastal environment	

	Mid-1st century 50 x 11 x 12 Internal diameter 4 Sheet thickness 3.5 23.5g Part of a group of 13, there are only images for 2 of them, but average diameters are provided. They range from 36-55mm, but average at 43-48mm. From 16.6 to 39.7g Parfitt 2000, 126	
W63	Dickson’s Corner, Worth, Kent Urban context Coastal environment Mid-1st century 44 x 14 5 int.d. 4mm thick 38.7g Part of a group of 13, there are only images for 2 of them, but average diameters are provided. They range from 36-55mm, but average at 43-48mm. From 16.6 to 39.7g Parfitt 2000, 126	
W64	Dickson’s Corner, Worth, Kent Urban context Coastal environment Mid-1st century Part of a group of 13, there are only images for 2 of them, but average diameters are provided. They range from 36-55mm, but average at 43-48mm. From 16.6 to 39.7g Parfitt 2000, 126	X
W65	Dickson’s Corner, Worth, Kent Urban context Coastal environment Mid-1st century Part of a group of 13, there are only images for 2 of them, but average diameters are provided. They range from 36-55mm, but average at 43-48mm. From 16.6 to 39.7g Parfitt 2000, 126	X
W66	Dickson’s Corner, Worth, Kent Urban context Coastal environment Mid-1st century Part of a group of 13, there are only images for 2 of them, but average diameters are provided. They range from 36-55mm, but average at 43-48mm. From 16.6 to 39.7g Parfitt 2000, 126	X
W67	Dickson’s Corner, Worth, Kent Urban context Coastal environment Mid-1st century	X

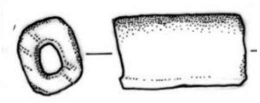
	Part of a group of 13, there are only images for 2 of them, but average diameters are provided. They range from 36-55mm, but average at 43-48mm. From 16.6 to 39.7g Parfitt 2000, 126	
W68	Dickson's Corner, Worth, Kent Urban context Coastal environment Mid-1st century Part of a group of 13, there are only images for 2 of them, but average diameters are provided. They range from 36-55mm, but average at 43-48mm. From 16.6 to 39.7g Parfitt 2000, 126	X
W69	Dickson's Corner, Worth, Kent Urban context Coastal environment Mid-1st century Part of a group of 13, there are only images for 2 of them, but average diameters are provided. They range from 36-55mm, but average at 43-48mm. From 16.6 to 39.7g Parfitt 2000, 126	X
W70	Dickson's Corner, Worth, Kent Urban context Coastal environment Mid 1st century Part of a group of 13, there are only images for 2 of them, but average diameters are provided. They range from 36-55mm, but average at 43-48mm. From 16.6 to 39.7g Parfitt 2000, 126	X
W71	Dickson's Corner, Worth, Kent Urban context Coastal environment Mid-1st century Part of a group of 13, there are only images for 2 of them, but average diameters are provided. They range from 36-55mm, but average at 43-48mm. From 16.6 to 39.7g Parfitt 2000, 126	X
W72	Dickson's Corner, Worth, Kent Urban context Coastal environment Mid-1st century Part of a group of 13, there are only images for 2 of them, but average diameters are provided. They range from 36-55mm, but average at 43-48mm. From 16.6 to 39.7g Parfitt 2000, 126	X
W73	Dickson's Corner, Worth, Kent Urban context Coastal environment Mid-1st century Part of a group of 13, there are only images for 2 of them, but average diameters are provided. They range from 36-55mm, but average at 43-48mm. From 16.6 to 39.7g	X

Parfitt 2000, 126

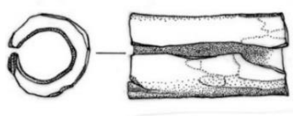
W74 Dickson's Corner, Worth, Kent
Urban context
Coastal environment
Mid-1st century
Part of a group of 13, there are only images for 2 of them, but average diameters are provided. They range from 36-55mm, but average at 43-48mm. From 16.6 to 39.7g
Parfitt 2000, 126

X

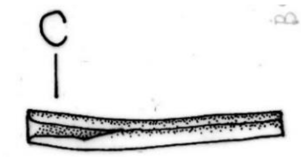
W75 Wroxeter, Shropshire
Unconfirmed (military or urban context)
Riverine environment
4th century
38 x 21 x 17
10 x 7 int diam
5 thick
Barker et al. 1997



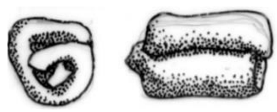
W76 Wroxeter, Shropshire
Unconfirmed (military or urban context)
Riverine environment
4th century
66 x 34.5 x 33 (33 x 17 x 16.5 ?)
Internal diameter 20 (10 ?)
Sheet thickness 6 (3 ?)
The scale bar provided in the publication is 10 mm but other examples have a 5 mm bar. Given the size ranges of similar artefacts from this site, I believe there was a mistake in the scale bar provided and that the artefact is half the size suggested in the record. I am awaiting confirmation, but a 6mm thick sheet is unprecedented in the catalogue and would suggest a weight of over 100g (also unpresedented).
Barker et al. 1997



W77 Wroxeter, Shropshire
Unconfirmed (military or urban context)
Riverine environment
4th century
23.5 x 3.5
Internal diameter 2.5
Sheet thickness 1
Barker et al. 1997

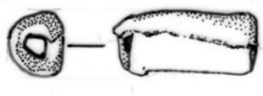


W78 Wroxeter, Shropshire
Unconfirmed (military or urban context)
Riverine environment
4th century
30 x 17 x 18
Internal diameter 6 x 5
Sheet thickness 4
Barker et al. 1997

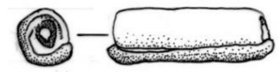


W79 Wroxeter, Shropshire
Unconfirmed (military or urban context)
Riverine environment

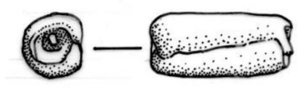
4th century
30 x 13 x 11
Internal diameter 4
Sheet thickness 4.5
Barker et al. 1997



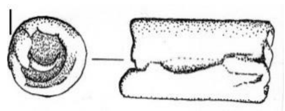
W80 Wroxeter, Shropshire
Unconfirmed (military or urban context)
Riverine environment
4th century
47 x 15 x 16
Internal diameter 4
Sheet thickness 5
Barker et al. 1997



W81 Wroxeter, Shropshire
Unconfirmed (military or urban context)
Riverine environment
4th century
31 x 14 x 13
Internal diameter 3
Sheet thickness 3.5
Barker et al. 1997

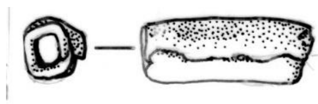


W82 Wroxeter, Shropshire
Unconfirmed (military or urban context)
Riverine environment
4th century
30 x 16 x 15
Internal diameter 6
Sheet thickness 4
Barker et al. 1997

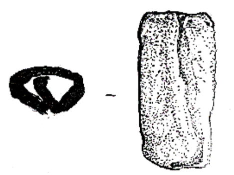


W83 Wroxeter, Shropshire
Unconfirmed (military or urban context)
Riverine environment
4th century
16.5 x 11.5
Internal diameter 3
Sheet thickness 4
Barker et al. 1997

W84 Wroxeter, Shropshire
Unconfirmed (military or urban context)
Riverine environment
4th century
32 x 12 x 12
Internal diameter 5
Sheet thickness 3
Barker et al. 1997



W85 Wroxeter, Shropshire
Unconfirmed (military or urban context)
Riverine environment
4th century
No scale bar provided for this weight. Pending feedback from English Heritage to obtain measurements.



	Barker et al. 1997	
W86	Wroxeter, Shropshire Urban context Riverine environment Accession Number 743420 Roman 26 x 13 x 10 Internal diameter 6 24g Courtesy of Cameron Moffett, English Heritage These artefacts do not coincide with the examples recorded in Barker et al. 1997, they are therefore poorly recorded additional finds from Wroxeter.	
W87	Wroxeter, Shropshire Urban context Riverine environment Accession Number 775367 Roman 33 x 7 Internal diameter 4 5g Courtesy of Cameron Moffett, English Heritage These artefacts do not coincide with the examples recorded in Barker et al. 1997, they are therefore additional finds from Wroxeter.	
W88	Wroxeter, Shropshire Urban context Riverine environment Accession Number 775371 Roman 28 x 13 x 11 Internal diameter 10 23g Courtesy of Cameron Moffett, English Heritage These artefacts do not coincide with the examples recorded in Barker et al. 1997, they are therefore additional finds from Wroxeter.	
W89	Wroxeter, Shropshire Urban context Riverine environment Accession Number 775380 Roman 47 x 16 x 14 Internal diameter 7 77g Courtesy of Cameron Moffett, English Heritage These artefacts do not coincide with the examples recorded in Barker et al. 1997, they are therefore additional finds from Wroxeter.	
W90	Wroxeter, Shropshire Urban context	

Riverine environment
Accession Number 775382
Roman
33 x 10
Internal diameter 7
24g
Courtesy of Cameron Moffett, English Heritage
These artefacts do not coincide with the examples recorded in Barker et al. 1997, they are therefore additional finds from Wroxeter.

W91 Wroxeter, Shropshire
Urban context
Riverine environment
Accession Number 814541
Roman
31 x 7
Internal diameter 3
8g
Courtesy of Cameron Moffett, English Heritage
These artefacts do not coincide with the examples recorded in Barker et al. 1997, they are therefore additional finds from Wroxeter.

W92 Wroxeter, Shropshire
Urban context
Riverine environment
Accession Number 830415
Roman
19 x 25 x 17
33g
Described as a potential clip for combining nets.
Courtesy of Cameron Moffett, English Heritage
These artefacts do not coincide with the examples recorded in Barker et al. 1997, they are therefore additional finds from Wroxeter.

W93 Wroxeter, Shropshire
Urban context
Riverine environment
Accession Number 856731
Roman
28 x 9 x 7
7g
Courtesy of Cameron Moffett, English Heritage
These artefacts do not coincide with the examples recorded in Barker et al. 1997, they are therefore additional finds from Wroxeter

W94 Wroxeter, Shropshire
Urban context
Riverine environment
Accession Number 7312473
Roman
26 x 14

	Internal diameter 10 31g Courtesy of Cameron Moffett, English Heritage These artefacts do not coincide with the examples recorded in Barker et al. 1997, they are therefore additional finds from Wroxeter.	
W95	Wroxeter, Shropshire Urban context Riverine environment Accession Number 7312475 Roman 43 x 14 Internal diameter 7 48g Courtesy of Cameron Moffett, English Heritage These artefacts do not coincide with the examples recorded in Barker et al. 1997, they are therefore additional finds from Wroxeter.	
W96	Wroxeter, Shropshire Urban context Riverine environment Accession Number 7312475.2 Roman 29 x 13 x 10 Internal diameter 7 29g Courtesy of Cameron Moffett, English Heritage These artefacts do not coincide with the examples recorded in Barker et al. 1997, they are therefore additional finds from Wroxeter.	
W97	Wroxeter, Shropshire Urban context Riverine environment Accession Number 7312476 Roman 14 x 11 x 9 Internal diameter 3 7g Courtesy of Cameron Moffett, English Heritage These artefacts do not coincide with the examples recorded in Barker et al. 1997, they are therefore additional finds from Wroxeter.	
W98	Wroxeter, Shropshire Urban context Riverine environment Accession Number 7312488 Roman 30 x 11 Internal diameter 7 17g Courtesy of Cameron Moffett, English Heritage	

	These artefacts do not coincide with the examples recorded in Barker et al. 1997, they are therefore additional finds from Wroxeter.	
W99	Wroxeter, Shropshire Urban context Riverine environment Accession Number 7312494 Roman 27 x 11 x 9 Internal diameter 8 x 5 34g Courtesy of Cameron Moffett, English Heritage These artefacts do not coincide with the examples recorded in Barker et al. 1997, they are therefore additional finds from Wroxeter.	
W100	Wroxeter, Shropshire Urban context Riverine environment Accession Number 78000539 Roman 33 x 12 x 10 Internal diameter 8 34g Courtesy of Cameron Moffett, English Heritage These artefacts do not coincide with the examples recorded in Barker et al. 1997, they are therefore additional finds from Wroxeter.	
W101	Wroxeter, Shropshire Urban context Riverine environment Accession Number 78001130 Roman 38 x 9 x 7 Internal diameter 7 20g Courtesy of Cameron Moffett, English Heritage These artefacts do not coincide with the examples recorded in Barker et al. 1997, they are therefore additional finds from Wroxeter.	
W102 to W138	Site 12 C, Lydd Quarry, Lydd, Kent Rural (unconfirmed) Coastal environment AD 70-150 Weight measured in bulk: 37 artefacts constitute 755g Site Code: LQ12C Described as “rolled lead weights” Priestley-Bell 2006 Artefacts could not be acquired at this time	X
W139	Site 18, Lydd Quarry, Lydd, Kent Rural (unconfirmed) Coastal environment	

	SF 16 AD 40-160 12g Site code: LQ18 Described as rolled weights of the clasped variety. Priestley-Bell 2013 Artefacts could not be acquired for the assessment	X
W140	Site 18, Lydd Quarry, Lydd, Kent Rural (unconfirmed) Coastal environment SF 17 AD 40-160 18g Site code: LQ18 Described as rolled weights of the clasped variety. Priestley-Bell 2013 Artefacts could not be acquired for the assessment	X
W141	Site 18, Lydd Quarry, Lydd, Kent Rural (unconfirmed) Coastal environment SF 18 AD 40-160 16g Site code: LQ18 Described as rolled weights of the clasped variety. Priestley-Bell 2013 Artefacts could not be acquired for the assessment	X
W142	Site 18, Lydd Quarry, Lydd, Kent Rural (unconfirmed) Coastal environment SF 19 AD 40-160 16g Site code: LQ18 Described as rolled weights of the clasped variety. Priestley-Bell 2013 Artefacts could not be acquired for the assessment	X
W143	Site 18, Lydd Quarry, Lydd, Kent Rural (unconfirmed) Coastal environment SF 20 AD 40-160 18g Site code: LQ18 Described as rolled weights of the clasped variety. Priestley-Bell 2013 Artefacts could not be acquired for the assessment	X
W144	Site 18, Lydd Quarry, Lydd, Kent Rural (unconfirmed) Coastal environment SF 21	

	AD 40-160 48g Site code: LQ18 Described as rolled weights of the clasped variety. Priestley-Bell 2013 Artefacts could not be acquired for the assessment	X
W145	Site 18, Lydd Quarry, Lydd, Kent Rural (unconfirmed) Coastal environment SF 22 AD 40-160 32g Site code: LQ18 Described as rolled weights of the clasped variety. Priestley-Bell 2013 Artefacts could not be acquired for the assessment	X
W146	Site 18, Lydd Quarry, Lydd, Kent Rural (unconfirmed) Coastal environment SF 23 AD 40-160 12g Site code: LQ18 Described as rolled weights of the clasped variety. Priestley-Bell 2013 Artefacts could not be acquired for the assessment	X
W147	Site 18, Lydd Quarry, Lydd, Kent Rural (unconfirmed) Coastal environment SF 24 AD 40-160 4g Site code: LQ18 Described as rolled weights of the clasped variety. Priestley-Bell 2013 Artefacts could not be acquired for the assessment	X
W148	Site 18, Lydd Quarry, Lydd, Kent Rural (unconfirmed) Coastal environment SF 25 AD 40-160 20g Site code: LQ18 Described as rolled weights of the clasped variety. Priestley-Bell 2013 Artefacts could not be acquired for the assessment	X
W149	Site 18, Lydd Quarry, Lydd, Kent Rural (unconfirmed) Coastal environment SF 26 AD 40-160	

	10g Site code: LQ18 Described as rolled weights of the clasped variety. Priestley-Bell 2013 Artefacts could not be acquired for the assessment	X
W150	Site 18, Lydd Quarry, Lydd, Kent AD 40-160 Unknown Cultural Context SF 27 No measurements 12g Site code: LQ18 Described as 'rolled' weights of the clasped variety. Priestley-Bell 2013 Artefacts could not be acquired for the assessment	X
W151	Site 18, Lydd Quarry, Lydd, Kent Rural (unconfirmed) Coastal environment SF 28 AD 40-160 20g Site code: LQ18 Described as rolled weights of the clasped variety. Priestley-Bell 2013 Artefacts could not be acquired for the assessment	X
W152	Site 18, Lydd Quarry, Lydd, Kent Rural (unconfirmed) Coastal environment SF 29 AD 40-160 8g Site code: LQ18 Described as rolled weights of the clasped variety. Priestley-Bell 2013 Artefacts could not be acquired for the assessment	X
W153	Site 18, Lydd Quarry, Lydd, Kent Rural (unconfirmed) Coastal environment SF 30 AD 40-160 2g Site code: LQ18 Described as rolled weights of the clasped variety. Priestley-Bell 2013 Artefacts could not be acquired for the assessment	X
W154	Site 18, Lydd Quarry, Lydd, Kent Rural (unconfirmed) Coastal environment SF 31 AD 40-160 26g	X

	Site code: LQ18 Described as rolled weights of the clasped variety. Priestley-Bell 2013 Artefacts could not be acquired for the assessment	
W155	Site 18, Lydd Quarry, Lydd, Kent Rural (unconfirmed) Coastal environment SF 32 AD 40-160 10g Site code: LQ18 Described as rolled weights of the clasped variety. Priestley-Bell 2013 Artefacts could not be acquired for the assessment	X
W156	Site 18, Lydd Quarry, Lydd, Kent Rural (unconfirmed) Coastal environment SF 33 AD 40-160 12g Site code: LQ18 Described as rolled weights of the clasped variety. Priestley-Bell 2013 Artefacts could not be acquired for the assessment	X
W157	Site 18, Lydd Quarry, Lydd, Kent Rural (unconfirmed) Coastal environment SF 35 AD 40-160 34g Site code: LQ18 Described as rolled weights of the clasped variety. Priestley-Bell 2013 Artefacts could not be acquired for the assessment	X
W158	Site 18, Lydd Quarry, Lydd, Kent Rural (unconfirmed) Coastal environment SF 38 AD 40-160 20g Site code: LQ18 Priestley-Bell 2013 Artefacts could not be acquired for the assessment	X
W159	Site 18, Lydd Quarry, Lydd, Kent Rural (unconfirmed) Coastal environment SF 39 AD 40-160 18g Site code: LQ18 Priestley-Bell 2013	X

	Artefacts could not be acquired for the assessment	
W160	Site 18, Lydd Quarry, Lydd, Kent Rural (unconfirmed) Coastal environment SF 40 AD 40-160 16g Site code: LQ18 Priestley-Bell 2013 Artefacts could not be acquired for the assessment	X
W161	Site 18, Lydd Quarry, Lydd, Kent Rural (unconfirmed) Coastal environment SF 41 AD 40-160 18g Site code: LQ18 Priestley-Bell 2013 Artefacts could not be acquired for the assessment	X
W162	Site 18, Lydd Quarry, Lydd, Kent Rural (unconfirmed) Coastal environment SF 42 AD 40-160 20g Site code: LQ18 Priestley-Bell 2013 Artefacts could not be acquired for the assessment	X
W163	Site 18, Lydd Quarry, Lydd, Kent Rural (unconfirmed) Coastal environment SF 43 AD 40-160 8g Site code: LQ18 Priestley-Bell 2013 Artefacts could not be acquired for the assessment	X
W164	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 2716 Roman 38.2 x 27.4 x 8.5 Sheet thickness 2.4 21.06g Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	X

W165	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 2723 Roman 28.5 x 11.4 x 8.6 Internal diameter 4.2 Sheet thickness 3.2 13.65g Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	X
W166	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 3362 Roman 36.7 x 12 x 3.5 Sheet thickness 1 6.49g Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	X
W167	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment Roman SF 5132 36.7 x 14 Internal diameter 4.5 Sheet thickness 3 25.22g Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	X
W168	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6564 Roman 39.7 x 23.5 x 7.8 Internal diameter 3.5 Sheet thickness 2.8 19.13g Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	X
W169	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 1053a Roman 53.2 x 26.4 x 23.6 Internal diameter 9 Sheet thickness 5.5	X

	114.7g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	
W170	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 1053b Roman 32 x 18.2 x 16.2 Internal diameter 7.7 Shet thickness 3.4 39.76 Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W171	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 1053c Roman 39.2 x 14.8 x 12.8 Internal diameter 5.6 Sheet thickness 3 27.78g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W172	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 1053d Roman 60.5 x 15.7 x 12.6 Internal diameter 3.4 Sheet thickness 2.6 44.82g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	
W173	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 1053e Roman 34.3 x 17.3 x 13.2 Internal diameter 5.6	X

	Sheet thickness 2.7 27.39g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	
W174	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 1053f Roman 56.7 x 17.8 x 15.2 Internal diameter 6.1 Sheet thickness 5.1 54.61g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W175	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 1053g Roman 46.6 x 18.6 x 15.5 Internal diameter 5.5 Sheet thickness 5.6 64.56g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W176	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 1053h Roman 43.2 x 13.4 x 12.8 Internal diameter 7.8 Sheet thickness 2.3 26.23g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	
W177	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 1053i Roman 57.3 x 18.2 x 15.4	

Internal diameter 6.2
Sheet thickness 5.3
67.45g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W178 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 1053j
Roman
39.7 x 14.9 x 11.1
Internal diameter 3.6
Sheet thickness 2.6
22.02g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

X

W179 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 1053k
Roman
34 x 21.6 x 15.6
Internal diameter 6.5
Sheet thickness 4.9
60g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W180 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 1053l
Roman
60.8 x 14 x 10.4
Internal diameter 6.1
Sheet thickness 3.6
31.76g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W181 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 1053m
Roman

	30.9 x 15.9 Internal diameter 5 Sheet thickness 3.5 33.88g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W182	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 1053n Roman 47.1 x 11.5 x 9.1 Internal diameter 4.9 Sheet thickness 2.9 21.1g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W183	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 1053o Roman 46.1 x 16.1 x 7.9 Internal diameter 1 Sheet thickness 2.6 23.92g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W184	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 1053p Roman 40 x 10.9 x 10 Internal diameter 4.3 Sheet thickness 3 21.45g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W185	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 1053q	

	Roman 31.9 x 12.9 x 10 Internal diameter 5.9 Sheet thickness 3.1 17.91g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W186	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 1053r Roman 42.8 x 10.8 Internal diameters 8.1 Sheet thickness 1.5 5.86g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W187	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 1053s Roman 34.4 x 20.9 x 10.4 Internal diameter 4.5 Sheet thickness 3.3 28.03g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W188	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 1053t Roman 43.2 x 18.2 x 15.4 Internal diameter 4.5 Sheet thickness 3.8 35.78g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W189	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment	

	SF 1053u Roman 46.6 x 15.4 x 9.5 Internal diameter 8.4 x 3 Sheet thickness 2.1 27.34g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W190	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 1053v Roman 52.6 x 11.4 x 5.5 Internal diameter <1 Sheet thickness 2.2 18.77g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W191	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 1053w Roman 21.5 x 21.5 x 11.5 Internal diameter 10 x 3.5 Sheet thickness 3.6 27.02g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	X
W192	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 1053x Roman 32.5 x 14 x 11.5 Internal diameter 3.2 Sheet thickness 2 18.77g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W193	Heybridge, Elms Farm, Essex Urban context	

	Riverine and estuarine environment SF 1053y Roman 45 x 15.3 x 8.1 Internal diameter 2.9 Sheet thickness 2.6 20.21g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	
W194	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 1053z Roman 31.4 x 16 x 9.4 Internal diameter 9.5 x 2 Sheet thickness 2.1 14.81g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W195	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 1053aa Roman 34.1 x 12.2 x 5.6 Internal diameter <1 Sheet thickness 1.9 9.69g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	X
W196	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 1053ab Roman 23.6 x 12.5 Internal diameter 5.4 Sheet thickness 3.2 18.03g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W197	Heybridge, Elms Farm, Essex	

	Urban context Riverine and estuarine environment SF 1053ac Roman 28.5 x 11 x 6.6 Sheet thickness 2.6 8.61g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	X
W198	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 1053ad Roman 19.7 x 12.8 x 7.9 Internal diameter 2.6 Sheet thickness 2.9 8.25g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W199	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 1053ae Roman 21.8 x 11.8 x 8.1 Internal diameter 6.3 x 2.1 Sheet thickness 2.2 6.08g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W200	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 1053af Roman 35 x 23.9 x 6.7 Internal diameter <1 Sheet thickness 2.4 16.3g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	
W201	Heybridge, Elms Farm, Essex	

Urban context
Riverine and estuarine environment
SF 1053ag
Roman
49.6 x 27.3 x 7.7
Internal diameter 4.2 x 3.5
Sheet thickness 2.4
30.25g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W202 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 921a
Roman
31.8 x 16.8 x 13.8
Internal diameter 6.2
Sheet thickness 4
33.34g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

X

W203 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 921b
Roman
39.6 x 23.1 x 13.2
Internal diameter 4
Sheet thickness 2.9
31.39g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

X

W204 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 921c
Roman
30.4 x 10.4 x 6.6
Internal diameter 2
Sheet thickness 1.9
7.1g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

X

W205	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 921d Roman 31.5 x 12.1 x 9.8 Internal diameter 3.2 Sheet thickness 2.9 10.6g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W206	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 921e Roman 17.2 x 16.8 x 8.9 Internal diameter 2 Sheet thickness 1.5 9.03g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W207	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 921f Roman 27.8 x 14.2 Internal diameter 3.5 Sheet thickness 3 22.53g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W208	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 921g Roman 14.9 x 11.5 Internal diameter 3 Sheet thickness 3.2 4.84g Small find group number has been assigned to several weights. No individual numbers to date.	X

Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W209 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 921h
Roman
21.1 x 9.1 x 6.1
Sheet thickness 1.5
5.49g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

X

W210 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 3979
Roman
33.4 x 14.5 x 7.4
Sheet thickness 2.6
11.73g
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W211 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 5621
Roman
59.4 x 14.6 x 12.5
Internal diameter 4.5
Sheet thickness 3.8
44.67g
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W212 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 7543a
Roman
30 x 11.6 x 8.5
Internal diameter I3.5
Sheet thickness 2.5
15.23g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W213 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment

SF 7543b
Roman
28.1 x 15.5 x 13.1
Internal diameter 6 x 8.4
Sheet thickness 1.9
15.15g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W214 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 7543c
Roman
20.5 x 10.4 x 7.6
Internal diameter 3
Sheet thickness 2.4
3.45g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W215 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
Roman
SF 5184a
44.2 x 13.5 x 11.7
Internal diameter 3.8
Sheet thickness 2.8
27.04g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W216 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 5184b
Roman
26 x 16.5 x 13.9
Internal diameter 6.2
Sheet thickness 4.5
23.85g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W217 Heybridge, Elms Farm, Essex
Urban context

Riverine and estuarine environment
SF 5184c
Roman
29.1 x 13.4 x 11.6
Internal diameter 5.2
Sheet thickness 3
17.93g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W218 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 5178a
Roman
31.6 x 16.9
Internal diameter 4.2
Sheet thickness 3.5
33.22g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

X

W219 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 5178b
Roman
39.4 x 15.1 x 10.3
Internal diameter 4.5
Sheet thickness 3.2
20.8g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W220 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 5178c
Roman
41.8 x 21.9 x 17.5
Internal diameter 5.4 x 10.2
Sheet thickness 4.6
50.13g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

X

W221 Heybridge, Elms Farm, Essex

Urban context
Riverine and estuarine environment
SF 5178d
Roman
62.5 x 26.6 x 17.1
Internal diameter 7
Sheet thickness 3.1mm thick
58.51g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W222 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 5178e
Roman
54.6 x 18.2 x 15.6
Internal diameter 5.2
Sheet thickness 4.6
61.32g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W223 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 5178f
Roman
37 x 16.4
Internal diameter 7.6 x 6.3
Sheet thickness 2.9
33.97g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W224 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 5178g
Roman
31.3 x 13.6
Internal diameter 5.9
Sheet thickness 4.3
20.06g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W225 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 5178h
Roman
25.6 x 19.3 x 8.3
Sheet thickness 2.9
12.8g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

X

W226 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 5178i
Roman
29.6 x 24.5 x 6.8
Sheet thickness 2.8
16.25g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W227 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 5178j
Roman
27.3 x 14.9 x 12.9
Internal diameter 3.4
Sheet thickness 4.6
20.55g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

X

W228 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 5178k
Roman
54.1 x 15.6
Internal diameter 5.3 x 3.2
Sheet thickness 2.5
63.62g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W229 Heybridge, Elms Farm, Essex

Urban context
Riverine and estuarine environment
SF 5178l
Roman
36.1 x 19.2 x 8.5
Sheet thickness 2.6
24g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W230 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 5178m
Roman
24 x 14 x 8.3
Internal diameter 4
Sheet thickness 3.1
11.82g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

X

W231 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 5178n
Roman
23 x 13.5 x 12.1
Internal diameter 3.9
Sheet thickness 2.8
14.32g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

X

W232 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 5178o
Roman
24.1 x 14.9 x 9.5
Internal diameter 4.5
Sheet thickness 2.8
8.96g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W233 Heybridge, Elms Farm, Essex

	Urban context Riverine and estuarine environment SF 5178p Roman 12 x 15.8 x 12.1 Sheet thickness 2.6 3.96g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W234	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 5178q Roman 22.6 x 19.8 x 7.8 Internal diameter <1 Sheet thickness 2.5 5.48g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	
W235	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 5178r Roman 26.4 x 15.1 x 7.7 Internal diameter <1 Sheet thickness 2.4 6.46g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	
W236	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 5178s Roman 31 x 22.8 x 6.1 Sheet thickness 2.2 13.21g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	
W237	Heybridge, Elms Farm, Essex Urban context	

	Riverine and estuarine environment SF 6880a Roman 32.2 x 9.4 Internal diameter 3.5 Sheet thickness 2.1 10.32g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W238	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6880b Roman 30.2 x 9 Sheet thickness 2.4 6.46g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W239	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6880c Roman 23.1 x 11.1 x 7.3 Sheet thickness 2.8 9.79g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W240	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6880d Roman 14.5 x 9.5 x 6.5 Sheet thickness 2.5 4.65g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W241	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6880e	

	Roman 30.3 x 7.6 Sheet thickness 2.5 8.63g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W242	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6880f Roman 24.3 x 8.2 Sheet thickness 2.7 7.76g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W243	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6880g Roman 36 x 10.4 Sheet thickness 3 14.9g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W244	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6880h Roman 26.4 x 9.2 Sheet thickness 3 11.18g Small find group number has been assigned to several weights. No individual numbers to date. Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.	X
W245	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6880i Roman 27.6 x 9.2 Sheet thickness 2.8	X

8.32g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W246 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6880j
Roman
37.1 x 8.6
Sheet thickness 2.8
10.41g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

X

W247 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6880k
Roman
62.4 x 17.3 x 14
Internal diameter 6.8
Sheet thickness 4
64.13g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W248 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6880l
Roman
45.7 x 29.1 x 9.9
Internal diameter <1
Sheet thickness 3.1
56.20g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W249 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6880m
Roman
51.5 x 22.6 x 11.7
Internal diameter 9.9 x 3.6
Sheet thickness 3

	42.7g Small find group number has been assigned to several weights. No individual numbers to date. Context (17000). Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	
W250	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6880n Roman 46 x 23.3 x 10.5 Internal diameter 3.3 Sheet thickness 3.7 35.41g Small find group number has been assigned to several weights. No individual numbers to date. Context (17000). Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	
W251	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6880o Roman 47.4 x 18.5 x 14.8 Internal diameter 7.6 x 5.2 Sheet thickness 4 32.73g Small find group number has been assigned to several weights. No individual numbers to date. Context (17000). Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	
W252	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6880p Roman 47.5 x 22.1 x 12.4 Internal diameter 4.2 Sheet thickness 2.5 34.24g Small find group number has been assigned to several weights. No individual numbers to date. Context (17000). Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	
W253	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6880q Roman 50 x 16.1 x 12.2 Internal diameter 4.6	

	Sheet thickness 3.5 41.89g Small find group number has been assigned to several weights. No individual numbers to date. Context (17000). Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	
W254	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6880r Roman 25.9 x 16.1 x 12.2 Internal diameter 14 x 4.3 Sheet thickness 4.8 37.13g Small find group number has been assigned to several weights. No individual numbers to date. Context (17000). Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	
W255	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6880s Roman 36.2 x 21.5 x 12.6 Internal diameter 6 Sheet thickness 4.3 29.37g Small find group number has been assigned to several weights. No individual numbers to date. Context (17000). Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	
W256	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6880t Roman 26.6 x 18 x 12.5 Internal diameter 8 x 6.5 Sheet thickness 3.2 21.95g Small find group number has been assigned to several weights. No individual numbers to date. Context (17000). Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	
W257	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6880u Roman 27 x 18.9 x 10.6	

Internal diameter 6.5
Sheet thickness 3
11.45g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W258 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6880v
Roman
29.3 x 18.9 x 10.6
Internal diameter 6.5
Sheet thickness 3
11.45g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W259 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6880w
Roman
38.3 x 14.3 x 9.5
Internal diameter <1
Sheet thickness 3
19.65g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W260 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6880x
Roman
35 x 14.2 x 9.1
Internal diameter 3
Sheet thickness 2.5
20.79g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W261 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6880y
Roman

30.1 x 13.8 x 9.2
Internal diameter 6.5 x 3.6
Sheet thickness 3
20.65g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W262 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6880z
Roman
31.2 x 15.4 x 10.2
Internal diameter 3.2
Sheet thickness 3.5
19.30g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W263 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6880aa
Roman
20.4 x 15.8 x 11.9
Internal diameter 3.4
Sheet thickness 3.6
12.53g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W264 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6880ab
Roman
32.4 x 10.5 x 7.9
Internal diameter 3.8 x 2.5
Sheet thickness 2
10.33g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W265 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6880ac

Roman
36 x 10.6 x 7.9
Internal diameter <1
Sheet thickness 3.1
14.92g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W266 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6880ad
Roman
37.1 x 10.4 x 6.4
Internal diameter <1
Sheet thickness 3
10.42g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W267 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6880ae
Roman
30.1 x 8.3 x 8.6
Internal diameter 3.1
Sheet thickness 2.8
6.27g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W268 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6880af
Roman
23.9 x 11.6 x 7.5
Internal diameter 1.8
Sheet thickness 1.8
9.77g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W269 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment

SF 6880ag
Roman
26.3 x 8.9 x 9
Internal diameter 3.2
Sheet thickness 2
11.18g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W270 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6880ah
Roman
30.2 x 8.3 x 7.4
Internal diameter 2.2
Sheet thickness <2
8.61g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W271 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6880ai
Roman
27.5 x 8.7 x 8.7
Internal diameter <1
Sheet thickness 2.2
8.3g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W272 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6880aj
Roman
24.3 x 8.8 x 7
Internal diameter <1
Sheet thickness 3
7.76g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W273 Heybridge, Elms Farm, Essex
Urban context

Riverine and estuarine environment
SF 6880ak
Roman
14.5 x 9.7 x 6.4
Internal diameter 1
Sheet thickness 2
4.63g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W274 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 5754
Roman
32.2 x 15.3 x 7.5
Internal diameter 1.7
Sheet thickness 2.6
9.76g
Context (12207)
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W275 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6410
Roman
23 x 10.1 x 6.9
Internal diameter <1
Sheet thickness 2.2
6.48g
Context (12362)
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W276 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6412
Roman
45.1 x 21.7 x 13.8
Internal diameter 9.2 x 4.5
Sheet thickness 2.7
45.66g
Context (12263)
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015.

W277 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6381a

	Roman 22.1 x 19.3 x 12.5 Internal diameter 5.9 Sheet thickness 3.3 17g Small find group number has been assigned to several weights. No individual numbers to date. Context (12250). Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	
W278	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6381b Roman 26.8 x 13.6 x 11.7 Internal diameter 7.6 x 5.3 Sheet thickness 2.7 17.27g Small find group number has been assigned to several weights. No individual numbers to date. Context (12250). Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	
W279	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6381c Roman 28.6 x 15.6 x 9.6 Internal diameter 3.2 Sheet thickness 2.4 10.8g Small find group number has been assigned to several weights. No individual numbers to date. Context (12250). Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	
W280	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6381d Roman 30.2 x 23.5 x 8.8 Internal diameter 9 x 5.4 Sheet thickness 2 11.47g Small find group number has been assigned to several weights. No individual numbers to date. Context (12250). Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	
W281	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment	

	SF 6381e Roman 51.1 x 19.2 x 11.2 Internal diameter 3.6 Sheet thickness 4.2 47.78g Small find group number has been assigned to several weights. No individual numbers to date. Context (12250). Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	
W282	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6381f Roman 51 x 25.4 x 9.2 Internal diameter 6.8 x 3.5 Sheet thickness 2.5 42.67g Small find group number has been assigned to several weights. No individual numbers to date. Context (12250). Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	
W283	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6381g Roman 51.3 x 38.5 x 11.3 Internal diameter 6.3 x 6 Sheet thickness 2.4 41.75g Small find group number has been assigned to several weights. No individual numbers to date. Context (12250). Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	
W284	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6362a Roman 42.6 x 11.9 x 11.1 Internal diameter 4.9 Sheet thickness 3.5 24.55g Small find group number has been assigned to several weights. No individual numbers to date. Context (12245). Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	
W285	Heybridge, Elms Farm, Essex Urban context	

Riverine and estuarine environment
SF 6362b
Roman
32.2 x 14.9 x 12.4
Internal diameter 5.7
Sheet thickness 4.2
17.4g
Small find group number has been assigned to several weights. No individual numbers to date. Context (12245).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W286 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6355a
Roman
49.2 x 23.1 x 14.6
Internal diameter <1
Sheet thickness 1.8
12.71g
Small find group number has been assigned to several weights. No individual numbers to date. Context (12249).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W287 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6355b
Roman
30.2 x 20.6 x 8.8
Internal diameter <1
Sheet thickness 1.8
12.71g
Small find group number has been assigned to several weights. No individual numbers to date. Context (12249).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W288 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 5751
Roman
48.6 x 8 x 6.7
Internal diameter 3.5 x 2.6
Sheet thickness 2
12.75g
Context (12206)
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W289 Heybridge, Elms Farm, Essex
Urban context

	Riverine and estuarine environment SF 6518a Roman 23 x 20.7 x 8.7 Internal diameter 1 Sheet thickness 2.5 11.39g Small find group number has been assigned to several weights. No individual numbers to date. Context (12000). Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	
W290	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6518b Roman 14.5 x 19.3 x 5.2 Internal diameter <1 Sheet thickness 2.3 6.64g Small find group number has been assigned to several weights. No individual numbers to date. Context (12000). Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	
W291	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6359a Roman 38.8 x 10.2 x 8.9 Internal diameter 3.8 Sheet thickness 2.3 14.75g Small find group number has been assigned to several weights. No individual numbers to date. Context (12054). Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	
W292	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6359b Roman 23.9 x 14.7 x 12.3 Internal diameter 6.9 x 5.9 Sheet thickness 2.3 15g Small find group number has been assigned to several weights. No individual numbers to date. Context (12054). Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	
W293	Heybridge, Elms Farm, Essex	

	Urban context Riverine and estuarine environment SF 6694a Roman 40.7 x 18.4 x 9.1 Internal diameter 3 x 1.4 Sheet thickness 2.6 19.87g Small find group number has been assigned to several weights. No individual numbers to date. Context (12000). Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	
W294	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6694b Roman 37.5 x 11 x 10.2 Internal diameter 5.2 Sheet thickness 2.6 20.63g Small find group number has been assigned to several weights. No individual numbers to date. Context (12000). Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	
W295	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6516a Roman 47.4 x 30.8 x 9.8 Internal diameter 2.5 Sheet thickness 2.7 55.58g Small find group number has been assigned to several weights. No individual numbers to date. Context (17000). Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	
W296	Heybridge, Elms Farm, Essex Urban context Riverine and estuarine environment SF 6516b Roman 25 x 19.5 x 8.7 Internal diameter 2.7 x 8.2 Sheet thickness 3.2 13.35g Small find group number has been assigned to several weights. No individual numbers to date. Context (17000). Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015	

W297 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6877a
Roman
24.6 x 13.5 x 10
Internal diameter 4.8 x 2.8
Sheet thickness 2
15.53g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000)
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W298 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6877b
Roman
22.7 x 8.2 x 7
Internal diameter 2.5
Sheet thickness 2
6.3g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W299 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 5489a
Roman
34.3 x 17.4 x 13.5
Internal diameter 3.8 x 9.2
Sheet thickness 1.8
28.82g
Context (17000)
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W300 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 5489b
Roman
52.4 x 18.9 x 17.3
Internal diameter 11.1
Sheet thickness 4.2
46.78g
Context (15353)
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W301 Heybridge, Elms Farm, Essex

Urban context
Riverine and estuarine environment
SF 5485
Roman
42.1 x 18.3 x 13.7
Internal diameter 2.8
Sheet thickness 1.9
34.78g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W302 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6622
Roman
46.2 x 17.5 x 11.8
Internal diameter 2.7
Sheet thickness 2.7
28.91g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W303 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6587a
Roman
41.2 x 19.8 x 16.4
Internal diameter 10.5 x 5.3
Sheet thickness 3.6
34.22g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W304 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6587b
Roman
25.7 x 18.4 x 14.6
Sheet thickness >6
35g
Small find group number has been assigned to several weights. No individual numbers to date.
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W305 Heybridge, Elms Farm, Essex

Urban context
Riverine and estuarine environment
SF 6587c
Roman
41.7 x 14.6 x 11.7
Internal diameter 3.5 x 2.5
Sheet thickness 3.3
22.12g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W306 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6587d
Roman
35 x 19.3 x 12.5
Internal diameter 3
Sheet thickness 2.7
28.85g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

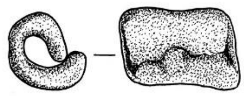
W307 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6587e
Roman
29.8 x 18.1 x 9.5
Internal diameter 1.7
Sheet thickness 3.1
18.02g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W308 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6587f
Roman
29.5 x 15.9 x 10.9
Internal diameter 4
Sheet thickness 2.9
15.09g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

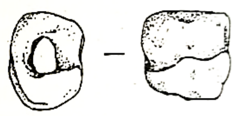
W309 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 6587g
Roman
29.5 x 11.1 x 9
Internal diameter 2.8
Sheet thickness 3.1
9g
Small find group number has been assigned to several weights. No individual numbers to date. Context (17000).
Courtesy of Ben Paites, Colchester Museum; See also Atkinson and Preston 2015

W310 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 5171a
Late Roman
55 x 14 x 11
Internal diameter 4 x 3.5
Sheet thickness 2
52g
Tyrrell 2015

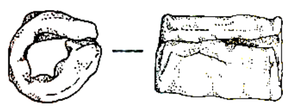
W311 Heybridge, Elms Farm, Essex
Urban context
Riverine and estuarine environment
SF 5171b
Late Roman
21 x 15 x 14
Internal diameter 5
Sheet thickness 4
14g
Tyrrell 2015



W312 Bishopstone, Sussex
Coastal and riverine
4th century
21.2 x 16 x 19
Internal diameter 5
Sheet thickness 5mm
Found together with W244, no weights taken. Uncertain stratigraphy but recovered directly above large amounts of 4th c. pottery.
Bell 1977, 184-5, Fig.84



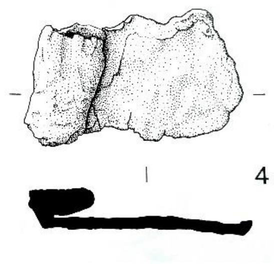
W313 Bishopstone, Sussex
Coastal and riverine
4th century
41 x 25 x 26
10 int. d.
6mm thick



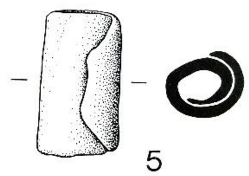
Found together with W243, no weights taken. Uncertain stratigraphy but recovered directly above large amounts of 4th c. pottery.
Bell 1977, 184-5, Fig.84

Anglo-Saxon, Medieval, and Unstratified Cylindrical Lead Artefacts

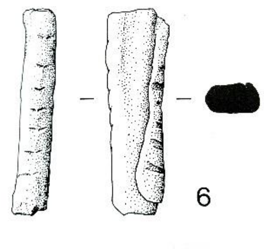
UW1
Fishergate, Norwich, Norfolk
Riverine environment
SF 80.91
Early 11th century
24 x 39 (partially unrolled diameter)
40g
Ayers 1994



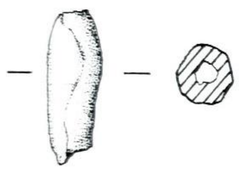
UW2
Fishergate, Norwich, Norfolk
Riverine environment
SF 169.75
11th century
24 x 13
35g
Ayers 1994
An additional partially rolled weight SF 194.165 is mentioned but not included in the publication.



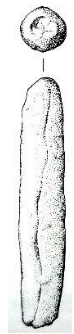
UW3
Fishergate, Norwich, Norfolk
Riverine environment
SF 196.165
11th century
38 x 12 x 6
30g
Ayers 1994



UW4
Fishergate, York, Yorkshire
Riverine environment
SF 480
8th-9th centuries
21
4.3g
Internal diameter 2.2mm
Rogers 1993



UW5
Fishergate, York, Yorkshire
Riverine environment
SF 482
8th-9th centuries
61.9
38.6g
An additional five lead weights have been found at this site (7 in total) but have no additional information.
Rogers 1993

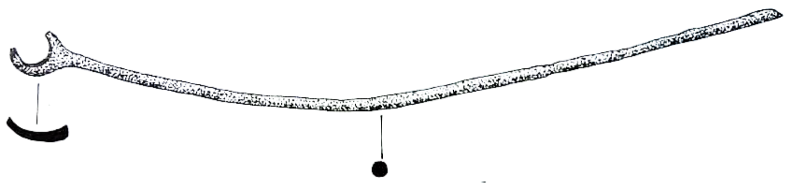


UW6	West Lindsey, Swinhope, Lincolnshire Riverine environment SF NLM-22BA33 8th-9th century 19.7 x 11.8 Sheet thickness: 2 13.6g Potable Antiquities Scheme	
UW7	West Lindsey, Swinhope, Lincolnshire Riverine environment SF NLM-226A02 8th -9th centuries 14.7 x 10.8 Internal diameter: 4 Sheet thickness: 2.5 8.76g Potable Antiquities Scheme	
UW8	West Lindsey, Northorpe, Lincolnshire Riverine environment SF NLM-CE5F27 8th century 41.7 x 16.9 x 14 8mm Central diameter 3mm thick 45.75g Potable Antiquities Scheme	
UW9	Winteringham, North Lincolnshire Riverine environment SF NLM-199F88 8th-10th centuries 18.7 x 16.2 Internal diameter: 7 Sheet thickness: 3 15.62g Potable Antiquities Scheme	
UW10 -52	Skirpenbeck, East Riding, Yorkshire Rural Riverine environment YORYM-2B5E43 Roman-Post Medieval Various measurements provided. 5.2-40.4 g range 43 artefacts recovered but returned to finder (metal detectorist). No contact information available. Portable Antiquities Scheme Vickers 2019a	
UW53-75	Skirpenbeck, East Riding, Yorkshire Rural Riverine environment YORYM-DF0B41 Various measurements provided.	

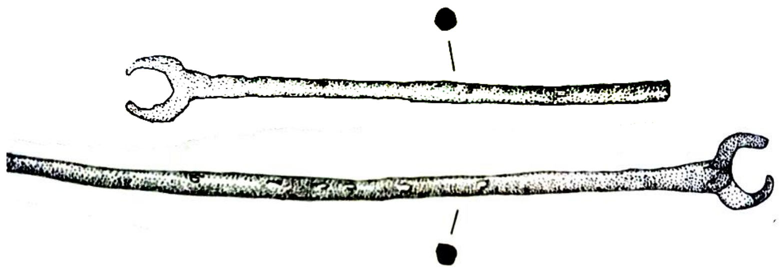
	7-24.7 g range 23 artefacts recovered but returned to finder (metal detectorist). No contact information available. The second assemblage from the same site as UW10-52 Portable Antiquities Scheme Vickers 2019b	
UW 76- 93	Blackfriars, Thames river, London Riverine/estuarine environment 15th entury Lengths vary from 14 to 45 Identified overlying a 15th century ship wreck and described as a seine net. These eighteen weights are part of an assemblage consisting of 1,109 weights. Marsden 1996	

Appendix A, Part 3: Catalogue of Romano-British Netting Needles

N1 South Shields, New Castle, Tyne and Wear
Military Fort, Vicus
Riverine and coastal environment
Record number 486
Roman
Cu.
72 x 5 x 2.5
67 RL
4 x 4 IPD/ Truncated
Described as 'bronze deviders', though with no further information.
Allason-Jones and Miket (1984, 174-176; fig.3.486)



N2 South Shields, New Castle, Tyne and Wear
Military Fort, Vicus
Riverine and coastal environment
Record number 487
Roman
Cu.
120 x 10 x 3 (in two pieces)
108 RL
4 x 4 / 5 x 4 IPD
Described as 'bronze dividers', though with no further information.
ü, 174-176; fig.3.487)



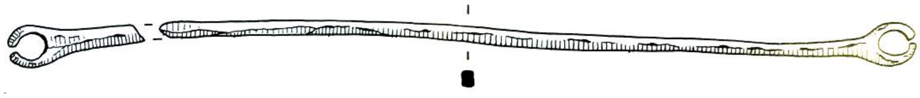
N3 Winterton, Lincolnshire
Rural, Villa
Riverine environment
3rd or 4th C AD
Fe.
160 x 12 x 5 (width provided is of the tail, not of the circular prongs).
117 RL
22 x 8 / 21 x ? IPD
Truncated head and open 'V' shaped tail.
Stead (1976)

N4 Wroxeter, Salop, Shropshire
Military Fort, East Portico
Riverine environment
SF B46
Potentially Pre-Flavian (Uncertain)
Fe.
228 x 21 x 6
157 RL
32 x 8/ 28 x 8 IPD
Atkinson (1942) (Illustration by L. Graña)

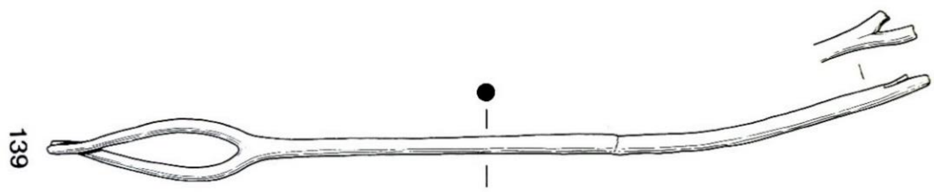
N5 Wroxeter, Salop, Shropshire
Military Fort, East Entrance
Riverine environment
SF B46a
Potentially Pre-Flavian (Uncertain)
Fe.
158 x 12 x 4.5
110 RL
15 x >5 (image is skewed, width is inaccurate) / Truncated IPD
Atkinson (1942) (Illustration by L. Graña)

N6 Wroxeter, Shropshire
Military Fort, East Entrance
Riverine environment
1st to E 2nd century
Fe.
174.5 x 11.5 x 6.5
140 RL
15 x 3/ truncated IPD
Circular Profile
Bushe-Fox (1914)

N7 Caister-on-sea, Norfolk
Military Fort
Coastal environment
SF 2092
Roman
Fe.
204 x 10 x 4 (TL including both pieces)
175 RL
7 x 6// 7 x 5 IPD
Broken, but recovered together
There is a potential second needle from this site, referenced by Darling and Gurney 1993, fig.91.599. It could not be located at this time. Area 2 of military fort.
Mould (1993)



N8 Hacheston, Suffolk
Settlement.
Riverine environment
SF Ae144
1st to 2nd c AD
Cu.
125 x 10 x 3.5 (TL truncated)
90 RL
20 x 5/ Truncated IPD
Prongs are set at right angles to each other. Little evidence for military presence in the area, though it has been suggested there was a fort nearby. Romano-British town, Pit in proximity to Building II (Round house)
Blagg et al. (2004)



N9 Littleport, East Camb., Cambridgeshire
Riverine environment
SF-C00841
Roman
Cu.
49.99 x 7.6 x 3.58 (Both TL and PW are truncated)
3.67g
Round profile of shank
Highly truncated object (less than half survives) Incomplete forked prongs at the surviving end. Dating is unreliable due to method of recovery. Found by metal detector (2007)

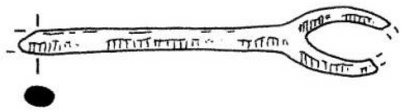
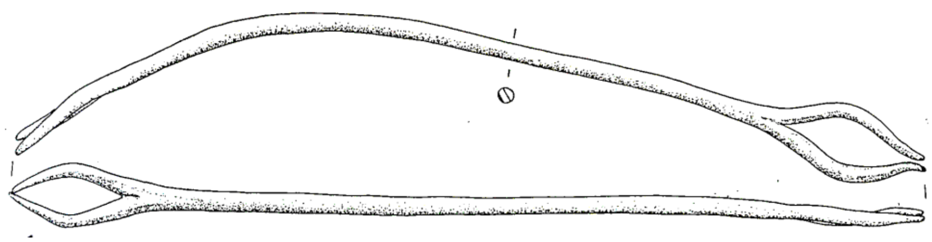
N10 Irchester, Wellingborough, Northamptonshire
Riverine environment, in proximity to the Nene and several tributaries
PAS ID: NARC941
AD43-300
Cu.
71.25 x 3.33 x 1.71
2.66g
Truncated needle with a missing end and a bend in the middle of the shank. Circular in section. Unclear type due to absence of an image
Found by metal detector
Johns (1996)

X

N11 Norton, Daventry, Northamptonshire
Riverine environment, in proximity to the Nene and several tributaries
PAS ID: NARC754
Roman
Cu.
Unknown length x 7.79 x 3.23
8.5g
Truncated needle of unknown type due to limited description and the absence of an image. One surviving end with a "flattened terminal with an oval aperture", rectangular section of shank at this end and sub-rounded towards the truncated end. Bent almost double.
Portable Antiquities Scheme. Found by metal detector (2000)

X

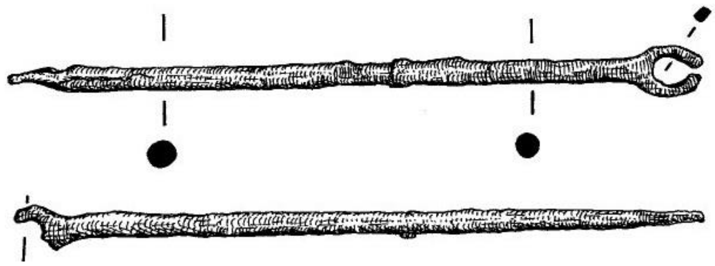
N12 Wicken, South Northam, Northamptonshire
Riverine environment, Great Ouse and in proximity to other tributaries
ID: BUC-BB09A5
Roman to Post Medieval (Uncertain)
Cu.
78.1 x 6.2 x 2.5 (truncated)
65 RL
11 x 4/ truncated IPD
2.03g
Rectangular profile of shank
Described as complete, which would suggest there is no further eye or pronged section to the tapered end. This would negate its function as a net-construction needle. Uncertainty with the dates also make this a poor candidate. Found by metal detector

N13	Balkerne Lane Colchester, Essex Settlement, period of defences, in proximity to temples Riverine environment River Colne SF BKC4167 Roman Cu. 125 x 10 x 3.5 80 RL 15 x 4/ ? Skewed IPD Eyes set at right angles. Described as square profile of shank, though unclear in illustration due to corrosion. Crummy (1995) 
N14	Elms Farm, Heybridge, Essex Riverine and estuarine environments SF 7569 Roman Fe. 75 x 14 x 5 (truncated) 54mm remaining RL 15 x 8/ T IPD Appears to be less than half of the tool, therefore an estimated TL of >150 Circular profile Atkinson (2015) 
N15	Barton Court Farm, Abingdon, Oxfordshire Rural enclosure ditch Riverine environment, proximity Thames river Early Roman (1st-2nd c) Cu. 170 x 12 x 4 115 RL 20 x 13/ 23 x 13 IPD Prongs are 28 and 20mm long and are set at right angles Round profile of shank Miles (1984) 

N16 Kingsholm Square, Gloucestershire
Military site
Riverine environment
Record number A2983 (Gloucester Museum)
1st to 2nd C AD
Cu.
Unknown measurements
On display at Gloucester Museum. Associated with disturbed military context, truncated by later inhumations, though no grave goods were associated.
Gloucester Museum correspondence, David Rice. No published or un-published material. Rennie 1953 is a single paragraph excavation report; he states that a netting needle was found and taken to the Gloucester museum, but there is no confirmed corelation
(Illustration by L. Graña)

N17 Hod Hill, Stourpaine, Dorset
Military Fort
Riverine environment
1st-2nd C AD
Cu.
207 x 14 x 4
135 RL
30 x 9 / 32 x ?
No evidence or mention of truncation, may be the orientation of the prongs set at right angles [recorded as such].
Durden Collection (part of the British Museum collections)

N18 Hod Hill, Stourpaine, Dorset
Military Fort
Riverine environment
Record number 1892,0901.1325 (British Museum)
1st to mid 2nd C AD
Fe.
156 x 11 x 5
125 RL
9 x 6/ 5 x ? IPD
Round shape of profile
Prongs are set at right angles
Durden Collection (part of the British Museum collections)
Payne (1892)

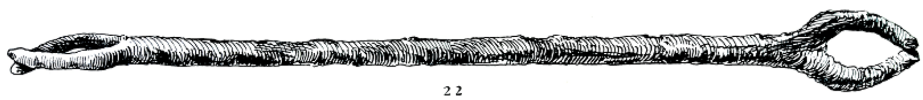


N19	Hascombe Court, Dorchester (Durnovaria), Dorset Riverine ecosystem Mid 1st c Cu. 140 x 11 x 3 115 RL 10 x 3/ 10 x 4 IPD Described as a “mollusc pick” Trevarthen (2008, 20)

N20	Hengistbury Head, Dorset Coastal environment Roman Cu. 240 x 12 x 5 210 RL 15 x 6/ truncated IPD Circular Profile Bushe-Fox (1915)

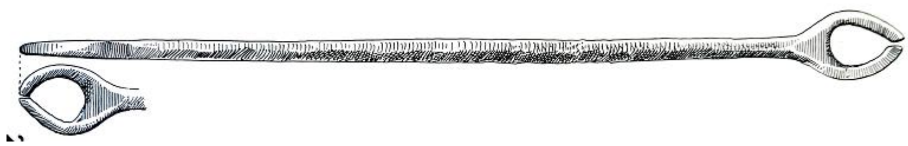
N21	County Hall, Dorchester, Dorset Riverine environment SF 4534 L1st-M2nd Cu. 100 x 11 x 5 (truncated) 80 RL (truncated) Circular profile From context (456) Street metalling Smith (1993, 31; fig.17.8)

N22 Richborough, Kent
Military Fort, South wall, unstratified context
Riverine and coastal environment
Roman (Unconfirmed)
Cu.
140 x 12.5 x 4.5
103 RL
12 x 6/ 11 x (skewed width) IPD
Round shape of profile
Prongs are set at right angles.
Bushe-Fox (1926), Described as Roman



22

N23 Richborough, Kent
Military Fort, Pit 269, context (4937)
Riverine and coastal environment
AD 80-95
Cu.
139 x 11 x 3.5
105 RL
10 x 7/ 9 x7 IPD
Sub-rounded shape of profile
Prongs are set at right angles. Dating based on samian ware from the pit.
Cunliffe (1968)



N24 Ickham, Kent
Coastal environment
SF ON591
The artefact is mentioned in two sources, Mould (2010) and Bennett (2010) but with no data on the size, material or provenance. SF number exists, but the artefact could not be located for this thesis.

X

N25 Saltwood Tunnel, Kent
Coastal environment
SF ON591
Fe.
223 x 5
56 / truncated IPD
Square profile. “Complete [condition]. A twin-pronged iron implement with a long shaft of square section tapering at one end to a rounded terminal. The other end bifurcates to form two prongs, both tapered on all sides.”
Riddler and Ager (2006).

X

N26	Billingsgate Market, Lorry Park, London Settlement Riverine and estuarine environment SF 1154 Roman Cu. Record referenced in Museum of London online archive https://www.museumoflondon.org.uk/collections/other-collection-databases-and-libraries/museum-london-archaeological-archive (accessed February 2019, but since removed following update of website). Hard copies may be available at MOLA. Context [184]. Site code BWB83. Could not access for the thesis. X
N27	Thames Bank, London Riverine and estuarine environment Cu. Mentioned by Ayodeji (2004), but with no further data nor references. The artefact could not be located at this time X

Appendix C, Part 1: Hook Data Table

ID	Site	County	Latitude	Longitude	Confirmed Coords	Region	Site Code	SF Number	Date	Environment	Cultural Context	Size (L x W x D in mm)	Shape	Size Grouping	Point	Terminal	Profile of shank	Material
H01	Vindolanda	Northumberland	54.990997	-2.3604083	N	N		21200	409	Riverine	Military	35 x 5 x 1	L	S	B?	E3	C	Cu.
H02	South Shields, New Castle	Tyne and Wear	55.004735	-1.4314	N	N		BR2	43-410	R & C	Military	?	?	?	?	?	?	?
H03	South Shields, New Castle	Tyne and Wear	55.004735	-1.4314	N	N		BR3	43-410	R & C	Military	?	?	?	?	?	?	?
H04	South Shields, New Castle	Tyne and Wear	55.004735	-1.4314	N	N		BR500	L3rd-E4th	R & C	Military	?	?	?	?	?	?	?
H05	South Shields, New Castle	Tyne and Wear	55.004735	-1.4314	N	N		BR544	4th	R & C	Military	?	?	?	?	?	?	?
H06	Binchester	Durham	54.682763	-1.6439581	N	N		?	43-410	Riverine	?	143 x 41 x 8	J	L	B3*	?	?	Fe.
H07	Millenium Project, Carlisle	Cumbria	54.896409	-2.94193	N	N		3285	83-94	Riverine	Military	25 X 12	J	S	B3	F2*	C	Fe.
H08	Beadlam	Yorkshire	54.049453	-1.590999	N	NE		LA/CR 705811	43-410	Riverine	Rural	115	J	L	B2	E1	S	Fe.
H09	Ribblesdale Mill, Ribchester	Lancashire	53.813902	-2.531367	N	NW		170	43-410	Riverine	Military	16	I	?	T	Tr	?	Fe.
H10	Ribchester	Lancashire	53.813902	-2.531367	N	NW		6/5631/2 Oxf221	43-410	Riverine	Military	39 x 16 x 2	J	S	P	?	?	Fe.
H11	Deanery Field, Chester	Cheshire	53.193757	-2.890929	Y	NW		?	1st	Riverine	Military	70 X 16	L	M	B3	E2*	M	Fe.
H12	Chester	Cheshire	53.190987	-2.8960669	N	NW		1884.245	43-410	R & E	Settlement	?	J	?	B3	F?	S	Cu.
H13	South Ferriby, Humber	Lincolnshire	53.677307	-0.505358	N	NE		2006.11370	43-410	R & E	?	51	J	M	B6*	Tr	S	Fe.
H14	Sites VI and VII, Wroxeter	Shropshire	52.674433	-2.644089	N	SW		?	1st-2nd	Riverine	Military	23 x 14	J	S	B1	F*	?	Cu.
H15	Wroxeter	Shropshire	52.674284	-2.6441431	N	SW		78000169	43-410	Riverine	?	?	J	?	T	F3	S	Cu.
H16	Wroxeter	Shropshire	52.674284	-2.6441431	N	SW		775562	43-410	Riverine	?	29 x 11 x 2	J	S	B?	F?	?	Cu.
H17	Wroxeter	Shropshire	52.674284	-2.6441431	N	SW		7310052	43-410	Riverine	?	28 x 14 x 3	J	S	P	?	S	Fe.
H18	Wroxeter	Shropshire	52.674284	-2.6441431	N	SW		7410422	43-410	Riverine	?	67 x 27 x 4	J	M	B8	?	S	Fe.
H19	Wroxeter	Shropshire	52.674284	-2.6441431	N	SW		811028	43-410	Riverine	?	37.5 x 18	J	S	?	?	?	Fe.
H20	Wroxeter	Shropshire	52.674284	-2.6441431	N	SW		?	43-410	Riverine	?	68 x 32 x 5	J	M	B3	F?	C	Fe.
H21	Wroxeter	Shropshire	52.674284	-2.6441431	N	SW		?	43-410	Riverine	Military	59 x 30 x 5	J	M	P	Tr	S	Fe.
H22	Wroxeter	Shropshire	52.674284	-2.6441431	N	SW		?	43-410	Riverine	Military	41	J	S	T	E3	S	?
H23	Wroxeter	Shropshire	52.674284	-2.6441431	N	SW		?	43-410	Riverine	?	?	?	?	?	?	?	Cu.
H24	Caister-on-sea	Norfolk	52.65082	1.719074	N	SE		2959	E-M4th	Coastal	Military	?	J	?	B5	Tr	C	Cu.
H25	Longthorpe, Peterborough	Cambridgeshire	52.568163	-0.291491	N	NE		?	60	Riverine	Military	25 x 7 x 1.5	L	S	B4	E3	C	Cu.
H26	St Albans	Hertfordshire	51.749848	-0.355843	N	SE		?	5th	Riverine	Military	?	J	?	B1	F2	C	Cu.
H27	Elms Farm, Heybridge	Essex	51.742475	0.670704	N	SE		5786	L2nd-E/M3rd	R & E	Settlement	30	?	S	P	F1	C	Cu.
H28	Woodeaton	Oxfordshire	51.805181	-1.224413	N	SE		?	43-410?	Riverine	Rural	19 x 14	J	S	B4	N	?	Cu.
H29	Worsham	Oxfordshire	51.791252	-1.567799	N	SE		AN1948.209	43-410	Riverine	Rural	32	J	S	P	Tr	S	Fe.
H30	Appleford	Oxfordshire	51.640415	-1.240112	N	SE		AN2009.1068.a	4th	Riverine	Rural	120 x 95	D	L	P	E1	?	Fe.
H31	Lower Slaughter, Farnworth	Gloucestershire	51.901633	-1.762962	N	SE		A24353	43-410	Riverine	?	?	J	?	P	E1	S	Fe.
H32	Eastgate Street, Gloucester	Gloucestershire	51.86356	-2.24244	N	SW		1974.46.i.77/353	43-410	Riverine	Military	?	?	?	?	?	?	Cu.
H33	Northgate Street, Gloucester	Gloucestershire	51.867066	-2.241517	N	SW		58	43-410	Riverine	Military	?	?	?	?	?	?	Cu.
H34	Bourton Bridge, Bourton-on-the-Water	Gloucestershire	51.886969	-1.76828	N	SE		1977.37/471	43-410	Riverine	?	?	?	?	?	?	?	Cu.
H35	Santhill	Gloucestershire	51.881947	-1.744580	N	SE		?	337-350	Riverine	?	?	?	?	?	?	?	Cu.
H36	Santhill	Gloucestershire	51.881947	-1.744580	N	SE		?	337-350	Riverine	?	?	?	?	?	?	?	Cu.
H37	Sea Mills	Bristol	51.486856	-2.642857	N	SW		?	1st-2nd, or 5th?	Riverine	Settlement	?	R	?	B3	F2	S	Fe.
H38	Keynsham	Somerset	51.41457	-2.500206	N	SW		?	43-410	Riverine	Rural	?	?	?	?	?	?	?
H39	Hod Hill, Blackmore Vale	Dorset	50.894003	-2.202039	N	S		1892.0901.581	43-410	Riverine	Military	52.9 x 50 x 1.2	D	M	?	?	?	?
H40	Hod Hill, Blackmore Vale	Dorset	50.894003	-2.202039	N	S		F139	43-410	Riverine	Military	110	?	L	?	?	?	?
H41	Portchester	Hampshire	50.837415	-1.113912	Y	S		1293	43-410	Coastal	Military	53 x 16	J	M	B1	F1	C	Cu.
H42	Silchester	Hampshire	51.357556	-1.082436	N	SE		2639	117-161	Riverine	Settlement	45 x 15 x 4	L	M	B3*	F1	C	?
H43	Cattlemarket, Chichester	West Sussex	50.83501	-0.772825	N	S		1182	3rd-4th	R & E	Military	27 x 18	J	S	B3	F1	S	Cu.
H44	Cattlemarket, Chichester	West Sussex	50.83501	-0.772825	N	S		469	L1st-L2nd	R & E	Military	23.5 x 19 x 2	J	S	B3	F1	S	Cu.
H45	East Pallant, Chichester	West Sussex	50.835156	-0.777782	N	S		221	R-M	R & E	Military	42 x 20	J	S	B5	F2	S	Cu.
H46	Fishbourne, Chichester	West Sussex	50.835878	-0.81048	N	S		?	L3rd-E4th, or L1st	Riverine	Rural	31	J	S	B1	F2	C	Cu.
H47	Fishbourne, Chichester	West Sussex	50.835878	-0.81048	N	S		?	L3rd-E4th, or L1st	Riverine	Rural	33	J	S	B2*	F3	C	Cu.
H48	Northwest Quadrant, Chichester	West Sussex	50.835156	-0.777782	N	S		27	M2nd	R & E	Settlement	15 x 9 x 1.5	J	S	B3	F1	C	Cu.
H49	Richborough	Kent	51.293094	1.331827	N	S		?	43-410	Coastal	?	68 x 21 x 4	J	M	B3	Tr	S	?
H50	Thames	Greater London	51.507129	-0.119778	N	SE		1884.11.43	43-410	R & E	Rural	30 x 10	J	S	B7	F*	C	Cu.
H51	Thames	Greater London	51.507129	-0.119778	N	SE		1884.11.44	43-410	R & E	Rural	30 X 33	D	M	B3/B3	E1	S	Cu.
H52	London	London	51.507848	-0.088062286	N	SE		1950.10.2.81	43-410	R & E	Settlement	107.3 x 32 x 4.5	L	L	B3	F3*	S	Fe.
H53	London	London	51.507848	-0.088062286	N	SE		96.5-1.38	43-410	R & E	Settlement	96.5 x 1.38	I	M	B3	Tr	S	Fe.
H54	London	London	51.507848	-0.088062286	N	SE		1950.10.2.82	43-410	R & E	Settlement	102.9 x 27.3 x 4.2	L	L	B3	F1	S	Fe.
H55	London	London	51.507848	-0.088062286	N	SE		1950.10.2.83	43-410	R & E	Settlement	65 x 27.3 x 3.7	J	M	B3	F1	S	Fe.
H56	London	London	51.507848	-0.088062286	N	SE		58.9-16.67	43-410	R & E	Settlement	67.6 x 23.9 x 3.6	J	M	B8	Tr	S	Fe.
H57	London	London	51.507848	-0.088062286	N	SE		58.9-16.66	43-410	R & E	Settlement	35 x 13.9 x 2	J	S	B4	F2	M	Cu.
H58	London	London	51.507848	-0.088062286	N	SE		58.9-16.68	43-410	R & E	Settlement	28.4 x 23.9	J	M	B8	Tr	S	Fe.
H59	London	London	51.507848	-0.088062286	N	SE		58.9-16.69	43-410	R & E	Settlement	37.7 x 17.4 x 3.2	J	S	B8	Tr	S	Fe.

H60	London	London	51.507848	-0.088062286	N	SE	58.9-16.70	43-410	R & E	Settlement	49.6 x 19.1 x 3.3	J	M	B8	F2	S	Fe.
H61	London	London	51.507848	-0.088062286	N	SE	1943.1001.19	43-410	R & E	Settlement	60.4 x 26.8 x 3.5	J	M	B8	F2	S*	Fe.
H62	London	London	51.507848	-0.088062286	N	SE	1896.0501.32	43-410	R & E	Settlement	27.1 x 11.4 x 1.4	J	S	B5	F1	M*	Cu.
H63	River Thames, London	London	51.507848	-0.088062286	N	SE	1865.1203.10	43-410	R & E	Settlement	22.94 x 12.67 x 1.19	J	S	B1*	F1	C	Cu.
H64	Hammersmith	London	51.490683	-0.22994041	N	SE	WG1766	43-410	R & E	Settlement	25.37 x 12.32 x 2.28	J	S	P	Tr	S*	Cu.
H65	Lombard Street	London	51.512395	-0.086613894	N	SE	1896.0501.34	43-410	R & E	Settlement	41.77 x 19.40 x 2.02	J	S	B1	E1	C	Cu.
H66	Tokenhouse Yard, Lothbury	London	51.515132	-0.088400245	Y	SE	189.0501.30	43-410	R & E	Settlement	85.99 x 32.60 x 3.37	J	M	B4*	E1	C	Fe.
H67	Tower Street	London	51.513223	-0.12774020	Y	SE	1896.0501.31	43-410	R & E	Settlement	51.45 x 74.13 x 2.40	D	M	P	E1	C	Cu.
H68	River Thames, London	London	51.507848	-0.088062286	N	SE	1856.0701.1258	43-410	R & E	Settlement	24.69 x 12.60 x 1.70	J	S	B8	F1	C	Cu.
H69	London	London	51.507848	-0.088062286	N	SE	1856.0701.1256	43-410	R & E	Settlement	26.93 x 8.63 x 1.21	J	S	B5*	F2	C	Cu.
H70	River Thames, London	London	51.507848	-0.088062286	N	SE	1856.0701.1257	43-410	R & E	Settlement	26.48 x 7.55 x 1.25	J	S	B5	F1	S	Cu.
H71	River Thames, London	London	51.507848	-0.088062286	N	SE	1838.0220.18	43-410	R & E	Settlement	24.40 x 5.81 x 2.25	Q	S	P	A	S	Cu.
H72	River Thames, London	London	51.507848	-0.088062286	N	SE	1864.0903.3	43-410	R & E	Settlement	34.38 x 7.19 x 1.78	Q	S	P	A	C	Cu.
H73	River Thames, London	London	51.507848	-0.088062286	N	SE	1864.0903.2	43-410	R & E	Settlement	43.61 x 14.01 x 1.71	D*	S	P	A	C	Cu.
H74	Tokenhouse Yard, Lothbury	London	51.515132	-0.088400245	N	SE	1896.0501.28	43-410	R & E	Settlement	51.34 x 33.30 x 2.54	J	M	P	F1	C	Cu.
H75	Lombard Street	London	51.512433	-0.086621940	N	SE	1896.0501.33	43-410	R & E	Settlement	66.97 x 22.90 x 4.75	J	M	B3	Tr	S	Fe.
H76	Tokenhouse Yard, Lothbury	London	51.515132	-0.088400245	N	SE	1896.0501.29	43-410	R & E	Settlement	90.1 x 34.2 x 2.9	J	M	B1	E1	C	Fe.
H77	Walbrook	London	51.512248	-0.090406537	N	SE	19176	M1st-M2nd	R & E	Settlement	21 x 17	?	S	?	?	?	Cu.
H78	St Magnus House, London	London	51.5092378	-0.0856011	Y	SE	178	M3rd	R & E	Settlement	79 x 33 x 3.5	J	M	B1	F3	C	Fe.
H79	Bilingsgate Market, Lorry Park, London	London	51.5088894	-0.084088	Y	SE	3529	43-410	R & E	Settlement	?	?	?	?	?	?	Cu.
H80	Caerleon	Gwent	51.608664	-2.954161	N	SW	?	L3rd	Riverine	Military	22	J	S	B1	E3	S	Cu.

Key:

?: Unknown Datum
SF: Small Find
R & C: River and Coastal Environment
R & E: River and Estuary Environment
Dates:
- E: Early
- M: Mid
- L: Late

Confirms Coords:
- N: No confirmed coordinates of context or trench. Coordi
- Y: Yes. Confirmed coordinates of the context or trench.

Hook Morphology:
- Size Groupings:
  - S: Small
  - M: Medium
  - L: Large
- Shape:
  - J: 'J' or Simple hook
  - L: Elongated hook
  - D: Double hook
  - Q: Quadrangular hook
  - R: Ring hook

Point:
- B: Barbed
- P: Pointed
- T: Truncated

Terminal:
- E: Eye
- F: Flattened
- N: Notched
- A: Absent
- Tr: Truncated

Profile of Shank:
- S: Square
- C: Circular
- M: Mixed

Material:
- Fe: Iron
- Cu: Copper

Appendix C, Part 2: Weight Data Table

ID	Site	County	Latitude Longitude	Region	Site Code	SF Number	Date	Environment	Cultural Context	Type	Sub-Type	State of Preservation	Weight (g)	Size (L x W x H in mm)	Internal Diameter	Sheet Thickness
W001	Portchester	Hampshire	50.836943,-1.115066	S	?		AD 270-317	Coastal	Military	Rolled	Clasped	Partially overlapped	?	34 x 20 x 14	?	?
W002	Grange Road, Fenham, Newcastle	Tyne and Wear	54.981437,-1.663459	N	GRF17	153	?	Riverine	?	Rolled	Clasped	Partially overlapped	9	26 x 11	?	?
W003	Ower, Purbeck	Dorset	50.6700,-2.004755	S	?	243	1st-2nd	Coastal	?	Rolled	Clasped	Partially unrolled	?	36.5 x 18 x 20	4.5 x 11	3
W004	Frocester	Gloucestershire	51.727049,-2.312019	SW	?	5	4th	Riverine	Military	Rolled	Clasped	Partially unrolled	?	33 x 12.5 x 9	4 x 7	3
W005	South Marston, Swindon	Wiltshire	51.590092,-1.722505	SE	?	WILT-745597	R-MED	Riverine	?	Rolled	Overlapped		14.68	14.34 x 12.97	5 x 3.5	2-2.5
W006	Durston, Taunton Deane	Somerset	51.046819,-3.028477	SW	?	WILT-EE1C84	Roman	Riverine	?	Rolled	Overlapped	Nail through it	121.17	30.13 x 32.14 x 25	17 x 5	1.84
W007	Shavington Cum Gresty	Cheshire	53.062465,-2.447459	NW	?	LVPL-85ADA3	Roman	Riverine	?	Rolled	Clasped	One side overlap	3.4	25.46 x 7.86 x 7.84	<1	1.5
W008	Oswestry	Shropshire	52.87166,-3.047600	SW	?	LVPL-DEA234	Roman	Riverine	?	Rolled	Clasped	One side overlap	10.7	26.21 x 9.85	4 x 2	3.5
W009	Skirpenbeck, East Riding	Yorkshire	53.995029,-0.903226	NE	?	YORYM-50E11C	R-MED	Riverine	?	Rolled	Clasped		17.7	25.28 x 12.87	4.5	3.5
W010	Barton-le-Street, Ryedale	Yorkshire	54.158779,-0.896772	NE	?	YORYM-0346A3	R-MED	Riverine	?	Rolled	Clasped	Partially overlapped	21.9	34.8 x 10.9	?	?
W011	Caerleon	Wales	51.610143,-2.954040	SW	?		L2nd - L3rd	Riverine	Military	Rolled	Clasped		?	50 x 11 x 9	6 x 5	2.5
W012	Carmarthen	Wales	51.855698,-4.305569	SW	?	1300	Roman	Riverine	Settlement	Rolled	Clasped		?	85 x 20 x 10	15 x 5	3
W013	Ickham	Kent	51.278276,1.182988	S	ick74	93 (180?)	L4th	Riverine	?	Rolled	?		?	?	?	?
W014	Saltwood Tunnel	Kent	51.092088,1.0566187	S	?	ON583	Roman	Coastal	?	Rolled	Clasped	One side overlap	18	22 x 11	3	2.5
W015	Ashford, Great Chart	Kent	51.144093,0.8344084	S	?	KENT-2E8965	R-MED	Riverine	?	Rolled	Overlapped	Partially unrolled	22.6	17.32 x 13.8 x 22	?	1-2mm
W016	Blyton, West Lindsey	Lincolnshire	53.441482,-0.721614	NE	?	NLM-6CECC7	Roman	Riverine	?	Rolled	Clasped	Partially overlapped	5.8	23.7 x 8.2	<1	1
W017	Scotter, West Lindsey	Lincolnshire	53.497827,-0.671573	NE	?	NLM-EA50C0	Roman	Riverine	?	Rolled	Overlapped	Two layers	63.53	45.1 x 16	<1	2
W018	Bottersford	Lincolnshire	53.552227,-0.652861	NE	?	NLM-7C6EA5	Roman	Riverine	?	Rolled	Overlapped	Three layers	13.33	34.6 x 11.5 x 8.1	?	1-2mm
W019	Blyborough	Lincolnshire	53.438326,-0.599484	NE	?	NLM-92F452	Roman	Riverine	?	Rolled	Overlapped	Three layers	35.44	27.9 x 15.4	2	1.7
W020	Roxby Cum Risby	Lincolnshire	53.640348,-0.610396	NE	?	NLM-017218	Roman	R & E	?	Rolled	Overlapped	Two layers	7.32	28.4 x 9.4	<1	0.6
W021	Hunt's House, Guy's Hospital	London	51.503206,-0.087099	SE	HH097	350	4th-5th	R & E	Settlement	Rolled	?		9	15 x 10.5	?	?
W022	Hunt's House, Guy's Hospital	London	51.503206,-0.087099	SE	HH097	468	4th-5th	R & E	Settlement	Rolled	?		10	14 x 12	?	?
W023	Forest Heath, Mildenhall	Suffolk	52.344359,0.511379	NE	?	379644	IA-MED	Riverine	?	Rolled	?		19.52	38.65 x 16.82 x 8.07	?	?
W024	Forest Heath, Mildenhall	Suffolk	52.344359,0.511379	NE	?	379644	IA-MED	Riverine	?	Rolled	?		6.61	26.09 x 9.32 x 5.27	?	?
W025	Rushock, Wyre Forest	Worcestershire	52.336949,-2.177542	SW	?	WMID-B20138	Roman	Riverine	?	Folded	Folded		103.4	51.9 x 39.1 x 5.99	?	3
W026	Rushock, Wyre Forest	Worcestershire	52.336949,-2.177542	SW	?	WMID-B21774	Roman	Riverine	?	Folded	M/F		249	45.1 x 39.5 x 21.3	?	4
W027	Isle of White	Isle of White	50.709019,-1.294920	S	?	IOW-76D368	Roman	Coastal	?	Rolled	Overlapped		7.08	12.39 x 10.69 x 7.51	<1	2.3
W028	Isle of White	Isle of White	50.709019,-1.294920	S	?	IOW-F3FB7A	R-MED	Coastal	?	Rolled	Overlapped		11.84	15.1 x 12.7 x 10.2	1	1-1.5
W029	Isle of White	Isle of White	50.709019,-1.294920	S	?	IOW-3366C7	R-MED	Coastal	?	Rolled	Overlapped		6.88	12.4 x 10 x 8.6	0.5	2
W030	Binchester	County Durham	54.676358,-1.676335	N	BCP18	?	L4th-E5th	Riverine	Military	Rolled	Clasped	Flattened	3.3	12.5 x 9	?	?
W031	Binchester	County Durham	54.676358,-1.676335	N	BCP18	?	L4th-E5th	Riverine	Military	Rolled	Clasped		2.6	11.5 x 8	?	?
W032	Binchester	County Durham	54.676358,-1.676335	N	BCP18	?	L4th-E5th	Riverine	Military	Rolled	Clasped		14.6	28 x 13	?	?
W033	Binchester	County Durham	54.676358,-1.676335	N	BCP18	?	L4th-E5th	Riverine	Military	Rolled	Clasped	Flattened	7.3	24 x 11, 17.5 where flat	?	?
W034	Gloucester	Gloucestershire	51.865331,-2.245748	SW	31/87	9	Roman	Riverine	?	Rolled	Clasped		55	39 x 17 x 15	?	4
W035	Gloucester	Gloucestershire	51.865331,-2.245748	SW	9//83	2750	Roman	Riverine	Military	Rolled	Clasped	One side overlapped, other damaged	15	35 x 11.3 x 8.8	?	3
W036	Gloucester	Gloucestershire	51.865331,-2.245748	SW	9//83	2413	Roman	Riverine	Military	Rolled	Clasped		20	44.5 x 12 x 10.6	5.8	2
W037	Gloucester	Gloucestershire	51.865331,-2.245748	SW	51/66	A8314	Roman	Riverine	?	Rolled	Overlapped	Over four layers	54	60.1 x 20 x 14.6	0	0.95
W038	Blacklands Villa, Graveney	Kent	51.314252, 0.9209203	SE	?	?	Roman	R & C	Rural villa	Rolled	Clasped	Widened at one end	20.1	42	?	?
W039	Blacklands Villa, Graveney	Kent	51.314252, 0.9209203	SE	?	?	Roman	R & C	Rural villa	Rolled	Clasped	Lightly curved	22.1	41.1	?	?
W040	Blacklands Villa, Graveney	Kent	51.314252, 0.9209203	SE	?	?	Roman	R & C	Rural villa	Rolled	Clasped	Widened at one end	19.9	44.5	?	?
W041	Blacklands Villa, Graveney	Kent	51.314252, 0.9209203	SE	?	?	Roman	R & C	Rural villa	Rolled	Clasped	Widened at both ends	27.6	47.1	?	?
W042	Blacklands Villa, Graveney	Kent	51.314252, 0.9209203	SE	?	?	Roman	R & C	Rural villa	Rolled	Clasped		24.4	47.5	?	?
W043	Blacklands Villa, Graveney	Kent	51.314252, 0.9209203	SE	?	?	Roman	R & C	Rural villa	Rolled	Clasped	Widened at one end	20.3	43.6	?	?
W044	Blacklands Villa, Graveney	Kent	51.314252, 0.9209203	SE	?	?	Roman	R & C	Rural villa	Rolled	Clasped		20.1	35.2	?	?
W045	Gill Mill Quarry	Oxfordshire	51.760455,-1.450509	SE	DUGM	524	M3-4th	Riverine	Settlement	Rolled	Clasped		8	38 x 8	3-4mm	2
W046	Gill Mill Quarry	Oxfordshire	51.760455,-1.450509	SE	DUGM	530	M3-4th	Riverine	Settlement	Rolled	Clasped		18	62 x 9	?	2
W047	Gill Mill Quarry	Oxfordshire	51.760455,-1.450509	SE	DUGM	531	M3-4th	Riverine	Settlement	Rolled	Clasped		12	41 x 0	3	2
W048	Gill Mill Quarry	Oxfordshire	51.760455,-1.450509	SE	DUGM	532	M3-4th	Riverine	Settlement	Rolled	Clasped		7	37 x 7.5	3	2
W049	Gill Mill Quarry	Oxfordshire	51.760455,-1.450509	SE	DUGM	533	M3-4th	Riverine	Settlement	Rolled	Clasped		4	24 x 7	3	2
W050	Gill Mill Quarry	Oxfordshire	51.760455,-1.450509	SE	DUGM	534	M3-4th	Riverine	Settlement	Rolled	Clasped		6	24 x 8	2-4mm	2
W051	Gill Mill Quarry	Oxfordshire	51.760455,-1.450509	SE	DUGM	535	M3-4th	Riverine	Settlement	Rolled	Clasped		6	20 x 9	3	2
W052	Gill Mill Quarry	Oxfordshire	51.760455,-1.450509	SE	DUGM	537	M3-4th	Riverine	Settlement	Rolled	Clasped		5	41 x 8.5		2
W053	Gill Mill Quarry	Oxfordshire	51.760455,-1.450509	SE	DUGM	538	M3-4th	Riverine	Settlement	Rolled	Clasped		8	31 x 10	3	2
W054	Gill Mill Quarry	Oxfordshire	51.760455,-1.450509	SE	DUGM	539	M3-4th	Riverine	Settlement	Rolled	Clasped		9	35 x 9	3	2
W055	Dickson´s Corner, Worth	Kent	51.260192,1.386475	S	DC18	1	Unstratified	Coastal	?	Rolled	Clasped	Opened on one side only	24	23 x 17	?	4
W056	Dickson´s Corner, Worth	Kent	51.260192,1.386475	S	DC18	2	Unstratified	Coastal	?	Rolled	Opened	Some damage as if opened by a tool	78	52 x 22	?	4
W057	Dickson´s Corner, Worth	Kent	51.260192,1.386475	S	DC18	3	Unstratified	Coastal	?	Rolled	Clasped	Slightly Flattened	22	17 x 19	?	?
W058	Dickson´s Corner, Worth	Kent	51.260192,1.386475	S	DC18	4	Unstratified	Coastal	?	Rolled	P/U	Evidence of original bends	25	38 x 39	?	1
W059	Dickson´s Corner, Worth	Kent	51.260192,1.386475	S	DC18	5	Unstratified	Coastal	?	Rolled	P/U		22	41 x 32	?	1

W060	Dickson´s Corner, Worth	Kent	51.260192,1.386475	S	DC18	6	Unstratified	Coastal	?	Rolled	Clasped		20	47 x 12	?	?
W061	Dickson´s Corner, Worth	Kent	51.260192,1.386475	S	DC18	7	Unstratified	Coastal	?	Rolled	P/U		58	43 x29	?	?
W062	Dickson´s Corner, Worth	Kent	51.260192,1.386475	S	?	?	Mid 1st	Coastal	Settlement	Rolled	Clasped	Partially opened	23.5	50 x 11 x 12	4	3.5
W063	Dickson´s Corner, Worth	Kent	51.260192,1.386475	S	?	?	Mid 1st	Coastal	Settlement	Rolled	Opened		38.7	44 x 14 x 14	5	4
W064	Dickson´s Corner, Worth	Kent	51.260192,1.386475	S	?	?	Mid 1st	Coastal	Settlement	Rolled	?		28	43-48	?	?
W065	Dickson´s Corner, Worth	Kent	51.260192,1.386475	S	?	?	Mid 1st	Coastal	Settlement	Rolled	?		28	43-48	?	?
W066	Dickson´s Corner, Worth	Kent	51.260192,1.386475	S	?	?	Mid 1st	Coastal	Settlement	Rolled	?		28	43-48	?	?
W067	Dickson´s Corner, Worth	Kent	51.260192,1.386475	S	?	?	Mid 1st	Coastal	Settlement	Rolled	?		28	43-48	?	?
W068	Dickson´s Corner, Worth	Kent	51.260192,1.386475	S	?	?	Mid 1st	Coastal	Settlement	Rolled	?		28	43-48	?	?
W069	Dickson´s Corner, Worth	Kent	51.260192,1.386475	S	?	?	Mid 1st	Coastal	Settlement	Rolled	?		28	43-48	?	?
W070	Dickson´s Corner, Worth	Kent	51.260192,1.386475	S	?	?	Mid 1st	Coastal	Settlement	Rolled	?		28	43-48	?	?
W071	Dickson´s Corner, Worth	Kent	51.260192,1.386475	S	?	?	Mid 1st	Coastal	Settlement	Rolled	?		28	43-48	?	?
W072	Dickson´s Corner, Worth	Kent	51.260192,1.386475	S	?	?	Mid 1st	Coastal	Settlement	Rolled	?		28	43-48	?	?
W073	Dickson´s Corner, Worth	Kent	51.260192,1.386475	S	?	?	Mid 1st	Coastal	Settlement	Rolled	?		28	43-48	?	?
W074	Dickson´s Corner, Worth	Kent	51.260192,1.386475	S	?	?	Mid 1st	Coastal	Settlement	Rolled	?		28	43-48	?	?
W075	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	?	4th	Riverine	Settlement	Cylinde	Cast Tube		?	38 x 21 x 17	10 x 7	5
W076	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	?	4th	Riverine	Settlement	Rolled	Clasped	Slightly opened	?	33 x 17 x 16.5	10	3
W077	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	?	4th	Riverine	Settlement	Rolled	Clasped	Slightly open at one end	?	23.5 x 35	2.5	1
W078	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	?	4th	Riverine	Settlement	Rolled	Clasped	One side overlap	?	30 x 17 x 18	6 x 5	4
W079	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	?	4th	Riverine	Settlement	Rolled	Clasped		?	30 x 13 x 11	4	4.5
W080	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	?	4th	Riverine	Settlement	Rolled	Clasped	One side overlap	?	47 x 15 x 16	3	3.5
W081	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	?	4th	Riverine	Settlement	Rolled	Clasped	One side overlap	?	31 x 14 x 13	3	3.5
W082	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	?	4th	Riverine	Settlement	Rolled	Clasped	One side overlap	?	30 x 16 x 15	6	4
W083	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	?	4th	Riverine	Settlement	Rolled	Clasped	One side overlap	?	16.5 x 11.5	3	4
W084	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	?	4th	Riverine	Settlement	Rolled	Clasped		?	32 x 12 x 12	5	4
W085	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	?	4th	Riverine	Settlement	Rolled	Clasped	One side overlap	?	?	?	?
W086	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	743420	Roman	Riverine	Settlement	Rolled	Clasped		24	26 x 13 x 10	6	?
W087	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	775367	Roman	Riverine	Settlement	Rolled	Clasped		5	33 x 7	4	?
W088	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	775371	Roman	Riverine	Settlement	Rolled	Clasped		23	28 x 13 x 11	10	?
W089	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	775380	Roman	Riverine	Settlement	Rolled	Clasped		77	47 x 16 x 14	7	?
W090	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	775382	Roman	Riverine	Settlement	Rolled	Clasped		24	33 x 10	7	?
W091	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	814541	Roman	Riverine	Settlement	Rolled	Clasped		8	31 x 7	3	?
W092	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	830415	Roman	Riverine	Settlement	Folded	Folded		33	19 x 25 x 17	0	?
W093	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	856731	Roman	Riverine	Settlement	Rolled	Clasped	Damaged on one side	7	28 x 9 x 7	?	?
W094	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	7312473	Roman	Riverine	Settlement	Rolled	Clasped		31	26 x 14	10	?
W095	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	7312475	Roman	Riverine	Settlement	Rolled	Clasped		48	43 x 14	7	?
W096	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	7312475.2	Roman	Riverine	Settlement	Rolled	Clasped		29	29 x 13 x 10	7	?
W097	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	7312476	Roman	Riverine	Settlement	Rolled	Clasped		7	14 x 11 x 9	3	?
W098	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	7312488	Roman	Riverine	Settlement	Rolled	Clasped		17	30 x 11	7	?
W099	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	7312494	Roman	Riverine	Settlement	Rolled	Clasped		34	27 x 11 x 9	8 x 5	?
W100	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	78000539	Roman	Riverine	Settlement	Rolled	Clasped		34	33 x 12 x 10	8	?
W101	Wroxeter	Shropshire	52.674304,-2.643754	SW	?	78001130	Roman	Riverine	Settlement	Rolled	Clasped		20	38 x 9 x 7	7	?
W102	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W103	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W104	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W105	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W106	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W107	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W108	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W109	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W110	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W111	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W112	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W113	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W114	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W115	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W116	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W117	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W118	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W119	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W120	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?

W121	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W122	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W123	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W124	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W125	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W126	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W127	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W128	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W129	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W130	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W131	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W132	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W133	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W134	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W135	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W136	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W137	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W138	Site 12 C, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ12C	?	70-150	Coastal	?	Rolled	?		20?	?	?	?
W139	Site 18, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ18	16	40-160	Coastal	?	Rolled	Clasped		12	?	?	?
W140	Site 18, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ18	17	40-160	Coastal	?	Rolled	Clasped		18	?	?	?
W141	Site 18, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ18	18	40-160	Coastal	?	Rolled	Clasped		16	?	?	?
W142	Site 18, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ18	19	40-160	Coastal	?	Rolled	Clasped		16	?	?	?
W143	Site 18, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ18	20	40-160	Coastal	?	Rolled	Clasped		18	?	?	?
W144	Site 18, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ18	21	40-160	Coastal	?	Rolled	Clasped		48	?	?	?
W145	Site 18, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ18	22	40-160	Coastal	?	Rolled	Clasped		32	?	?	?
W146	Site 18, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ18	23	40-160	Coastal	?	Rolled	Clasped		12	?	?	?
W147	Site 18, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ18	24	40-160	Coastal	?	Rolled	Clasped		4	?	?	?
W148	Site 18, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ18	25	40-160	Coastal	?	Rolled	Clasped		20	?	?	?
W149	Site 18, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ18	26	40-160	Coastal	?	Rolled	Clasped		10	?	?	?
W150	Site 18, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ18	27	40-160	Coastal	?	Rolled	Clasped		12	?	?	?
W151	Site 18, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ18	28	40-160	Coastal	?	Rolled	Clasped		20	?	?	?
W152	Site 18, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ18	29	40-160	Coastal	?	Rolled	Clasped		8	?	?	?
W153	Site 18, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ18	30	40-160	Coastal	?	Rolled	Clasped		2	?	?	?
W154	Site 18, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ18	31	40-160	Coastal	?	Rolled	Clasped		26	?	?	?
W155	Site 18, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ18	32	40-160	Coastal	?	Rolled	Clasped		10	?	?	?
W156	Site 18, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ18	33	40-160	Coastal	?	Rolled	Clasped		12	?	?	?
W157	Site 18, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ18	35	40-160	Coastal	?	Rolled	Clasped		34	?	?	?
W158	Site 18, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ18	38	40-160	Coastal	?	?	?		20	?	?	?
W159	Site 18, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ18	39	40-160	Coastal	?	?	?		18	?	?	?
W160	Site 18, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ18	40	40-160	Coastal	?	?	?		16	?	?	?
W161	Site 18, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ18	41	40-160	Coastal	?	?	?		18	?	?	?
W162	Site 18, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ18	42	40-160	Coastal	?	?	?		20	?	?	?
W163	Site 18, Lydd Quarry, Lydd	Kent	50.9427, 0.864714	S	LQ18	43	40-160	Coastal	?	?	?		8	?	?	?
W164	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	2716	Roman	R & E	Settlement	Rolled	P/U		21.06	38.2 x 27.4 x 8.5	?	2.4
W165	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	2723	Roman	R & E	Settlement	Rolled	Clasped		13.65	28.5 x 11.4 x 8.6	4.2	3.2
W166	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	3362	Roman	R & E	Settlement	Folded	Folded		6.49	36.7 x 12 x 3.5	?	1
W167	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5132	Roman	R & E	Settlement	Rolled	Clasped		25.22	36.7 x 14	4.5	3
W168	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6564	Roman	R & E	Settlement	Rolled	P/U		19.13	39.7 x 23.5 x 7.8	3.5	2.8
W169	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053a	Roman	R & E	Settlement	Rolled	Opened		114.7	53.2 x 26.4 x 23.6	9	5.5
W170	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053b	Roman	R & E	Settlement	Rolled	Clasped		39.76	32 x 18.2 x 16.2	7.7	3.4
W171	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053c	Roman	R & E	Settlement	Rolled	Clasped	Some truncation	27.78	39.2 x 14.8 x 12.8	5.6	3
W172	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053d	Roman	R & E	Settlement	Rolled	Clasped		44.82	60.5 x 15.7 x 12.6	3.4	2.6
W173	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053e	Roman	R & E	Settlement	Rolled	Clasped	One side overlap	27.39	34.3 x 17.3 x 13.2	5.6	2.7
W174	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053f	Roman	R & E	Settlement	Rolled	Clasped		54.61	56.7 x 17.8 x 15.2	6.1	5.1
W175	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053g	Roman	R & E	Settlement	Cylinde	Cast Tube		64.56	46.6 x 18.6 x 15.5	5.5	5.6
W176	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053h	Roman	R & E	Settlement	Rolled	Clasped		26.23	43.2 x 13.4 x 12.8	7.8	2.3
W177	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053i	Roman	R & E	Settlement	Rolled	Clasped		67.45	57.3 x 18.2 x 15.4	6.2	5.3
W178	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053j	Roman	R & E	Settlement	Rolled	Clasped		22.02	39.7 x 14.9 x 11.1	3.6	2.6
W179	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053k	Roman	R & E	Settlement	Rolled	Clasped	One side overlap	60	34 x 21.6 x 15.6	6.5	4.9

W180	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053l	Roman	R & E	Settlement	Rolled	Opened		31.76	60.8 x 14 x 10.4	6.1	3.6
W181	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053m	Roman	R & E	Settlement	Rolled	Clasped	One side overlap	33.88	30.9 x 15.9	5	3.5
W182	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053n	Roman	R & E	Settlement	Rolled	Clasped		21.1	47.1 x 11.5 x 9.1	4.9	2.9
W183	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053o	Roman	R & E	Settlement	Rolled	Clasped	Flattened	23.92	46.1 x 16.1 x 7.9	1	2.6
W184	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053p	Roman	R & E	Settlement	Rolled	Clasped		21.45	40 x 10.9 x 10	4.3	3
W185	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053q	Roman	R & E	Settlement	Rolled	Clasped		17.91	31.9 x 12.9 x 10	5.9	3.1
W186	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053r	Roman	R & E	Settlement	Rolled	Clasped		5.86	42.8 x 10.8	8.1	1.5
W187	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053s	Roman	R & E	Settlement	Rolled	Clasped		28.03	34.4 x 20.9 x 10.4	4.5	3.3
W188	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053t	Roman	R & E	Settlement	Rolled	Clasped		35.78	43.2 x 18.2 x 15.4	4.5	3.8
W189	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053u	Roman	R & E	Settlement	Rolled	Clasped	Flattened	27.34	46.6 x 15.4 x 9.5	8.4 x 3	2.1
W190	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053v	Roman	R & E	Settlement	Rolled	Clasped	Truncated	18.77	52.6 x 11.4 x 5.5	<1	2.2
W191	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053w	Roman	R & E	Settlement	Rolled	Clasped	Slightly Flattened	27.02	21.5 x 21.5 x 11.5	10 x 3.5	3.6
W192	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053x	Roman	R & E	Settlement	Rolled	Clasped	Slightly Flattened	18.77	32.5 x 14 x 11.5	3.2	2
W193	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053y	Roman	R & E	Settlement	Rolled	Clasped	Flattened	20.21	45 x 15.3 x 8.1	2.9	2.6
W194	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053z	Roman	R & E	Settlement	Rolled	Clasped	Some truncation	14.81	31.4 x 16 x 9.4	9.5 x 2	2.1
W195	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053aa	Roman	R & E	Settlement	Rolled	Clasped	Slightly Flattened	9.69	34.1 x 12.2 x 5.6	<1	1.9
W196	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053ab	Roman	R & E	Settlement	Rolled	Clasped		18.03	23.6 x 12.5	5.4	3.2
W197	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053ac	Roman	R & E	Settlement	Rolled	Clasped	Slightly Flattened	8.61	28.5 x 11 x 6.6		2.6
W198	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053ad	Roman	R & E	Settlement	Rolled	Clasped		8.25	19.7 x 12.8 x 7.9	2.6	2.9
W199	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053ae	Roman	R & E	Settlement	Rolled	Clasped		6.08	21.8 x 11.8 x 8.1	6.3 x 2.1	2.2
W200	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053af	Roman	R & E	Settlement	Rolled	P/U	Slightly Flattened	16.3	35 x 23.9 x 6.7	<1	2.4
W201	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	1053ag	Roman	R & E	Settlement	Rolled	P/U	Slightly Flattened	30.25	49.6 x 27.3 x 7.7	4.2 x 3.5	2.4
W202	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	921a	Roman	R & E	Settlement	Rolled	P/U		33.34	31.8 x 16.8 x 13.8	6.2	4
W203	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	921b	Roman	R & E	Settlement	Rolled	Clasped		31.39	39.6 x 23.1 x 13.2	4	2.9
W204	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	921c	Roman	R & E	Settlement	Rolled	Clasped		7.1	30.4 x 10.4 x 6.6	2	1.9
W205	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	921d	Roman	R & E	Settlement	Rolled	Clasped		10.6	31.5 x 12.1 x 9.8	3.2	2.9
W206	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	921e	Roman	R & E	Settlement	Rolled	Clasped	Slightly Flattened	9.03	17.2 x 16.8 x 8.9	2	1.5
W207	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	921f	Roman	R & E	Settlement	Rolled	Clasped	One side overlap	22.53	27.8 x 14.2	3.5	3
W208	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	921g	Roman	R & E	Settlement	Rolled	Clasped		4.84	14.9 x 11.5	3	3.2
W209	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	921h	Roman	R & E	Settlement	Rolled	Overlapped	Slightly Flattened	5.49	21.1 x 9.1 x 6.1	?	1.5
W210	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	3979	Roman	R & E	Settlement	Rolled	Opened		11.73	33.4 x 14.5 x 7.4	?	2.6
W211	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5621	Roman	R & E	Settlement	Rolled	Clasped		44.67	59.4 x 14.6 x 12.5	4.5	3.8
W212	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	7543a	Roman	R & E	Settlement	Rolled	Clasped		15.23	30 x 11.6 x 8.5	3.5	2.5
W213	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	7543b	Roman	R & E	Settlement	Rolled	Clasped		15.15	28.1 x 15.5 x 13.1	6 x 8.4	1.9
W214	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	7543c	Roman	R & E	Settlement	Rolled	Clasped	Damaged on one side	3.45	20.5 x 10.4 x 7.6	3	2.4
W215	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5184a	Roman	R & E	Settlement	Rolled	Clasped		27.04	44.2 x 13.5 x 11.7	3.8	2.8
W216	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5184b	Roman	R & E	Settlement	Rolled	Clasped		23.85	26 x 16.5 x 13.9	6.2	4.5
W217	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5184c	Roman	R & E	Settlement	Rolled	Clasped		17.93	29.1 x 13.4 x 11.6	5.2	3
W218	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5178a	Roman	R & E	Settlement	Rolled	Clasped		33.22	31.6 x 16.9	4.2	3.5
W219	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5178b	Roman	R & E	Settlement	Rolled	Clasped	Some truncation	20.8	39.4 x 15.1 x 10.3	4.5	3.2
W220	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5178c	Roman	R & E	Settlement	Rolled	Clasped		50.13	41.8 x 21.9 x 17.5	5.4 x 10.2	4.6
W221	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5178d	Roman	R & E	Settlement	Rolled	?	Substantial Truncation	58.51	62.5 x 26.6 x 17.1	>7	3.1
W222	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5178e	Roman	R & E	Settlement	Rolled	Clasped		61.32	54.6 x 18.2 x 15.6	5.2	4.6
W223	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5178f	Roman	R & E	Settlement	Rolled	Clasped		33.97	37 x 16.4	7.6 x 6.3	2.9
W224	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5178g	Roman	R & E	Settlement	Cylinde	Cast Tube	Truncated	20.06	31.3 x 13.6	5.9	4.3
W225	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5178h	Roman	R & E	Settlement	Folded	Folded	Truncated	12.8	25.6 x 19.3 x 8.3	?	2.9
W226	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5178i	Roman	R & E	Settlement	Folded	Folded	Truncated	16.25	29.6 x 24.5 x 6.8	?	2.8
W227	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5178j	Roman	R & E	Settlement	Rolled	Clasped		20.55	27.3 x 14.9 x 12.9	3.4	4.6
W228	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5178k	Roman	R & E	Settlement	Rolled	Clasped		63.62	54.1 x 15.6	5.3 x 3.2	2.5
W229	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5178l	Roman	R & E	Settlement	Folded	Folded	Flattened	24	36.1 x 19.2 x 8.5	?	2.6
W230	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5178m	Roman	R & E	Settlement	Rolled	Clasped		11.82	24 x 14 x 8.3	4	3.1
W231	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5178n	Roman	R & E	Settlement	Rolled	Clasped	One side overlap	14.32	23 x 13.5 x 12.1	3.9	2.8
W232	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5178o	Roman	R & E	Settlement	Rolled	Clasped	Opened on one side only	8.96	24.1 x 14.9 x 9.5	4.5	2.8
W233	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5178p	Roman	R & E	Settlement	Folded	Folded		3.96	12 x 15.8 x 12.1	?	2.6
W234	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5178q	Roman	R & E	Settlement	Rolled	Clasped	Opened on one side only	5.48	22.6 x 19.8 x 7.8	<1	2.5
W235	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5178r	Roman	R & E	Settlement	Rolled	Clasped	Opened on one side only	6.46	26.4 x 15.1 x 7.7	<1	2.4
W236	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5178s	Roman	R & E	Settlement	Folded	Folded		13.21	31 x 22.8 x 6.1	?	2.2
W237	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880a	Roman	R & E	Settlement	Rolled	Clasped		10.32	32.2 x 9.4	3.5	2.1
W238	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880b	Roman	R & E	Settlement	Rolled	Clasped		6.46	30.2 x 9	?	2.4
W239	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880c	Roman	R & E	Settlement	Rolled	Clasped		9.79	23.1 x 11.1 x 7.3	?	2.8

W240	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880d	Roman	R & E	Settlement	Rolled	Clasped		4.65	14.5 x 9.5 x 6.5	?	2.5
W241	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880e	Roman	R & E	Settlement	Rolled	Clasped		8.63	30.3 x 7.6	?	2.5
W242	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880f	Roman	R & E	Settlement	Rolled	Clasped		7.76	24.3 x 8.2	?	2.7
W243	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880g	Roman	R & E	Settlement	Rolled	Clasped		14.9	36 x 10.4	?	3
W244	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880h	Roman	R & E	Settlement	Rolled	Clasped		11.18	26.4 x 9.2	?	3
W245	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880i	Roman	R & E	Settlement	Rolled	Clasped		8.32	27.6 x 9.2	?	2.8
W246	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880j	Roman	R & E	Settlement	Rolled	Clasped		10.41	37.1 x 8.6	?	2.8
W247	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880k	Roman	R & E	Settlement	Rolled	Clasped	Partially opened	64.13	62.4 x 17.3 x 14	6.8	4
W248	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880l	Roman	R & E	Settlement	Folded	Folded		56.2	45.7 x 29.1 x 9.9	<1	3.1
W249	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880m	Roman	R & E	Settlement	Folded	Folded		42.7	51.5 x 22.6 x 11.7	9.9 x 3.6	3
W250	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880n	Roman	R & E	Settlement	Rolled	Opened	Partially opened	35.41	46 x 23.3 x 10.5	3.3	3.7
W251	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880o	Roman	R & E	Settlement	Rolled	Clasped	Partially unrolled on one side	32.73	47.4 x 18.5 x 14.8	7.6 x 5.2	4
W252	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880p	Roman	R & E	Settlement	Rolled	Clasped	Partially unrolled on one side	34.24	47.5 x 22.1 x 12.4	4.2	2.5
W253	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880q	Roman	R & E	Settlement	Rolled	Clasped		41.89	50 x 16.1 x 12.2	4.6	3.5
W254	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880r	Roman	R & E	Settlement	Folded	Folded		37.13	25.9 x 16.1 x 12.2	14 x 4.3	4.8
W255	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880s	Roman	R & E	Settlement	Rolled	P/U		29.37	36.2 x 21.5 x 12.6	6	4.3
W256	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880t	Roman	R & E	Settlement	Rolled	Clasped	Partially unrolled on one side	21.95	26.6 x 18 x 12.5	8 x 6.5	3.2
W257	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880u	Roman	R & E	Settlement	Rolled	Opened	Partially opened	11.45	27 x 18.9 x 10.6	6.5	3
W258	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880v	Roman	R & E	Settlement	Rolled	Opened	Partially opened	11.45	29.3 x 18.9 x 10.6	6.5	3
W259	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880w	Roman	R & E	Settlement	Rolled	Clasped		19.65	38.3 x 14.3 x 9.5	<1	3
W260	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880x	Roman	R & E	Settlement	Rolled	Clasped	Partially opened on one side	20.79	35 x 14.2 x 9.1	3	2.5
W261	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880y	Roman	R & E	Settlement	Rolled	Clasped		20.65	30.1 x 13.8 x 9.2	6.5 x 3.6	3
W262	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880z	Roman	R & E	Settlement	Rolled	Clasped		19.3	31.2 x 15.4 x 10.2	3.2	3.5
W263	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880aa	Roman	R & E	Settlement	Rolled	Clasped		12.53	20.4 x 15.8 x 11.9	3.4	3.6
W264	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880ab	Roman	R & E	Settlement	Rolled	Clasped		10.33	32.4 x 10.5 x 7.9	3.8 x 2.5	2
W265	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880ac	Roman	R & E	Settlement	Rolled	Clasped		14.92	36 x 10.6 x 7.9	<1	3.1
W266	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880ad	Roman	R & E	Settlement	Rolled	Clasped		10.42	37.1 x 10.4 x 6.4	<1	3
W267	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880ae	Roman	R & E	Settlement	Rolled	Opened		6.27	30.1 x 8.3 x 8.6	3.1	2.8
W268	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880af	Roman	R & E	Settlement	Rolled	Clasped		9.77	23.9 x 11.6 x 7.5	1.8	1.8
W269	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880ag	Roman	R & E	Settlement	Rolled	Clasped		11.18	26.3 x 8.9 x 9	3.2	2
W270	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880ah	Roman	R & E	Settlement	Rolled	Clasped		8.61	30.2 x 8.3 x 7.4	2.2	2
W271	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880ai	Roman	R & E	Settlement	Rolled	Clasped		8.3	27.5 x 8.7 x 8.7	<1	2.2
W272	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880aj	Roman	R & E	Settlement	Rolled	Clasped		7.76	24.3 x 8.8 x 7	<1	3
W273	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6880ak	Roman	R & E	Settlement	Rolled	Clasped		4.63	14.5 x 9.7 x 6.4	1	2
W274	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5754	Roman	R & E	Settlement	Rolled	Clasped	Opened on one side	9.76	32.2 x 15.3 x 7.5	1.7	2.6
W275	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6410	Roman	R & E	Settlement	Rolled	Clasped	Partially overlapped	6.48	23 x 10 .1 x 6.9	<1	2.2
W276	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6412	Roman	R & E	Settlement	Rolled	Clasped	Partially overlapped	45.66	45.1 x 21.7 x 13.8	9.2 x 4.5	2.7
W277	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6381a	Roman	R & E	Settlement	Rolled	Clasped	Partially opened	17	22.1 x 19.3 x 12.5	5.9	3.3
W278	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6381b	Roman	R & E	Settlement	Rolled	Clasped		17.27	26.8 x 13.6 x 11.7	7.6 x 5.3	2.7
W279	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6381c	Roman	R & E	Settlement	Folded	Folded		10.8	28.6 x 15.6 x 9.6	3.2	2.4
W280	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6381d	Roman	R & E	Settlement	Folded	Folded		11.47	30.2 x 23.5 x 8.8	9 x 5.4	2
W281	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6381e	Roman	R & E	Settlement	Rolled	Clasped	Damaged on one side	47.78	51.1 x 19.2 x 11.2	3.6	4.2
W282	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6381f	Roman	R & E	Settlement	Rolled	P/U		42.67	51 x 25.4 x 9.2	6.8 x 3.5	2.5
W283	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6381g	Roman	R & E	Settlement	Rolled	P/U	Damaged in the centre	41.75	51.3 x 38.5 x 11.3	6.3 x 6	2.4
W284	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6362a	Roman	R & E	Settlement	Rolled	Opened	Bent on one side	24.55	42.6 x 11.9 x 11.1	4.9	3.5
W285	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6362b	Roman	R & E	Settlement	Rolled	Opened	Damaged on one side	17.4	32.2 x 14.9 x 12.4	5.7	4.2
W286	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6355a	Roman	R & E	Settlement	Rolled	Opened		12.71	49.2 x 23.1 x 14.6	<1	1.8
W287	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6355b	Roman	R & E	Settlement	Rolled	Clasped	Damaged	12.71	30.2 x 20.6 x 8.8	<1	1.8
W288	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5751	Roman	R & E	Settlement	Rolled	Opened	Curved	12.75	48.6 x 8 x 6.7	3.5 x 2.6	2
W289	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6518a	Roman	R & E	Settlement	Folded	Folded		11.39	23 x 20.7 x 8.7	1	2.5
W290	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6518b	Roman	R & E	Settlement	Folded	Folded		6.64	14.5 x 19.3 x 5.2	<1	2.3
W291	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6359a	Roman	R & E	Settlement	Rolled	Clasped		14.75	38.8 x 10.2 x 8.9	3.8	2.3
W292	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6359b	Roman	R & E	Settlement	Rolled	Clasped	Partially overlapped	15	23.9 x 14.7 x 12.3	6.9 x 5.9	2.3
W293	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6694a	Roman	R & E	Settlement	Rolled	Opened	Damaged and flattened	19.87	40.7 x 18.4 x 9.1	3 x 1.4	2.6
W294	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6694b	Roman	R & E	Settlement	Rolled	Clasped		20.63	37.5 x 11 x 10.2	5.2	2.6
W295	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6516a	Roman	R & E	Settlement	Rolled	P/U		55.58	47.4 x 30.8 x 9.8	2.5	2.7
W296	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6516b	Roman	R & E	Settlement	Rolled	P/U		13.35	25 x 19.5 x 8.7	2.7 x 8.2	3.2
W297	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6877a	Roman	R & E	Settlement	Rolled	Clasped		15.53	24.6 x 13.5 x 10	4.8 x 2.8	2
W298	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6877b	Roman	R & E	Settlement	Rolled	Clasped		6.3	22.7 x 8.2 x 7	2.5	2
W299	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5489a	Roman	R & E	Settlement	Rolled	Overlapped	Three layers	28.82	34.3 x 17.4 x 13.5	3.8 x 9.2	1.8

W300	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5489b	Roman	R & E	Settlement	Rolled	Opened		46.78	52.4 x 18.9 x 17.3	11.1	4.2
W301	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5485	Roman	R & E	Settlement	Rolled	Overlapped	Three layers	34.78	42.1 x 18.3 x 13.7	2.8	1.9
W302	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6622	Roman	R & E	Settlement	Rolled	Clasped		28.91	46.2 x 17.5 x 11.8	2.7	2.7
W303	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6587a	Roman	R & E	Settlement	Rolled	Clasped	Damaged	34.22	41.2 x 19.8 x 16.4	10.5 x 5.3	3.6
W304	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6587b	Roman	R & E	Settlement	Rolled	Clasped		35	25.7 x 18.4 x 14.6	0	6
W305	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6587c	Roman	R & E	Settlement	Rolled	Clasped	Partially opened on one side	22.12	41.7 x 14.6 x 11.7	3.5 x 2.5	3.3
W306	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6587d	Roman	R & E	Settlement	Rolled	Clasped	Partially opened on one side	28.85	35 x 19.3 x 12.5	3	2.7
W307	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6587e	Roman	R & E	Settlement	Rolled	P/U		18.02	29.8 x 18.1 x 9.5	1.7	3.1
W308	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6587f	Roman	R & E	Settlement	Rolled	Opened		15.09	29.5 x 15.9 x 10.9	4	2.9
W309	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	6587g	Roman	R & E	Settlement	Rolled	Clasped		9	29.5 x 11.1 x 9	2.8	3.1
W310	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF95	5171	Late Roman	R & E	Settlement	Rolled	Clasped		52	55 x 14 x 11	4 x 3.5	2
W311	Heybridge, Elms Farm	Essex	51.742366,0.670587	SE	HYEF94	5171	Late Roman	R & E	Settlement	Rolled	Clasped		14	21 x 15 x 14	5	4
W312	Bishopstone	Sussex	50.782040,0.083329	S	?	?	4th	Coastal	?	Rolled	Clasped		?	21.2 x 16 x 19	5	5
W313	Bishopstone	Sussex	50.782040,0.083329	S	?	?	4th	Coastal	?	Rolled	Clasped		?	41 x 25 x 26	10	6

Key:
?: Unknown Datum
SF: Small Find
R & E: River and Estuary Environment
R & C: River and Coastal Environment
Dates:
E: Early
M: Mid
L: Late
Weight Morphology:
P/U: Partially unrolled
M/F: Multiple folds

Appendix C, Part 3: Netting Needle Data Table

ID	Site	County	Latitude	Longitude	Region	SF Number	Date	Ecosystem	Cultural context	AL	ETL	RL	OWP	PD	IDP 1	IDP 2	Profile Shape	Orientation of ends to eachother	Material
N01	South Shields, New Castle	Tyne and Wear	55.004735	-1.4314	N	486	43-410	R & C	Military	72	80	>67	5	2.5	4 x 4	T	Circular	?	Cu.
N02	South Shields, New Castle	Tyne and Wear	55.004735	-1.4314	N	487	43-410	R & C	Military	120	N/A	108	10	3	4 x 4	5 x 4	Circular	?	Cu.
N03	Winterton	Lincolnshire	53.6530	-0.6057	NE	_	3rd 4th	Riverine	Villa	160	N/A	117	12	5	22 x 8	21 x ?	Square	Aligned	Fe.
N04	Wroxeter, Salop	Shropshire	52.674284	-2.6441431	SW	B46	1st	Riverine	Military	228	N/A	157	21	6	32 x 8	28 x 8	?	Aligned	Fe.
N05	Wroxeter, Salop	Shropshire	52.674284	-2.6441431	SW	B46a	1st	Riverine	Military	158	170	110	12	4.5	15 x 5	T	?	?	Fe.
N06	Wroxeter, Salop	Shropshire	52.674284	-2.6441431	SW	_	1st-2nd	Riverine	?	174.5	180	140	11.5	6.5	15 x 3	T	Circular	Aligned	Fe.
N07	Caister-On-Sea	Norfolk	52.6504	1.7198	SE	2092	43-410	Coastal	Military	204	N/A	175	10	4	7 x 6	7 x 5	Square	Aligned	Fe.
N08	Hacheston	Suffolk	52.1861	1.3751	SE	aE144	1st-2nd	Riverine	Settlement	125	153	90	>10	3.5	20 x 5	T	Circular	Perpendicular	Cu.
N09	Littleport	Cambridgeshire	52.4578	0.31122	NE	C00841	43-410	Riverine	?	49.99	N/A	T	7.6	3.58	? x 4	T	Circular	?	Cu.
N10	Irchester	Northamptonshire	52.2794	-0.6533	NE	NARC941	43-410	Riverine	?	71.25	?	?	?	?	?	T	?	?	Cu.
N11	Norton	Northamptonshire	52.2672	-1.1181	NE	NARC754	43-410	Riverine	?	?	?	?	7.79	3.23	?	?	?	?	Cu.
N12	Wicken	Northamptonshire	52.0340	0.9215	NE	BUC-BB09A5	R-MED	Riverine	?	78	95	65	6.2	2.5	11 x 4	T	Square	?	Cu.
N13	Balkern Lane, Colchester	Essex	51.8900	0.8941	SE	BKC4167	43-410	Riverine	Settlement	125	N/A	80	10	3.5	15 x 4	?	Circular	Perpendicular	Cu.
N14	Elms Farm, Heybridge	Essex	51.7422	0.6705	SE	7569	43-410	R & E	?	75	N/A	T	14	5	15 x 8	T	Circular	?	Fe.
N15	Barton Court Farm, Abingdon	Oxfordshire	51.6827	-1.2560	SE	_	1st-2nd	Riverine	Rural/Farm	170	N/A	115	15	4	20 x 7	23 x 9	Circular	Perpendicular	Cu.
N16	Kingsholm Square, Gloucester	Gloucestershire	51.8648	-2.2398	SW	A2983	1st-2nd	Riverine	Military	?	?	?	?	?	?	?	Circular	?	Cu.
N17	Hod Hill	Dorset	50.894003	-2.202039	S	_	1st-2nd	Riverine	Military	207	N/A	135	14	4	30 x 9	32 x ?	?	Perpendicular	Cu.
N18	Hod Hill	Dorset	50.894003	-2.202039	S	18920901.13	1st-2nd	Riverine	Military	156	N/A	125	11	5	9 x 6	5 x ?	Circular	Perpendicular	Fe.
N19	Hascombe Court, Dorchester	Dorset	50.7136	-2.44025	S	_	Mid 1st	Riverine	?	140	N/A	115	11	3	10 x 3	10 x 4	Circular	Perpendicular	Cu.
N20	Hengistbury Head	Dorset	50.7209	-1.77336	S	_	43-410	Coastal	?	240	255	210	12	5	15 x 6	T	Circular	Aligned	Cu.
N21	County Hall, Dorchester	Dorset	50.7154	-2.4373	S	4534	L1st-M2nd	Riverine	?	100	?	?	>11	5	?	T	Circular	?	Cu.
N22	Richborough	Kent	51.29309	1.331827	S	_	43-410	Coastal	Military	140	N/A	103	12.5	4.5	12 x 6	11 x ?	Circular	Perpendicular	Cu.
N23	Richborough	Kent	51.29309	1.331827	S	_	80-95	Coastal	Military	139	N/A	105	11	3.5	10 x 7	9 x 7	Circular	Perpendicular	?
N24	Ickham	Kent	51.2790	1.1850	S	ON591	?	Riverine	?	?	?	?	?	?	?	?	?	?	?
N25	Saltwood Tunnel	Kent	51.0923	1.0552	S	ON594	43-410	Coastal	?	223	>270	75-80	?	5	56	T	Square	?	Fe.
N26	Billingsgate Market, London	London	51.5088	-0.0841	SE	1154	43-410	R & E	Settlement	?	?	?	?	?	?	?	?	?	Cu.
N27	Thames Bank, London	London	51.507848	-0.0880	SE	_	43-410	R & E	?	?	?	?	?	?	?	?	?	?	Cu.

Key:

SF:	Small find or record number
AL:	Artefact Length (With truncated examples it does not relate to total length)
ETL:	Estimated Total Length (Where prongs are missing at one end)
RL:	Rod Length (Base of first prongs to base of second)
OWP:	Outer width of prongs (widest area of the needle)
PD:	Profile diameter/thickness of the rod
IDP 1:	Internal diameter of first prongs
IDP 2:	Internal diameter of second prongs
T:	Truncated
>:	Minimum estimates due to truncation

Appendix C, Part 4: Ichthyofaunal Data Table (List of Sites)

As ID	IDs in Locker 2007	Regions defined in Locker 2007	Current Region	Site	County	Site Code	Latitude	Longitude	Site Type	Date	Associated environment	Reference	Feature Type	Number of Contexts	Sampling Strategy	Sample Vol. in Litres	NISP Total
1	1	North	N	Birdoswald	Cumbria	420	54.989486	-2.602224	Military Fort	E 3rd- E 4th	Riverine	Smith 1993	Fort Horrea	3	WSB	?	17
2a	2	North	N	Carlisle, Castle Street	Cumbria	?	54.895266	-2.93872	Military	M1st Flavian	Riverine	Locker 1985	Various	?	WSB	?	533
2b	2	North	N	Carlisle, Castle Street	Cumbria	?	54.895266	-2.93872	Military	M-L 1st	Riverine	Locker 1985	Various	?	WSB	?	1373
2c	2	North	N	Carlisle, Castle Street	Cumbria	?	54.895266	-2.93872	Military	L 1st- E 2nd	Riverine	Locker 1985	Various	?	WSB	?	639
2d	2	North	N	Carlisle, Castle Street	Cumbria	?	54.895266	-2.93872	Military	E 2nd	Riverine	Locker 1985	Various	?	WSB	?	472
2e	2	North	N	Carlisle, Castle Street	Cumbria	?	54.895266	-2.93872	Military	E- M 2nd	Riverine	Locker 1985	Various	?	WSB	?	135
2f	2	North	N	Carlisle, Castle Street	Cumbria	?	54.895266	-2.93872	Military	M-L 2nd	Riverine	Locker 1985	Various	?	WSB	?	67
2g	2	North	N	Carlisle, Castle Street	Cumbria	?	54.895266	-2.93872	Military	M 2nd- E 3rd	Riverine	Locker 1985	Various	?	WSB	?	180
3	3	North	N	Carlisle, The Lanes	Cumbria	?	54.895691	-2.934819	Settlement	1st-2nd	Riverine	Nicholson 1993b; Locker 2007	?	?	WSB	?	?
4a	4	North	NE	Catterick Bridge, Thornborough Farm	Yorkshire	?	54.3871	-1.65703	Military/Civilian	L2nd-3rd	Riverine	Stallibrass 2002	?	?	WSB	?	5
4b	4	North	NE	Catterick Bridge, Thornborough Farm	Yorkshire	?	54.3871	-1.65703	Military/Civilian	3rd-4th	Riverine	Stallibrass 2002	?	?	WSB	?	6
4c	4	North	NE	Catterick Bridge, Thornborough Farm	Yorkshire	?	54.3871	-1.65703	Military/Civilian	L 4th	Riverine	Stallibrass 2002	?	?	WSB	?	3
5a	5	North	N	Inveresk, Edinburgh, Phase 1	Scotland	?	55.934956	-3.043246	Military/Civilian	M 2nd	R/C	Ceron-Carrasco 2002	Trench	1	WSB	?	1
5b	5	North	N	Inveresk, Edinburgh, Phase 2	Scotland	?	55.934956	-3.043246	Military/Civilian	180-200	R/C	Ceron-Carrasco 2002	Midden	12	WSB	?	50
5c	5	North	N	Inveresk, Edinburgh, Phase 3, 4, 5	Scotland	?	55.934956	-3.043246	Military/Civilian	L 2nd	R/C	Ceron-Carrasco 2002	Trenches	3	WSB	?	3
6	6	North	NW	Lancaster	Lancashire	?	54.05063	-2.804921	?	?	R/C	Jones and Shotter 1998	Layers and a pit	?	?	?	?
7a	7	North	NW	Ribchester, The Lanes, Phase 2	Lancashire	?	53.81148	-2.532694	Military	L1st	Riverine	Nicholson 1993	Layers and a pit	?	WSB	?	10
7b	7	North	NW	Ribchester, The Lanes, Phase 2.2	Lancashire	?	53.81148	-2.532694	Military	L1st-E 2nd	Riverine	Nicholson 1993	Layers and a pit	?	WSB	?	4
7c	7	North	NW	Ribchester, The Lanes, Phase 3	Lancashire	?	53.81148	-2.532694	Military	E 2nd	Riverine	Nicholson 1993	Ditch	?	WSB	?	86
7d	7	North	NW	Ribchester, The Lanes, Phase 4.2	Lancashire	?	53.81148	-2.532694	Military	E-L 2nd	Riverine	Nicholson 1993	Ditch	?	WSB	?	41
7e	7	North	NW	Ribchester, The Lanes, Phase 5	Lancashire	?	53.81148	-2.532694	Military	?	Riverine	Nicholson 1993	Layers and a pit	?	WSB	?	2
7f	7	North	NW	Ribchester, The Lanes, Phase 6	Lancashire	?	53.81148	-2.532694	Military	?	Riverine	Nicholson 1993	Layers and a pit	?	WSB	?	1
8	8	North	NE	York, Bedern	Yorkshire	?	53.961464	-1.078975	Settlement	?	Riverine	O'Connor 1988; Locker 2007	?	1	?	?	?
9	9	North	NE	York, Church Street	Yorkshire	?	53.959925	-1.081165	Military	?	Riverine	Enghoff 2000	?	?	WSB	?	?
10	10	North	NE	York, Fishergate	Yorkshire	?	53.951589	-1.075768	?	1st	Riverine	Enghoff 2000	?	?	WSB	?	?
11	11	North	NE	York, Skeldergate	Yorkshire	?	53.955782	-1.08387	?	?	Riverine	Enghoff 2000	?	?	WSB	?	?
12	12	North	NE	York, Tanner Row, General Accident Site	Yorkshire	?	53.958316	-1.087484	?	L2nd-E3rd	Riverine	O'Connor 1988	Various	?	WSB + HC	?	?
13a	13	Midlands	NW	Chester, 25 Bridge Street	Cheshire	CHE25B5'01	53.189806	-2.891166	Garrison Town	1st- 4th	Riverine	Jacques et al. 2004	?	5	WSB	?	?
13b	13	Midlands	NW	Chester, 25 Bridge Street	Cheshire	CHE25B5'01	53.189806	-2.891166	Garrison Town	4th-9th	Riverine	Jacques et al. 2004	?	9	WSB + HC	?	?
14	14	Midlands	NW	Chester, Dee House	Cheshire	?	53.188933	-2.887061	Garrison Town	1st, 2nd, 3rd	Riverine	Jones 2001; Locker 2007	?	?	WSB	?	?
15a	15	Midlands	NE	Dragonby	Lincolnshire	?	53.615652	-0.634565	Settlement	IA-L1st	Riverine	Jones 1996	Pottery within gully	4	?	?	7
15b	15	Midlands	NE	Dragonby	Lincolnshire	?	53.615652	-0.634565	Settlement	1st-4th	Riverine	Jones 1996	Pottery and well deposits	4	?	?	4
16	16	Midlands	NE	Godmanchester	Cambridgeshire	?	52.318068	-0.174279	Settlement	2nd,3rd	Riverine	Locker 1993; Locker 2007	?	?	WSB	?	?
17a	17	Midlands	NE	Leicester, Little Lane, Phase 3.1	Leicestershire	?	52.628703	-1.296398	Settlement	60-70	Riverine	Nicholson 1992	Various	1	WSB	-12	8
17b	17	Midlands	NE	Leicester, Little Lane, Phase 3.4	Leicestershire	?	52.628703	-1.296398	Settlement	L1st	Riverine	Nicholson 1992	Various	1	WSB	-12	2
17c	17	Midlands	NE	Leicester, Little Lane, Phase 4	Leicestershire	?	52.628703	-1.296398	Settlement	L1st - E 2nd	Riverine	Nicholson 1992	Various	3	WSB	-12	16
17d	17	Midlands	NE	Leicester, Little Lane, Phase 5	Leicestershire	?	52.628703	-1.296398	Settlement	2nd	Riverine	Nicholson 1992	Various	6	WSB	-12	88
17e	17	Midlands	NE	Leicester, Little Lane, Phase 6	Leicestershire	?	52.628703	-1.296398	Settlement	M-L 2nd	Riverine	Nicholson 1992	Various	2	WSB	-12	70
17f	17	Midlands	NE	Leicester, Little Lane, Phase 7	Leicestershire	?	52.628703	-1.296398	Settlement	L2nd - E 3rd	Riverine	Nicholson 1992	Various	2	WSB	-12	41
17g	17	Midlands	NE	Leicester, Little Lane, Phase 8.1	Leicestershire	?	52.628703	-1.296398	Settlement	3rd-4th	Riverine	Nicholson 1992	Various	1	WSB	-12	6
17h	17	Midlands	NE	Leicester, Little Lane, Phase 9	Leicestershire	?	52.628703	-1.296398	Settlement	4th	Riverine	Nicholson 1992	Various	2	WSB	-12	12
18a	18	Midlands	NE	Leicester, Causeway Lane	Leicestershire	?	52.637689	-1.13737	Settlement	L1st	Riverine	Nicholson 1999	Various	?	WSB	?	17
18b	18	Midlands	NE	Leicester, Causeway Lane	Leicestershire	?	52.637689	-1.13737	Settlement	L1st-Mid2nd	Riverine	Nicholson 1999	Various	?	WSB	?	338
18c	18	Midlands	NE	Leicester, Causeway Lane	Leicestershire	?	52.637689	-1.13737	Settlement	M 2nd-E3rd	Riverine	Nicholson 1999	Various	?	WSB	?	391
18d	18	Midlands	NE	Leicester, Causeway Lane	Leicestershire	?	52.637689	-1.13737	Settlement	E-M 3rd	Riverine	Nicholson 1999	Various	?	WSB	?	53
18e	18	Midlands	NE	Leicester, Causeway Lane	Leicestershire	?	52.637689	-1.13737	Settlement	L2nd-M-L 4th	Riverine	Nicholson 1999	Various	?	WSB	?	291
18f	18	Midlands	NE	Leicester, Causeway Lane	Leicestershire	?	52.637689	-1.13737	Settlement	M-L 4th	Riverine	Nicholson 1999	Various	?	WSB	?	111
19a	19	Midlands	NE	Lincoln	Lincolnshire	WN87; WNW88;	53.23502	-0.538585	Settlement	3rd	Riverine	Irving, B. 1996, 53-56	Various	?	SSR	?	970
19b	19	Midlands	NE	Lincoln	Lincolnshire	WO89; WF90	53.23502	-0.538585	Settlement	4th	Riverine	Irving, B. 1996, 53-56	Various	?	SSR	?	1499+
20	20	Midlands	NE	Rectory Farm, West Deeping	Lincolnshire	?	52.681626	-0.35205	Settlement	?	Riverine	Locker 1998a; Locker 2007	?	?	?	?	?
21	21	Midlands	NE	Thetford, Redcastle Furze	Norfolk	?	52.41389	0.7343	Settlement	1st	Riverine	Nicholson 1995	Pit	1	WSB	36	?
22a	22	Midlands	SW	Worcester, Deansway	Worcestershire	?	52.19117	-2.222384	Settlement	47-120	Riverine	Nicholson and Scott 2004	Spreads and fills, various features	?	WSB	100+	1
22b	22	Midlands	SW	Worcester, Deansway	Worcestershire	?	52.19117	-2.222384	Settlement	120-240	Riverine	Nicholson and Scott 2004	Spreads and fills, various features	?	WSB	100+	7
22c	22	Midlands	SW	Worcester, Deansway	Worcestershire	?	52.19117	-2.222384	Settlement	240-400	Riverine	Nicholson and Scott 2004	Spreads and fills, various features	?	WSB	100+	1
23a	23	Midlands	SW	Wroxeter, Baths Basilica	Shropshire	?	52.674288	-2.643764	Settlement	249/251- L4th	Riverine	Locker 1997	?	?	HC	?	7
23b	23	Midlands	SW	Wroxeter, Baths Basilica	Shropshire	?	52.674288	-2.643764	Settlement	L 4th- E 5th	Riverine	Locker 1997	?	?	HC	?	40
24a	24	South/SE	SE	Barton Court Farm, Abingdon	Oxfordshire	?	51.673416	-1.272398	Settlement	3rd-4th	Riverine	Wheeler 1984	?	?	WSB	?	7
24b	24	South/SE	SE	Barton Court Farm, Abingdon	Oxfordshire	?	51.673416	-1.272398	Settlement	4th-5th	Riverine	Wheeler 1984	?	?	WSB	?	5
25	25	South/SE	SE	Beddington	Surrey	?	51.376567	-0.137007	Villa-Well	4th	Riverine	Locker 2007	?	?	?	?	?
26	26	South/SE	S	Bignor	West Sussex	?	50.92337	-0.595603	Villa	3rd-4th	Riverine	Parfitt 1995; Locker 2007	?	?	?	?	?
27	27	South/SE	S	Bishopstone	Sussex	?	50.790223	0.089034	Settlement	2nd	Coastal	Jones 1997; Locker 2007	?	?	?	?	?
28a	28	South/SE	S	Canterbury, Marlowe Car Park	Kent	?	51.280553	1.079323	Settlement	1st	Riverine	Locker 1986	Various	3+	WSB	?	18
28b	28	South/SE	S	Canterbury, Marlowe Car Park	Kent	?	51.280553	1.079323	Settlement	2nd-3rd	Riverine	Locker 1986	Various	4+	WSB	?	24
28c	28	South/SE	S	Canterbury, Marlowe Car Park	Kent	?	51.280553	1.079323	Settlement	4th	Riverine	Locker 1986	Various	4+	WSB	?	64
29	29	South/SE	SE	Canvey Island, Site 1	Essex	?	51.519773	0.573911	Settlement	?	Coastal	Jones 1986	?	?	WSB + SSR	?	11+
30a	30	South/SE	S	Castle Copse, Phase VI	Wiltshire	?	50.993903	-1.648695	Villa	L2nd-E3rd	Riverine	Jones 1997	Posthole structures	?	WSB	?	1
30b	30	South/SE	S	Castle Copse, Phase IX	Wiltshire	?	50.993903	-1.648695	Villa	L 3rd- E 4th	Riverine	Jones 1997	Building	?	WSB	?	16
30c	30	South/SE	S	Castle Copse, Phase X	Wiltshire	?	50.993903	-1.648695	Villa	E4th-330	Riverine	Jones 1997	Building	?	WSB	?	3
30d	30	South/SE	S	Castle Copse, Phase XI	Wiltshire	?	50.993903	-1.648695	Villa	330-L4th/E5th	Riverine	Jones 1997	Domestic surfaces/hypocaust	?	WSB	?	244

30e	30	South/SE	S	Castle Copse, Phase X/XI	Wiltshire	?	50.993903	-1.648695	Villa	375/L 4th	Riverine	Jones 1997	Exterior of Building	?	WSB	?	6
31	31	South/SE	S	Chichester, Chapel Street	West Sussex	?	50.838009	-0.78007	Town (Garden)	4th	Riverine	Locker 1981; Locker 2007	?	?	?	?	?
32a	32	South/SE	SE	Colchester, Culver Street	Essex	MCC8529	51.88912	0.898957	Town (Military)	44-49	Riverine	Locker 1992	Various	3	WSB	-288	222
32b	32	South/SE	SE	Colchester, Culver Street	Essex	MCC8529	51.88912	0.898957	Town (Military)	44-60/1	Riverine	Locker 1992	Various	1	WSB	-288	210
32c	32	South/SE	SE	Colchester, Culver Street	Essex	MCC8529	51.88912	0.898957	Town (Military)	49-60/1	Riverine	Locker 1992	Various	1	WSB	-288	43
32d	32	South/SE	SE	Colchester, Culver Street	Essex	MCC8529	51.88912	0.898957	Settlement	60/1-225	Riverine	Locker 1992	Various	12	WSB	-288	92
32e	32	South/SE	SE	Colchester, Culver Street	Essex	MCC8529	51.88912	0.898957	Settlement	100/125-275/325	Riverine	Locker 1992	Various	4	WSB	-288	44
32f	32	South/SE	SE	Colchester, Culver Street	Essex	MCC8529	51.88912	0.898957	Settlement	150-225	Riverine	Locker 1992	Various	4	WSB	-288	221
32g	32	South/SE	SE	Colchester, Culver Street	Essex	MCC8529	51.88912	0.898957	Settlement	150/200-275-325	Riverine	Locker 1992	Various	2	WSB	-288	310
32h	32	South/SE	SE	Colchester, Culver Street	Essex	MCC8529	51.88912	0.898957	Settlement	225-275/325	Riverine	Locker 1992	Various	12	WSB	-288	538
32i	32	South/SE	SE	Colchester, Culver Street	Essex	MCC8529	51.88912	0.898957	Settlement	Roman	Riverine	Locker 1992	Various	3	WSB	-288	393
33	33	South/SE	SE	Colchester, Former Post Office, Head Street	Essex	MCC8577	51.888673	0.89602	Settlement	1st, 2nd	Riverine	Locker 2002; Locker 2007	?	?	WSB?	?	?
34a	34	South/SE	SE	Colchester, Gilberd School	Essex	MCC8005	51.890613	0.894733	Settlement	M-L 1st	Riverine	Locker 1986	Various	7	WSB	-288	93
34b	34	South/SE	SE	Colchester, Gilberd School	Essex	MCC8006	51.890613	0.894733	Settlement	2nd-3rd	Riverine	Locker 1986	Pits	2	WSB	-288	342
35	35	South/SE	SE	Elm Farm, Heybridge	Essex	?	51.742475	0.670704	Settlement	1st, 3rd, 4th	R/E	Locker 1998b; Locker 2007	?	?	WSB?	?	?
36	36	South/SE	S	Fishbourne Palace, nr Chichester	Sussex	?	50.836499	-0.809665	Villa	1st	R/E	Ingrem 2004; Locker 2007	?	?	?	?	?
37a	37	South/SE	SE	Gorhambury, nr St Albans	Hertfordshire	?	51.762208	-0.390132	Villa and Settlement	1st	Riverine	Locker 1990	Various	?	WSB	?	228
37b	37	South/SE	SE	Gorhambury, nr St Albans	Hertfordshire	?	51.762208	-0.390132	Villa and Settlement	2nd	Riverine	Locker 1990	Various	?	WSB	?	65
37c	37	South/SE	SE	Gorhambury, nr St Albans	Hertfordshire	?	51.762208	-0.390132	Villa and Settlement	3rd/4th	Riverine	Locker 1990	Various	?	WSB	?	6
38	38	South/SE	SE	Great Holts Farm, Boreham	Essex	?	51.779867	0.538674	Villa	L3rd-E4th	Riverine	Locker 2003	Well		WSB	?	95+
39	39	South/SE	S	Hayling Island	Sussex	?	50.80558	-0.978329	Temple	4th	E/C	Locker 2007	?	?	?	?	?
40	40	South/SE	SE	North Shoebury	Essex	?	51.541537	0.781582	Settlement	300-400	Coastal	Jones 1995	Ditch	2	WSB	?	?
41	41	South/SE	NE	Meppershall	Bedfordshire	LMB01	52.016907	-0.339982	Settlement	2nd	Riverine	Locker 2004; Locker 2007	?	?	?	?	?
42	42	South/SE	SE	Silchester, nr Basingstoke	Hampshire	?	51.357529	-1.082896	Settlement	3rd, 4th	Riverine	Hamilton Dyer 2000; Ingrem 2006	?	?	WSB	?	?
43	43	South/SE	SE	Skeleton Green, Stevenage	Hertfordshire	?	51.895011	0.014064	Oppidum	LIA/Roman	Riverine	Wheeler 1981	Well	1	WSB	?	100+?
44	44	London City	SE	Baltic Exchange/14-21 St Mary Axe, EC3	London	BAX95	51.515012	-0.080183	Settlement	2nd, 3rd	R/E	Locker 2007	?	?	?		?
45	45	London City	SE	Billingsgate Fish Market Lorry Park/Lower Thames St, EC3	London	BIG82	51.508995	-0.083899	Settlement	2nd	R/E	Locker 1992c; Locker 2007	?	?	?		?
46	46	London City	SE	28-32 Bishopsgate, EC2	London	BOP	51.5147	-0.083219	Settlement	2nd	R/E	Locker 2007	?	?	?		?
47	47	London City	SE	201 Bishopsgate, EC2	London	BGB98	51.521199	-0.079341	Settlement	2nd	R/E	Locker 2007	?	?	?		?
48	48	London City	SE	Monument House/ 30-35 St Botolph Lane, EC3	London	BPL95	51.509834	-0.084873	Settlement	1st,3rd	R/E	Locker 2007	?	?	?		?
49	49	London City	SE	2-5 Devonshire Sq/ Hounsditch Telephone Exchange, EC2	London	CDV99	51.516568	-0.0799	Settlement	2nd	R/E	Locker 2007	?	?	?		?
50	50	London City	SE	Tanners Hall/ 13-21 Eastcheap, EC3	London	ESC97	51.510787	-0.08468	Settlement	3rd	R/E	Locker 2007	?	1	?		?
51	51	London City	SE	Lloyds Registry/ 68-71 Fenchurch Street, EC3	London	FCC95	51.512387	-0.079221	Settlement	1st,2nd,3rd	R/E	Locker 2007	?	?	?		?
52	52	London City	SE	168 Fenchurch Street, EC3	London	FEH95	51.511949	-0.084741	Settlement	1st	R/E	Locker 2007	?	?	?		?
53	53	London City	SE	Guildhall, EC2	London	GYE92	51.515881	-0.092023	Settlement	2nd,3rd,4th	R/E	Locker 2007	?	?	?		?
54	54	London City	SE	Miles Lane/131-7 Upper Thames Street, EC4	London	ILA79	51.511056	-0.095546	Settlement	1st,2nd	R/E	Locker 2007	?	?	?		?
55	55	London City	SE	King Edwards Bldgs/ GPO West Yard	London	KEW98	51.5163	-0.0989	Settlement	1st	R/E	Locker 2007	?	?	?		?
56	56	London City	SE	15-17 King St/42-46 Gresham St, EC2	London	KIG95	51.514924	-0.091919	Settlement	1st	R/E	Locker 2007	?	?	?		?
57	57	London City	SE	Regis House/King William St, EC4	London	KWS94	51.509978	-0.086631	Settlement	1st, 2nd	R/E	Locker 2007	?	?	?		?
58	58	London City	SE	Leadenhall Ct/ Gracechurch St, EC3	London	LCT84	51.513234	-0.083822	Settlement	1st	R/E	Locker 1992d; Locker 2007	?	?	?		?
59	59	London City	SE	17 Fish Street/ Monument St, EC3	London	MFI87	51.510136	-0.086135	Settlement	L1st	R/E	Locker 2007	Well	2	?		2226+
60	60	London City	SE	Northgate House, Moorgate, EC2	London	MRG95	51.516154	-0.089032	Settlement	2nd, 3rd	R/E	Locker 2007	?	?	?		?
61	61	London City	SE	6-9 Newgate St, EC1	London	NEG98	51.515784	-0.100201	Settlement	1st, 2nd	R/E	Locker 2007	?	?	?		?
62	62	London City	SE	29 Gresham St, EC2	London	NHG98	51.515935	-0.095302	Settlement	1st, 2nd	R/E	Locker 2007	?	?	?		?
63	63	London City	SE	No 1 Poultry, EC2	London	ONE94	51.513229	-0.090798	Settlement	1st, 2nd, 3rd, 4th	R/E	Locker 2007	?	?	?		?
64	64	London City	SE	Pudding Lane, EC3	London	PDN81	51.510103	-0.085296	Settlement	3rd	R/E	Locker 2007	?	1	?		?
65	65	London City	SE	Peninsular House/ Lower Thames St, EC3	London	PEN79	51.509565	-0.085035	Settlement	3rd	R/E	Bateman and Locker 1982	?	1	?		?
66	66	London City	SE	Rangoon Street, EC3	London	RAG82	51.51225	-0.076947	Settlement	2nd	R/E	Locker 1986c; Locker 2007	?	?	?		?
67	67	London City	SE	St Magnus	London	SM82	51.509339	-0.086283	Settlement	?	R/E	Locker 2007	?	?	?		?
68	68	London City	SE	Billingsgate Bldg/L Thames St. EC3	London	TR74	51.508995	-0.082688	Settlement	1st, 2nd	R/E	Wheeler 1974; Locker 2007	?	?	?		?
69	69	London City	SE	Fleet Valley, EC4	London	VAL88	51.51451	-0.104078	Settlement	1st	R/E	Locker 1994; Locker 2007	?	1	?		?
70	70	E London Cemete	SE	East Tenter St/Scarborough St, E1	London	ETN88	51.512536	-0.070396	Cemetery	?	R/E	Barber and Bowsher 2000	?	?	?		?
71	71	E London Cemete	SE	13 Haydon St, EC3	London	HAY86	51.512145	-0.074676	Cemetery	?	R/E	Barber and Bowsher 2000	?	?	?		?
72	72	E London Cemete	SE	Hooper St, E1	London	HOO88	51.512259	-0.06788	Cemetery	?	R/E	Barber and Bowsher 2000	?	?	?		?
73	73	E London Cemete	SE	49-59 Mansell St/2-8 Alie St, E1	London	MSL87	51.513099	-0.07301	Cemetery	?	R/E	Barber and Bowsher 2000	?	?	?		?
74	74	E London Cemete	SE	31-43 Mansell St/1-15 Alie St, E1	London	MST87	51.513099	-0.07301	Cemetery	?	R/E	Barber and Bowsher 2000	?	1	?		?
75	75	E London Cemete	SE	53-66 Prescot St, E1	London	PRE89	51.511834	-0.070654	Cemetery	?	R/E	Barber and Bowsher 2000	?	?	?		?
76	76	E London Cemete	SE	9 St Claire St, EC3	London	SCS83	51.512675	-0.074496	Cemetery	?	R/E	Barber and Bowsher 2000	?	1	?		?
77	77	E London Cemete	SE	28-29 West Tenter St/59 Mansell St, E1	London	WTE90	51.512665	-0.072784	Cemetery	?	R/E	Barber and Bowsher 2000	?	?	?		?
78	78	Swrk and E Londo	SE	Arcadia Buildings, Sylvester St	London	AB78	51.500475	-0.091896	Settlement	1st, 4th	R/E	Locker 2007	?	?	?		?
79	79	Swrk and E Londo	SE	New Wolfson Wing, kings College, SE1	London	BHB00	51.50271	-0.085765	Settlement	3rd	R/E	Armitage 2002a; Locker 2007	?	1	?		?
80	80	Swrk and E Londo	SE	179 Borough High Street, SE1	London	179 BHS89	51.502437	-0.092079	Settlement	2nd	R/E	Locker 2007	?	?	?		?
81	81	Swrk and E Londo	SE	199 Borough High Street, SE1	London	199 BHS	51.502167	-0.092186	Settlement	2nd	R/E	Jones 1988b; Locker 2007	?	?	?		?
82	82	Swrk and E Londo	SE	Calverts Buildings, 15-23 Southwark St, SE1	London	?	51.504887	-0.090854	Settlement	1st, 2nd	R/E	Locker 1991; Locker 2007	?	?	?		?
83	83	Swrk and E Londo	SE	Fennings Wharf, SE1	London	FW84	51.506647	-0.087742	Settlement	4th	R/E	Locker 1992b; Locker 2007	?	?	?		?
84	84	Swrk and E Londo	SE	Babe Ruth Bathhouse, 172-6 The Highway, E1	London	HGA02	51.509495	-0.058452	Settlement	3rd,4th	R/E	Armitage 2005a; Locker 2007	?	?	?		?
85	85	Swrk and E Londo	SE	Hibernia Wharf, SE1	London	HIB79	51.50646	-0.088649	Settlement	3rd	R/E	Locker 2007	?	?	?		?
86	86	Swrk and E Londo	SE	Lefevre Road, Bow E3	London	LR	51.533735	-0.025283	Settlement	2nd, 3rd, 4th	R/E	Locker 1998c; Locker 2007	?	?	?		?
87	87	Swrk and E Londo	SE	Shadwell Tower	London	LD76	51.509368	-0.052219	Settlement	4th	R/E	Locker 2007	?	1	?		?
88	88	Swrk and E Londo	SE	Long Lane, SE1	London	LGK99	51.499851	-0.08708	Settlement	2nd	R/E	Armitage 2000a; Locker 2007	?	?	?		?

89	89	Swrk and E London	SE	Southwark Cathedral, SE1	London	MTA99	51.506368	-0.089714	Settlement	1st	R/E	Armitage 2000b; Locker 2007	?	1	HC		?
90	90	Swrk and E London	SE	Parnell Road, Bow, E3	London	PRB95	51.534977	-0.027437	Settlement	2nd, 3rd, 4th	R/E	Locker 1998d; Locker 2007	?	?	?		?
91	91	Swrk and E London	SE	4-26 St Thomas St, SE1	London	4STS82	51.504832	-0.088597	Settlement	4th	R/E	Locker 2007	?	?	?		?
92	92	Swrk and E London	SE	1-7 St Thomas St, SE1	London	1-7ST T	51.505059	-0.089111	Settlement	2nd	R/E	Jones 1978; Locker 2007	?	?	?		?
93	93	Swrk and E London	SE	Swan St, SE1	London	SWN98	51.499337	-0.09448	Settlement	2nd	R/E	Armitage 2002b; Locker 2007	?	?	?		?
94	94	Swrk and E London	SE	Tobacco Dock, 130-162 The Highway, EI	London	TOC 02	51.509091	-0.060859	Settlement	3rd,4th	R/E	Armitage 2005b; Locker 2007	?	?	?		?
95	95	Swrk and E London	SE	10-18 Union St, SE1	London	USB 98	51.503555	-0.092471	Settlement	2nd, 3rd	R/E	Locker 2007	?	?	?		?
96	96	Swrk and E London	SE	Winchester Palace, SE1	London	WP 83	51.506892	-0.091096	Settlement	1st	R/E	Yule 1989, 2005; Locker 2007	?	?	?		?
97	97	South and SW	S	Dorchester, County Hall	Dorset	?	50.71702	-2.440632	Settlement	1st, 3rd, 4th	Riverine	Hamilton Dyer 1993a; Locker 2007	?	?	?		?
98	98	South and SW	S	Dorchester, Greyhound Yard	Dorset	?	50.794524	-2.523004	Settlement	1st, 2nd, 3rd, 4th	Riverine	Hamilton Dyer 1993b; Locker 2007	?	?	?		?
99	99	South and SW	S	Exeter	Devon	?	50.719843	-3.535779	Settlement	?	Riverine	Wilkinson 1979; Locker 2007	?	?	?		?
100	100	South and SW	S	Figheldean	Wiltshire	?	51.222867	-1.788017	Settlement	E RB	Riverine	Hamilton-Dyer1999	?	1	Partial WSB		4
101	101	South and SW	SW	Ilchester, Great Yard	Somerset	?	51.002978	-2.686808	Settlement	2nd	Riverine	Locker 1997b; Locker 2007	?	?			?
102	102	South and SW	S	Maddington Farm, Shrewton	Wiltshire	?	51.195037	-1.908041	Settlement	3rd 4th	Riverine	Hamilton-Dyer 1996	?	1	Partial WSB		2
103	103	South and SW	S	Atlantic Road, Newquay	Cornwall	?	50.413068	-5.093328	Settlement	?	R/C	Ingrem 2000; Locker 2007	?	?			?
104	104	South and SW	S	Ower	Somerset	?	50.703727	-2.191186	Settlement	1st, 2nd	Riverine	Coy 1987; Locker 2007	?	?			?
105	105	South and SW	S	Rope Lake	Dorset	?	50.62337	-2.074199	Settlement	?	Coastal	Coy 1987; Locker 2007	?	1			?
106	106	South and SW	S	Scillies, Halangy Down	Scillies	?	49.931231	-6.307427	Settlement	3rd	Coastal	Locker 1996	?	?			?
107	107	South and SW	S	Scillies, May Hill St Martin	Scillies	?	49.963535	-6.28645	Settlement	?	Coastal	Turk 1984; Locker 2007	?	?			?
108a	108	South and SW	SW	Uley	Gloucestershire	?	51.683298	-2.305005	Shrines	L1st- E2nd	Riverine	Wheeler 1993	Various	1+	WSB + HC	?	?
108b	108	South and SW	SW	Uley	Gloucestershire	?	51.683298	-2.305005	Shrines	2nd	Riverine	Wheeler 1993	Various	1+	WSB + HC	?	?
108c	108	South and SW	SW	Uley	Gloucestershire	?	51.683298	-2.305005	Shrines	3rd-E4th	Riverine	Wheeler 1993	Various	1+	WSB + HC	?	?
108d	108	South and SW	SW	Uley	Gloucestershire	?	51.683298	-2.305005	Shrines	E-M 4th	Riverine	Wheeler 1993	Various	3+	WSB + HC	?	?
108e	108	South and SW	SW	Uley	Gloucestershire	?	51.683298	-2.305005	Shrines	345-353	Riverine	Wheeler 1993	Various	1+	WSB + HC	?	?
108f	108	South and SW	SW	Uley	Gloucestershire	?	51.683298	-2.305005	Shrines	360-380	Riverine	Wheeler 1993	Various	1+	WSB + HC	?	?
108g	108	South and SW	SW	Uley	Gloucestershire	?	51.683298	-2.305005	Shrines	380-400	Riverine	Wheeler 1993	Various	1+	WSB + HC	?	?
108h	108	South and SW	SW	Uley	Gloucestershire	?	51.683298	-2.305005	Shrines	400-420	Riverine	Wheeler 1993	Various	1+	WSB + HC	?	?
108i	108	South and SW	SW	Uley	Gloucestershire	?	51.683298	-2.305005	Shrines	Roman	Riverine	Wheeler 1993	Various	1+	WSB + HC	?	?
109	109	South and SW	S	Wadden Hill	Dorset	?	50.810389	-2.78636	Military Fort	1st	Riverine	Webster 1964, 1979; Locker 2007	?	1			?
110	N/A	N/A	NE	Catterick	Yorkshire	?	54.375408	-1.6306973	?	?	Riverine	Norther Arch Ass. Unpublished					?
111a	N/A	N/A	NE	Healam Bridge Filed 61a Phase 1, Yorkshire	Yorkshire	?	54.245045	-1.5045069	Settlement	1st- L 2nd	Riverine	Ambrey et al. 2017	Post Hole, Hearth	2	WSB	3	1
111b	N/A	N/A	NE	Healam Bridge Field 63 Phase 1a, Yorkshire	Yorkshire	?	54.25118	-1.505966	Settlement	1st-2nd	Riverine	Ambrey et al. 2017	Various	?	WSB	74	1
111c	N/A	N/A	NE	Healam Bridge Field 63 Phase 3, Yorkshire	Yorkshire	?	54.25118	-1.505966	Settlement	L 3rd-E 5th	Riverine	Ambrey et al. 2017	Ditch	1	?	?	1
111d	N/A	N/A	NE	Healam Bridge Field 63 Phase 3c, Yorkshire	Yorkshire	?	54.25118	-1.505966	Settlement	L 4th-E 5th	Riverine	Ambrey et al. 2017	Ditch	1	?	?	*
112	N/A	N/A	N	Binchester	Durham	?	54.677119	-1.6777754	?	?	Riverine	Unpublished	?	?			?
113	N/A	N/A	NE	York, St Mary Bishophill Junior	Yorkshire	?	53.955808	-1.0870108	Settlement	L Roman	Riverine	Jones 1988	Layer	1	WSB	4.2	40000+
114	N/A	N/A	N	Carlisle, South Lanes	Cumbria	?	54.894275	-2.934401	Settlement	?	Riverine	Nicholson 2010	?	?			500?
115	N/A	N/A	N	Carlisle, North Lanes	Cumbria	?	54.896472	-2.9345834	Settlement	?	Riverine	Ingrem 2009	?	?			
116a	N/A	N/A	NW	Chester, Amphitheatre Phase 4	Cheshire	CHE/AMP04	53.189257	-2.8870146	Settlement	71+	Riverine	Harland 2017	Construction Cuts	?	WSB	?	1001
116b	N/A	N/A	NW	Chester, Amphitheatre Phase 5	Cheshire	CHE/AMP04	53.189257	-2.8870146	Settlement	71-100	Riverine	Harland 2017	Cess pit and amphitheatre layers	?	WSB	?	1206
116c	N/A	N/A	NW	Chester, Amphitheatre Phase 6	Cheshire	CHE/AMP04	53.189257	-2.8870146	Settlement	94+	Riverine	Harland 2017	Amphitheatre dumps	?	WSB	?	1024
116d	N/A	N/A	NW	Chester, Amphitheatre Phase 7	Cheshire	CHE/AMP04	53.189257	-2.8870146	Settlement	100-190	Riverine	Harland 2017	Structures and surfaces	?	WSB	?	285
116e	N/A	N/A	NW	Chester, Amphitheatre Phase 8	Cheshire	CHE/AMP04	53.189257	-2.8870146	Settlement	190+	Riverine	Harland 2017	Construction Deposits	?	WSB	?	2
116f	N/A	N/A	NW	Chester, Amphitheatre Phase 9	Cheshire	CHE/AMP04	53.189257	-2.8870146	Settlement	190-290	Riverine	Harland 2017	Road and Surfaces	?	WSB	?	226
117	N/A	N/A	NW	Chester, Gores Stacks, Cheshire	Cheshire	?	53.193886	-2.8888142	settlement	?	Riverine	Baxter 2012	?	?	HC	?	3
118a	N/A	N/A	S	Winchester, Staple Garden, Phase 2.1	Hampshire	?	51.06451	-1.3168788	?	43-130/150	Riverine	Nicholson 2011	Pits and trample layers and dumps	?	WSB	396	47
118b	N/A	N/A	S	Winchester, Staple Garden, Phase 2.2	Hampshire	?	51.06451	-1.3168788	?	130/50-270	Riverine	Nicholson 2011	?	?	WSB	192.5	2
118c	N/A	N/A	S	Winchester, Staple Garden, Phase 2.3	Hampshire	?	51.06451	-1.3168788	?	270-350/75	Riverine	Nicholson 2011	?	5+	WSB + HC	318	17
118d	N/A	N/A	S	Winchester, Staple Garden, Phase 2.4	Hampshire	?	51.06451	-1.3168788	Settlement	350/75-400/50	Riverine	Nicholson 2011	Dark earth layer and cess pit	8+	WSB + HC	304	34
119a	N/A	N/A	SE	Elms Farm, Heybridge	Essex	?	51.74222	0.675555	?	LIA-R Trans	R/E	Locker 2015	Pits, Ditches	?	WSB		72+
119b	N/A	N/A	SE	Elms Farm, Heybridge	Essex	?	51.74222	0.675555	?	E Roman	R/E	Locker 2015	Pits, Ditches and Well	?	WSB		106+
119c	N/A	N/A	SE	Elms Farm, Heybridge	Essex	?	51.74222	0.675555	?	M Roman	R/E	Locker 2015	Pits, Ditches and Well	?	WSB		35+
119d	N/A	N/A	SE	Elms Farm, Heybridge	Essex	?	51.74222	0.675555	?	L Roman	R/E	Locker 2015	Pits, Ditches and Well	?	WSB		54+
120	N/A	N/A	NE	Leicester, Bonner's Lane	Leicestershire	PPG16	52.63016	-1.1368251	Settlement	L 2nd- L 4th	Riverine	Nicholson 2002	Various	3+	WSB	102	31
121	N/A	N/A	SE	21 St. Peter's Street, Colchester	Essex	?	51.892606	0.89927247	Settlement	67 BC- AD53	Riverine	Wightman 2010	Drains	1	SSR	10	1+
122	N/A	N/A	SE	Silchester	Hampshire	?	51.357418	-1.0832691	Settlement	?	Riverine	Ingrem 2012	?	?			
123	N/A	N/A	SE	Stanford Wharf	Essex	?	51.502599	0.44614792	Rural (Uncertain)	120-250	Coastal	Nicholson 2012	Fish related Ditch	1			3356+
124	N/A	N/A	S	Pepperhill to Cobham, The A2	Kent	?	51.282199	1.0329509	Rural (Uncertain)	L Roman	Riverine	Nicholson 2012	sub-rectangular pit and ditch	2+	?	?	4*
125a	N/A	N/A	S	Winchester, Victoria Road East	Hampshire	VRE73-80	51.067544	-1.3164818	Settlement	L2nd-M3rd	Riverine	Bullock 2010	Various	?	WSB	?	133
125b	N/A	N/A	S	Winchester, Victoria Road East	Hampshire	VRE73-80	51.067544	-1.3164818	Settlement	L3rd-M4th	Riverine	Bullock 2010	Various	?	WSB	?	27
126	N/A	N/A	S	Portchester Castle	Hampshire	?	50.837729	-1.1147153	Military Fort	3rd-4th	Coastal	Grant 1975	?	?	HC	x	?
127	N/A	N/A	SE	Church Street, Maidstone	Kent	?	51.274932	0.52496	Settlement	1st	Riverine	Locker 2014	Pits containing cess	5	WSB	?	355+
128	N/A	N/A	S	South Thanet, East Kent Access 2	Kent	?	51.29992	1.366436	Rural (Uncertain)	M-L Roman	R/C	Nicholson 2015	?	1	SSR	5 (of a 30)	120
129	N/A	N/A	S	Pomeroy Wood, A30 Honiton to Exeter, Sowton	Devon	?	50.78293	-3.251189	Settlement	2nd-3rd	Riverine	Butterworth et al 1999	Ring gully	1	WSB	10	1
130a	N/A	N/A	S	Dorchester, Hospital SW Quarter, Oven 1470	Dorset	?	50.7127	-2.446	Settlement	2nd	Riverine	Hamilton-Dyer 2008	Oven	2	WSB	6 (100%)	1280 (EST)
130b	N/A	N/A	S	Dorchester, Hospital SW Quarter, Latrine 4162	Dorset	?	50.7127	-2.446	Settlement	4th	Riverine	Hamilton-Dyer 2008	Latrine Trench	3	WSB	10 + 3	6400 (EST)
130c	N/A	N/A	S	Dorchester, Hospital SW Quarter, Pit 4230	Dorset	?	50.7127	-2.446	Settlement	4th	Riverine	Hamilton-Dyer 2008	Pit	1	WSB	20	xx
131	N/A	N/A	SW	Worcester, Bath Road	Worcestershire	?	52.168313	-2.2178076	Settlement	L IA- E R	Riverine	Pearson 2014	Crop waste	8	WSB	?	?
132	N/A	N/A	S	Isle of Portland	Dorset	?	50.542727	-2.4443722	Settlement	?	Coastal	Maltby and Hamilton-Dyer 2012	Multiple features	<110	HC	x	763
133	N/A	N/A	SW	Bath, New Royal Baths	Somerset	?	51.380332	-2.3615348	Settlement	1st-E 2nd	Riverine	Humphrey and Jones 2007	?	?	WSB + HC	?	17

134	N/A	N/A	SW	Worcester, City Campus	Worcestershire	?	52.193688	-2.2259921	?	L 3rd- E 4th	Riverine	Hamilton-Dyer 2014	Pit and ditch	16	WSB	140-280?	64
135	N/A	N/A	SW	Worcester, Sanctuary House, Farrier Street	Worcestershire	?	52.196036	-2.2244537	?	2nd	Riverine	Clapham 2010	?	?	WSB	40	?
136a	N/A	N/A	S	Isles of Scilly, Bryher, Hillside Farm, Trench 1	Cornwall	?	49.947851	-6.3533163	?	IA-R Trans	Coastal	Ingrem 2006	?	?	WSB + HC	?	13
136b	N/A	N/A	S	Isles of Scilly, Bryher, Hillside Farm, Trench 5	Cornwall	?	49.947851	-6.3533163	?	IA-R Trans	Coastal	Ingrem 2006	Midden	?	WSB + HC	?	105
136c	N/A	N/A	S	Isles of Scilly, Bryher, Hillside Farm, Trench 8	Cornwall	?	49.947851	-6.3533163	?	IA-R Trans	Coastal	Ingrem 2006	Midden	?	WSB + HC	?	711
137	N/A	N/A	SE	Cirencester, St Michael's Field, Gloucestershre	Gloucestershire	?	51.711495	-1.9620895	?	?	Riverine	Maltby 1998	?	?	HC	x	*
138a	N/A	N/A	SE	2-4 Bedale Street, Phase 2, London	London	BVG10	51.505343	-0.0900843	Settlement	E Roman	R/E	Nicholson 2013b	Pit Backfill and Occupation Layers	9	WSB	?	?
138b	N/A	N/A	SE	2-4 Bedale Street, Phase 3, London	London	BVG11	51.505343	-0.0900843	Settlement	L Roman	R/E	Nicholson 2013b	Well	1	WSB + HC	?	4+
139a	N/A	N/A	SE	Vaults 2,5 and 9, railway Approach	London	BVL10	51.506159	-0.089934911	Settlement	IA-R Trans	R/E	Nicholson 2013a	Layer		WSB	21	?
139b	N/A	N/A	SE	Vaults 2,5 and 9, railway Approach	London	BVL11	51.506159	-0.089934911	Settlement	M 1st-2nd	R/E	Nicholson 2013a	Pit, Dump Layer	4	WSB	96? (6s)	?
140	N/A	N/A	S	Dickson's Corner, Worth	Kent	?	51.260192	1.386475	Settlement	M 1st	R/C	Parfitt 2000	Layers		HC	X	23

Key:

	Dates	Environment	Sampling methods
N/A: Non applicable	E: Early	R/E: Riverine and Estuarine	WSB: Wet-sieved bulk sample
?: As yet unknown	M: Mid	R/C: Riverine and Coastal	SSR: Sub-sample residue
	L: Late		HC: Hand-collected
	IA: Iron Age		
	R: Roman		
	Trans: Transition		

Appendix C, Part 4: Ichthyofaunal Data Table (List of Species NISP)

Assemblage ID	1	2a	2b	2c	2d	2e	2f	2g	3	4a	4b	4c	5a	5b	5c	6	7a	7b	7c	7d	7e	7f
Current Region	N	N	N	N	N	N	N	N	N	NE	NE	NE	N	N	N	NW	NW	NW	NW	NW	NW	NW
NISP Total	17	533	1373	639	472	135	67	180	?	5	6	3	1	50	3	?	10	4	86	41	2	1
Diagnostic fragments	15	35	81	85	39	5	13	9	475	3	5	0	1	20	2	1	2	0	6	3	2	0
Undiagnostic	2	498	1292	554	433	130	54	171	?	2	1	3	0	30	1	?	8	4	80	38	0	1
Elasmobranch subclass, including selachimorpha																						
Rajidae, Ray family																						
Raja clavata, Roker or Thornback ray/ roker																						
Galeorhinus galeus, Tope shark																						
Scyliorhinidae, Cat Shark family																						
Acipenser sturio, Atlantic sturgeon																						
Conger conger, European conger																						
Anguilla anguilla, European eel		4	17	30	15	1	5	1	353								2			2		
Clupeidae																						
Clupea harengus, Atlantic herring											1			2								
Sprattus sprattus, European sprat																						
Sprat/Herring																						
Alosa alosa, Allis shad																						
Alosa sp. Allis Shad/ Twaite Shad																						
Cobitidae, Loaches Family																						
Barbatula barbatula, Stone loach																						
Cyprinid																						
Carassius carassius, Crucian carp																						
Tinca tinca, Tench																						
Rhodeus sericeus, Bitterling																						
Abramis brama, Bream																						
Blicca bjoerkna, White/silver bream																						
Alburnus alburnus, Bleak																						
Barbus barbus, Barbel																						
Gobio gobio, Gudgeon																						
Leuciscus leuciscus, Common dace																						
Squalius cephalus, Chub																						
Chub/Dace																						
Rutilus rutilus, Roach																						
Roach/Rudd																						
Leuciscus sp. Dace/Ide/ Soufie/Chub																						
Synodontis sp. Nile Catfish (Import)																						
Esox lucius, Northern pike									11													
Salmonidae		16	50	48	15	4	7	1	83		1			5	1	1			2	1		
Salmo salar, Atlantic salmon																						
Salmo trutta, Sea/brown trout	15								1													
Thymallus thymallus, Grayling																						
Coregonidae (Whitefish)																						
Osmerus eperlanus, European smelt																			2		2	
Zeus Faber, John Dory																						
Lota lota, Burbot																						
Molva molva, Ling																						
Gadidae									2				1	1	1							
Gadus morhua, Atlantic cod									1					1								
Melanogrammus aeglefinus, Haddock									2													
Merlangius merlangus, Whiting																						
Pollachius pollachius, Pollack																						
Pollachius virens, Saithe																						
Trisopterus minutus, Poor cod																						
Trisopterus sp. Bib/Pout																						
Merluccius merluccius, Hake			1	1				1														
Scombridae																						
Scomber japonicus, Spanish mackerel																						
Scomber colias, Chub mackerel																						
Scomber scombrus, Atlantic mackerel					1				1					2								
Syngnathidae, Pipefish family																						
Callionymiidae (Dragonets)																						
Mullus surmuletus, Red mullet										1?	1?											
Gobiidae, Gobies family																						
Pomatoschisus microps, Common goby																						
Flatfish		1	7	3	1		3	5	4					2								
Scophthalmidae (L eye flat fish)																						
Scophthalmus maximus, Turbot																						
Pleuronectidae (R eyed flat fish)																						
Pleuronectes platessa, European plaice				3				1														
Platichthys flesus, European flounder		1	2		1																	
Plaice/Flounder		13							16										1			
Limanda limanda, Common dab																						
P/F/D																						
Microstomus kitt, Lemon Sole														1								
Hippoglossus hippoglossus, Atlantic halibut																						
Hippoglossoides platessoides, Long Rough Dab																						
Solidae																						
Solea solea, Common sole																						
Trachurus trachurus, Atlantic horse mackerel/Scad																						
Atherina presbyter, Sand smelt																						
Belone belone, Garfish																						
Mugilidae					2						1											
Chelon labrosus, Thicklip grey mullet																			1			
Chelon ramada, Thin-lipped grey mullet																						
Lophius piscatorius, Angler																						
Dicentrarchus labrax, Bass																						
Sparidae																						
Spondyliosoma cantharus, Black seabream																						
Pagellus bogaraveo, Red seabream																						
Sparus aurata, Gilthead seabream																						
Sparus pagrus L., Red porgy/couches seabream																						
Argyrosomus regius, Meagre																						
Labridae					2						1			1								
Labrus mixtus, Cuckoo wrasse																						
Labrus bergylta, Ballan wrasse														1								
Perciformes (ray-finned fish)																						
Percidae																						
Perca fluviatilis, European perch																						
Gymnocephalus cernuus (cernua), Ruffe																						
Anarhichas lupus, Atlantic wolffish										2												
Ammodytidae																						
Ammodytes tobianus, Small sandeel														1								
Triglidae, Gurnards														1								
Gasterostidae, Sticklebacks																						
Gasterosteus aculeatus, Three Spined Stickleback																						
Cottidae																						
Cottus gobio, Bullhead																						
Myoxocephalus scorpius, Shorthorn sculpin																						
Taurulus bubalis (Euphrasen), Longspined bullhead																						
Agonus cataphractus (L.), Hooknose																						

Assemblage ID	8	9	10	11	12	13a	13b	14	15a	15b	16	17a	17b	17c	17d	17e	17f	17g	17h
Current Region	NE	NE	NE	NE	NE	NW	NW	NW	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
NISP Total	?	?	?	?	?	?	?	?	7	4	?	8	2	16	88	70	41	6	12
Diagnostic fragments	1*	123+	65	1*	705	69	189	116			56	1	0	10	48	21	11	1	1
Undiagnostic	?	?	?	?	?	?	?	?	?	?	?	7	2	6	40	49	30	5	11
Elasmobranch subclass, including selachimorpha			1				1												
Rajidae, Ray family							1												
Raja clavata, Roker or Thornback ray/ roker																			
Galeorhinus galeus, Tope shark																			
Scyliorhinidae, Cat Shark family																			
Acipenser sturio, Atlantic sturgeon																			
Conger conger, European conger																			
Anguilla anguilla, European eel		29	10	*	104	10	8	23	1		35			2	14	4			1
Clupeidae				*	11			6									1		
Clupea harengus, Atlantic herring			50		11	3	52				1			2	9	2	3		
Sprattus sprattus, European sprat																			
Sprat/Herring																			
Alosa alosa, Allis shad							2												
Alosa sp. Allis Shad/ Twaite Shad					5														
Cobitidae, Loaches Family																			
Barbatula barbatula, Stone loach																			
Cyprinid		3*			346						4			6	15	12	4		
Carassius carassius, Crucian carp																			
Tinca tinca, Tench															1				
Rhodeus sericeus, Bitterling																			
Abramis brama, Bream																			
Blicca bjoerkna, White/silver bream																			
Alburnus alburnus, Bleak		1																	
Barbus barbus, Barbel					1														
Gobio gobio, Gudgeon																1			
Leuciscus leuciscus, Common dace					4														
Squalius cephalus, Chub					2														
Chub/Dace																			
Rutilus rutilus, Roach		2									1								
Roach/Rudd																			
Leuciscus sp. Dace/Ide/ Soufie/Chub																			
Synodontis sp. Nile Catfish (Import)										1									
Esox lucius, Northern pike			1		10				1		7				8				
Salmonidae					17		5	42	5	2								1	
Salmo salar, Atlantic salmon						2	3			1									
Salmo trutta, Sea/brown trout					11														
Thymallus thymallus, Grayling					14												2		
Coregonidae (Whitefish)																			
Osmerus eperlanus, European smelt		82			56		14	17									1?		
Zeus Faber, John Dory																			
Lota lota, Burbot					3														
Molva molva, Ling																			
Gadidae							1												
Gadus morhua, Atlantic cod							1												
Melanogrammus aeglefinus, Haddock			1																
Merlangius merlangus, Whiting			1				1												
Pollachius pollachius, Pollack																			
Pollachius virens, Saithe																			
Trisopterus minutus, Poor cod																			
Trisopterus sp. Bib/Pout																			
Merluccius merluccius, Hake																			
Scombridae																			
Scomber japonicus, Spanish mackerel						3?	1												
Scomber colias, Chub mackerel																			
Scomber scombrus, Atlantic mackerel																			
Syngnathidae, Pipefish family																			
Callionymiidae (Dragonets)																			
Mullus surmuletus, Red mullet																			
Gobiidae, Gobies family																			
Pomatoschisus microps, Common goby																			
Flatfish				*							2					2			
Scophthalmidae (L eye flat fish)																			
Scophthalmus maximus, Turbot																			
Pleuronectidae (R eyed flat fish)						15	89												
Pleuronectes platessa, European plaice							3												
Platichthys flesus, European flounder					1	1	2,1?												
Plaice/Flounder					33			28			4								
Limanda limanda, Common dab																			
P/F/D																			
Microstomus kitt, Lemon Sole																			
Hippoglossus hippoglossus, Atlantic halibut																			
Hippoglossoides platessoides, Long Rough Dab																			
Solidae																			
Solea solea, Common sole																			
Trachurus trachurus, Atlantic horse mackerel/Scad					1														
Atherina presbyter, Sand smelt																			
Belone belone, Garfish																			
Mugilidae						34	2												
Chelon labrosus, Thicklip grey mullet																			
Chelon ramada, Thin-lipped grey mullet							1?												
Lophius piscatorius, Angler																			
Dicentrarchus labrax, Bass						1	1												
Sparidae	*				6														
Spondyliosoma cantharus, Black seabream																			
Pagellus bogaraveo, Red seabream																			
Sparus aurata, Gilthead seabream																			
Sparus pagrus L., Red porgy/couches seabream																			
Argyrosomus regius, Meagre																			
Labridae																			
Labrus mixtus, Cuckoo wrasse																			
Labrus bergylta, Ballan wrasse																			
Perciformes (ray-finned fish)																			
Percidae			1																
Perca fluviatilis, European perch		5		*	69						2	1							
Gymnocephalus cernuus (cernua), Ruffe																			
Anarhichas lupus, Atlantic wolffish																			
Ammodytidae																			
Ammodytes tobianus, Small sandeel																			
Triglidae, Gurnards															1				
Gasterostidae, Sticklebacks																			
Gasterosteus aculeatus, Three Spined Stickleback		1																	
Cottidae																			
Cottus gobio, Bullhead																			
Myoxocephalus scorpius, Shorthorn sculpin																			
Taurulus bubalis (Euphrasen), Longspined bullhead																			
Agonus cataphractus (L.), Hooknose																			

Assemblage ID	18a	18b	18c	18d	18e	18f	19a	19b	20	21	22a	22b	22c	23a	23b	24a	24b	25	26	27	28a	28b	28c	29	30a	30b	30c	30d	30e
Current Region	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	SW	SW	SW	SW	SW	SE	SE	SE	S	S	S	S	S	SE	S	S	S	S	S
NISP Total	17	338	391	53	291	111	970	1499+	?	?	1	7	1	7	40	7	5	?	?	?	18	24	64	11+	1	16	3	244	6
Diagnostic fragments	7	146	173	23	74	57	562	836+	53	5	1	5	1	7	22	7	5	4*	1	2	5	10	15	11+	1	5	2	112	4
Undiagnostic	10	192	218	30	217	54	408	663+	?	?	0	2	0	0	18	?	?	?	?	?	13	14	49	?	0	11	1	132	2
Elasmobranch subclass, including selachimorpha																													
Rajidae, Ray family																													
Raja clavata, Roker or Thornback ray/ roker																													
Galeorhinus galeus, Tope shark											?	?	?																
Scyliorhinidae, Cat Shark family																													
Acipenser sturio, Atlantic sturgeon																													
Conger conger, European conger																													
Anguilla anguilla, European eel	3, 2?	93	80, 4?	9	22, 1?	10	22	42	34	2		1				1	4	1	1					*	1	1	1	20	
Clupeidae	1	1	26	2	6	1	***	***																*					
Clupea harengus, Atlantic herring		35	22	8	11					3	1	3						1										11(+1)	
Sprattus sprattus, European sprat																													
Sprat/Herring																								2+					
Alosa alosa, Allis shad																													
Alosa sp. Allis Shad/ Twaite Shad																													
Cobitidae, Loaches Family																													
Barbatula barbatula, Stone loach							6																						
Cyprinid	1?	2, 9?	5, 12?	1, 1?	5, 2?	6, 6?	87	55	6			1				1?										1 (+4)			
Carassius carassius, Crucian carp																													
Tinca tinca, Tench			1?	1?			2																						
Rhodeus sericeus, Bitterling								1																					
Abramis brama, Bream							1																						
Blicca bjoerkna, White/silver bream																													
Alburnus alburnus, Bleak																	1												
Barbus barbus, Barbel																													
Gobio gobio, Gudgeon			2																										
Leuciscus leuciscus, Common dace									1																				
Squalius cephalus, Chub					1																								
Chub/Dace						1									1														
Rutilus rutilus, Roach								2																					
Roach/Rudd				1																									
Leuciscus sp. Dace/Ide/ Soufie/Chub								2																					
Synodontis sp. Nile Catfish (Import)																													
Esox lucius, Northern pike		1	3?		2		4	4	5						5	3													
Salmonidae					1		1	1						2	10													2	
Salmo salar, Atlantic salmon					3	2		1																		1		1	
Salmo trutta, Sea/brown trout		1																								1		28	1
Thymallus thymallus, Grayling																													
Coregonidae (Whitefish)																													
Osmerus eperlanus, European smelt			1?																										
Zeus Faber, John Dory																													
Lota lota, Burbot																													
Molva molva, Ling																													
Gadidae						1																2	1						
Gadus morhua, Atlantic cod													1																
Melanogrammus aeglefinus, Haddock																													
Merlangius merlangus, Whiting																								*					
Pollachius pollachius, Pollack																													
Pollachius virens, Saithe																													
Trisopterus minutus, Poor cod																													
Trisopterus sp. Bib/Pout																													
Merluccius merluccius, Hake																													
Scombridae																													
Scomber japonicus, Spanish mackerel																													
Scomber colias, Chub mackerel																													
Scomber scombrus, Atlantic mackerel			4		2	3									2					1									
Syngnathidae, Pipefish family																													
Callionymiidae (Dragonets)																													
Mullus surmuletus, Red mullet																													
Gobiidae, Gobies family																													
Pomatoschisus microps, Common goby																													
Flatfish					2, 1?	5, 2?			1												1	1	8	3+					
Scophthalmidae (L eye flat fish)																													
Scophthalmus maximus, Turbot																						1							
Pleuronectidae (R eyed flat fish)			7		3	6	3	10																		1	1	59	3
Pleuronectes platessa, European plaice									1												3	1	1						
Platichthys flesus, European flounder			1						1																			2	
Plaice/Flounder					1	9			2													2	1						
Limanda limanda, Common dab																													
P/F/D																													
Microstomus kitt, Lemon Sole																													
Hippoglossus hippoglossus, Atlantic halibut																													
Hippoglossoides platessoides, Long Rough Dab																													
Solidae																													
Solea solea, Common sole																													
Trachurus trachurus, Atlantic horse mackerel/Scad																												1	
Atherina presbyter, Sand smelt																													
Belone belone, Garfish																						3	3, 1?						
Mugilidae																													
Chelon labrosus, Thicklip grey mullet																													
Chelon ramada, Thin-lipped grey mullet															1						1								
Lophius piscatorius, Angler																													
Dicentrarchus labrax, Bass																												3	
Sparidae																												4	
Spondyliosoma cantharus, Black seabream																													
Pagellus bogaraveo, Red seabream																													
Sparus aurata, Gilthead seabream																												1	
Sparus pagrus L., Red porgy/couches seabream																													
Argyrosomus regius, Meagre																				1									
Labridae																													
Labrus mixtus, Cuckoo wrasse																													
Labrus bergylta, Ballan wrasse																													
Perciformes (ray-finned fish)																													
Percidae							1																						
Perca fluviatilis, European perch		1, 3?	1, 4?		8, 2?	2, 2?	16	23	2					5	3	2													
Gymnocephalus cernuus (cernua), Ruffe								1																					
Anarhichas lupus, Atlantic wolffish																													
Ammodytidae							11	29																					
Ammodytes tobianus, Small sandeel							***	***																					
Triglidae, Gurnards					1	1																							
Gasterostidae, Sticklebacks																													
Gasterosteus aculeatus, Three Spined Stickleback																		*						2+					
Cottidae																													
Cottus gobio, Bullhead								1										*											
Myoxocephalus scorpius, Shorthorn sculpin																													
Taurulus bubalis (Euphrasen), Longspined bullhead																													
Agonus cataphractus (L.), Hooknose																													

Assemblage ID	31	32a	32b	32c	32d	32e	32f	32g	32h	32i	33	34a	34b	35	36	37a	37b	37c	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Current Region	S	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	S	SE	SE	SE	SE	S	SE	NE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE
NISP Total	?	222	210	43	92	44	##	310	538	##	?	93	##	?	?	228	65	6	95+	?	?	?	?	100+?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?226-	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Diagnostic fragments	1?	37	15	4	14	10	25	52	72	31	##	15	24	##	51	215	40	3	86	2+	27	11	##	46	60	13	6	2*	55	50	1	53	6	16	17	9	11	62	2+	###	16	49	25	162	1	1	301	3	6	1	4	34	46	5	1	4	1	27	20	1	6	50	11	273	11	2	4	1	11	1	16
Undiagnostic	?	185	195	39	78	34	##	258	466	##	?	78	##	?	?	13	25	3	9+	?	?	?	?	100+ ?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	1000-	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Elasmobranch subclass, including selachimorpha											1																		1														2	1																											
Rajidae, Ray family																																																																							
Raja clavata, Roker or Thornback ray/ roker																									2																																							1							
Galeorhinus galeus, Tope shark																																																																							
Scyliorhinidae, Cat Shark family																																																																						
Acipenser sturio, Atlantic sturgeon																																																																	1					
Conger conger, European conger																											1																																1												
Anguilla anguilla, European eel		15	5	1	1	1	12	7	8	3	58	3	9	28	16	206	28	2	1		27	8	82	16	7	1			16			26	2	1	2	2		3	2	108	1	17	4	22			4				2	16	2	3		1	1				3	16	5	201	2		1				3
Clupeidae											2												6		25			*	19				1	1		1				53	8	12	16	24			1+	1																			2				3
Clupea harengus, Atlantic herring		6	2		6		7	5	22		13	5	1	6	4	1	5		39			1					2		5			18						1		4				1		*	2				1	2	28	1	1	1		4			1		1	33	1						1
Sprattus sprattus, European sprat	*																																														56		2				2											4							
Sprat/Herring																																																										6													
Alosa alosa, Allis shad																																																																							
Alosa sp. Allis Shad/ Twaite Shad														8																				5																		10*	1					1													2
Cobitidae, Loaches Family																																																																						
Barbatula barbatula, Stone loach																																																																						
Cyprinid																	1					1	18	4	5				1			4			2			9		474		4		32									1									10		4	1						
Carassius carassius, Crucian carp																																																																	1						
Tinca tinca, Tench																																																																						
Rhodeus sericeus, Bitterling																																																																						
Abramis brama, Bream																																																																						
Blicca bjoerkna, White/silver bream																																								7																															
Alburnus alburnus, Bleak																																																																						
Barbus barbus, Barbel																									1															3																															
Gobio gobio, Gudgeon																																								11																															
Leuciscus leuciscus, Common dace																																	1							20																															1
Squalius cephalus, Chub																								4											3					11							3																								
Chub/Dace																3																																																							
Rutilus rutilus, Roach																								3														2		34																													1		
Roach/Rudd																																																																						
Leuciscus sp. Dace/Ide/ Soufie/Chub																																																																						
Synodontis sp. Nile Catfish (Import)																																																																						
Esox lucius, Northern pike														1					6				2																														1																		3
Salmonidae								1	1		4			3			2						9			1									2			7		47												3									1		1								
Salmo salar, Atlantic salmon																																																																						
Salmo trutta, Sea/brown trout																																																																						
Thymallus thymallus, Grayling																																																																						
Coregonidae (Whitefish)																																																																						
Osmerus eperlanus, European smelt								3	1														1		3										3			4		126				2			230+						2					12				6		12							1
Zeus Faber, John Dory																																																																						
Lota lota, Burbot																																																																						
Molva molva, Ling																																																1																							
Gadidae						2				4				25											5			*	5			1	1	1*	1			13			2	8	2	10					1				1						10		1		1	12							
Gadus morhua, Atlantic cod						3			3																					49								1				1		3					1				1						3					1		1		1	1	1	
Melanogrammus aeglefinus, Haddock								3	1																															2		1																													
Merlangius merlangus, Whiting					1				1	8	2	3	1	1	3											1												2				2	1				1				1		1	1				1						1							
Pollachius pollachius, Pollack																																																																						
Pollachius virens, Saithe														1																																																									
Trisopterus minutus, Poor cod														1	1																																																								
Trisopterus sp. Bib/Pout																																																																						
Merluccius merluccius, Hake												1																																																											
Scombridae																2	2	1	3																																																				
Scomber japonicus, Spanish mackerel																																																																						
Scomber colias, Chub mackerel																								1																																															
Scomber scombrus, Atlantic mackerel		11	2	3	4	2				1	8			1											6	1	1			1								3		6				4								1													2						
Syngnathidae, Pipefish family																																																																						
Callionymiidae (Dragonets)										1																																																													
Mullus surmuletus, Red mullet																																																																						
Gobiidae, Gobies family																																																																						
Pomatoschisus microps, Common goby																																																																						
Flatfish		1				1	3	12	18	7	3	1	5	##		1							7			1																			1		4			1														1	1		1				2
Scophthalmidae (L eye flat fish)																																																																						
Scophthalmus maximus, Turbot																																								10																															
Pleuronectidae (R eyed flat fish)																																																																						
Pleuronectes platessa, European plaice		1			2	1	2	2	15	5	4	1	1	5						*				7					1											2																															
Platichthys flesus, European flounder							1	4		1				8										10																10													1																		
Plaice/Flounder											14		6	40		1			31						6	7	2		7			3	1	8	2	6	11	16		261	5	4		60			*					2	5			2		2	6					3					9		
Limanda limanda, Common dab														7																																												1													
P/F/D																																																																							
Microstomus kitt, Lemon Sole																																																																						
Hippoglossus hippoglossus, Atlantic halibut														1																																																									
Hippoglossoides platessoides, Long Rough Dab																																																																						
Solidae																																																																						
Solea solea, Common sole																																																																						
Trachurus trachurus, Atlantic horse mackerel/Scad																			6				1																																																
Atherina presbyter, Sand smelt																																															*																								
Belone belone, Garfish																																																																						
Mugilidae														1									8								1							1		6				3																											
Chelon labrosus, Thicklip grey mullet			5												12																																																								
Chelon ramada, Thin-lipped grey mullet			1						2					1																					1																														1						
Lophius piscatorius, Angler																																																																						
Dicentrarchus labrax, Bass															15								20																	20																															
Sparidae												1											8			1																																													
Spondyliosoma cantharus, Black seabream																																																1	1											1					2						
Pagellus bogaraveo, Red seabream																				1																			*																																
Sparus aurata, Gilthead seabream																																																																						
Sparus pagrus L., Red porgy/couches seabream																																																																						
Argyrosomus regius, Meagre																																																																						
Labridae																							1									1																																							
Labrus mixtus, Cuckoo wrasse																																																																						
Labrus bergylta, Ballan wrasse																																																																						
Perciformes (ray-finned fish)																1	2																																																						
Percidae																																																																						
Perca fluviatilis, European perch																						1																		11									1																						
Gymnocephalus cernuus (cernua), Ruffe																																																																						
Anarhichas lupus, Atlantic wolffish																																																																						
Ammodytidae																																																																						
Ammodytes tobianus, Small sandeel																																																																						
Triglidae, Gurnards										1																																																													
Gasterostidae, Sticklebacks																																																																						
Gasterosteus aculeatus, Three Spined Stickleback		3						15					1																																		*															18									
Cottidae																																																																						
Cottus gobio, Bullhead																																																																						
Myoxocephalus scorpius, Shorthorn sculpin																																																																						
Taurulus bubalis (Euphrasen), Longspined bullhead																																																																						
Agonus cataphractus (L.), Hooknose																																																																						

Assemblage ID	91	92	93	94	95	96	97	98	99	##	##	##	##	##	##	106	107	108a	108b	108c	108d	108e	108f	108g	108h	108i	109	110	111a	111b	111c	111d	##	113	114	115	116a	116b	116c	116d	116e	116f	117	118a	118b	118c	118d	119a	119b	119d	119c	120
Current Region	SE	SE	SE	SE	SE	SE	S	S	S	S	SW	S	S	S	S	S	S	SW	SW	SW	SW	SW	SW	SW	SW	SW	S	NE	NE	NE	NE	NE	N	NE	N	N	NW	NW	NW	NW	NW	NW	NW	S	S	S	S	SE	SE	SE	SE	NE
NISP Total	?	?	?	?	?	?	?	?	?	4	?	2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	1	1	1	*	?	0000500?			###	###	###	285	2	226	3	47	2	17	34	72+	106+	35+	54+	31
Diagnostic fragments	6	11+	5	8	31	2	##	522	23	4	14	2	17	2	1	38	1+	6	20	7	25	19	3	11	##	13	1+	?	0	0	0	0	?	5756+			288	615	326	117	1	107	2	21	1	14	30	72	106	35	54	19
Undiagnostic	?	?	?	?	?	?	?	?	?	0	?	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	1	1s	1v		?	?			713	591	698	168	1	119	1	26	1	3	4	?	?	?	?	lf,11
Elasmobranch subclass, including selachimorpha																1																																				
Rajidae, Ray family																																										1										
Raja clavata, Roker or Thornback ray/ roker					1																																															
Galeorhinus galeus, Tope shark																																																				
Scyliorhinidae, Cat Shark family																																																				
Acipenser sturio, Atlantic sturgeon					5																																															
Conger conger, European conger								10	1							2																																				
Anguilla anguilla, European eel	4	*		2	4		##	1		4	8	2		*			*	1	4			2		3	10	1											63	49	58	5	1	62		7		5	19	1	18	2	5	
Clupeidae																																														2	5					
Clupea harengus, Atlantic herring		*		3	1																													41			3	2	12	5		20		3		4	3		1	1	3	
Sprattus sprattus, European sprat																																																				
Sprat/Herring																																		###																		
Alosa alosa, Allis shad																																					8		8	1								7	1			
Alosa sp. Allis Shad/ Twaite Shad																																		13																		
Cobitidae, Loaches Family																																					1															
Barbatula barbatula, Stone loach																																																				
Cyprinid		*			8		81				4																										1		8													5
Carassius carassius, Crucian carp																																																				
Tinca tinca, Tench																																																				
Rhodeus sericeus, Bitterling																																																				
Abramis brama, Bream																																																				
Blicca bjoerkna, White/silver bream																																																				
Alburnus alburnus, Bleak																																																				
Barbus barbus, Barbel																																																				
Gobio gobio, Gudgeon		*																																																		
Leuciscus leuciscus, Common dace		*																																																		
Squalius cephalus, Chub		*																																																		
Chub/Dace																																																				
Rutilus rutilus, Roach					1																																															
Roach/Rudd																																																				
Leuciscus sp. Dace/Ide/ Soufie/Chub																																																				
Synodontis sp. Nile Catfish (Import)																																																				
Esox lucius, Northern pike		*																																																	1	1
Salmonidae								2	4									3	11	2	4	1	2	1	11	4											15	12	24	7		1		1			1		1	2		
Salmo salar, Atlantic salmon																								1	4																			1		1						
Salmo trutta, Sea/brown trout																																																				
Thymallus thymallus, Grayling																																																				
Coregonidae (Whitefish)																																							1													
Osmerus eperlanus, European smelt		*			1																																11	1	5	2		2										
Zeus Faber, John Dory																	*																																			
Lota lota, Burbot																																																				
Molva molva, Ling																	*																																			
Gadidae	2	*			3			5	1																		*										2	1	1	2		1						3	25			
Gadus morhua, Atlantic cod			5			1																																														
Melanogrammus aeglefinus, Haddock		*																																																		
Merlangius merlangus, Whiting									3							5	*																					1	1											1		
Pollachius pollachius, Pollack																1	*																																			
Pollachius virens, Saithe																																																	1			
Trisopterus minutus, Poor cod																																																		1		
Trisopterus sp. Bib/Pout																																																				
Merluccius merluccius, Hake									5																																											
Scombridae																																					3		1	2												
Scomber japonicus, Spanish mackerel						*																															2		11	1												
Scomber colias, Chub mackerel																																																				
Scomber scombrus, Atlantic mackerel		*			1											2																					2	19	3	1										1		
Syngnathidae, Pipefish family																																																				
Callionymiidae (Dragonets)																																																				
Mullus surmuletus, Red mullet																																																			1 cf.	
Gobiidae, Gobies family																																																				
Pomatoschistus microps, Common goby																																																				
Flatfish				3			3	21																													11	8	7	5		5	2	1		1		30	45	19	18	
Scophthalmidae (L eye flat fish)																																					1															
Scophthalmus maximus, Turbot									1																																											
Pleuronectidae (R eyed flat fish)																		2	2	2	9	16		6	78	8											140	531	161	84		6		7			2					
Pleuronectes platessa, European plaice																	*																				5	3	12									1			4	
Platichthys flesus, European flounder																			2	1	2				2												5 (+1?	15		1				1				28	1	5		
Plaice/Flounder					5						1																										5	4	5	1								1	11	3	15	
Limanda limanda, Common dab																																																	2		5	
P/F/D																																																				
Microstomus kitt, Lemon Sole																																																				
Hippoglossus hippoglossus, Atlantic halibut																																					1														1	
Hippoglossoides platessoides, Long Rough Dab																																					1															
Solidae																																																				
Solea solea, Common sole																																																				
Trachurus trachurus, Atlantic horse mackerel/Scad								10																																												
Atherina presbyter, Sand smelt																																																				
Belone belone, Garfish																																																					
Mugilidae					1			56									*								2												2											1				
Chelon labrosus, Thicklip grey mullet																																																				
Chelon ramada, Thin-lipped grey mullet																																																			1	
Lophius piscatorius, Angler													1																																							
Dicentrarchus labrax, Bass								268	4										1	1							*										1	1	7													
Sparidae							9	45	2		1																																		1							
Spondyliosoma cantharus, Black seabream																1																														1						
Pagellus bogaraveo, Red seabream																1					8		1																													
Sparus aurata, Gilthead seabream														2		1																																				
Sparus pagrus L., Red porgy/couches seabream																																																				
Argyrosomus regius, Meagre																																																				
Labridae							2	103	1				7			16											*																									
Labrus mixtus, Cuckoo wrasse													1				*																																			
Labrus bergylta, Ballan wrasse													8		1	8	*																																			
Perciformes (ray-finned fish)																																							1													
Percidae											*									1	2																					2										
Perca fluviatilis, European perch																																					1?					10										1
Gymnocephalus cernuus (cernua), Ruffe																																																				
Anarhichas lupus, Atlantic wolffish																																																				
Ammodytidae																																																				
Ammodytes tobianus, Small sandeel																																																				
Triglidae, Gurnards								1	1																																											
Gasterostidae, Sticklebacks																																																				
Gasterosteus aculeatus, Three Spined Stickleback																																																				
Cottidae																																																				
Cottus gobio, Bullhead																																																				
Myoxocephalus scorpius, Shorthorn sculpin																																																				
Taurulus bubalis (Euphrasen), Longspined bullhead																																																				
Agonus cataphractus (L.), Hooknose																																																				

Assemblage ID	##	122	123	124	125a	125b	##	127	128	##	130a	130b	130c	##	##	133	134	135	136a	136b	136c	137	138a	138b	139a	139b	140
Current Region	SE	SE	SE	S	S	S	S	SE	S	S	S	S	S	SW	S	SW	SW	SW	S	S	S	SE	SE	SE	SE	SE	S
NISP Total	1+		3356+	4*	133	27	?	355+	120	1	30 (E	0 (E	xx	?	##	17	64	?	13	105	711	*	?	4+	?	?	23
Diagnostic fragments	?		3173+	?	113	15	11	49+	108					?	##	7	9	?	7	64	388	*	0	4+	?	?	12
Undiagnostic	?		183+	?	20	12	?	306	12					?	##	10	55	?	6	41	323		X	?	?	?	11
Elasmobranch subclass, including selachimorpha									65						1												
Rajidae, Ray family								1																			
Raja clavata, Roker or Thornback ray/ roker									1																		
Galeorhinus galeus, Tope shark																											
Scyliorhinidae, Cat Shark family						1																					
Acipenser sturio, Atlantic sturgeon																											
Conger conger, European conger															16					1	3						
Anguilla anguilla, European eel			35	*	52	4		40	2				X		1	1	5				6				?	X	
Clupeidae			1768						4		***	***	*														
Clupea harengus, Atlantic herring			6	*	20	5		*			?	?					3							**?			
Sprattus sprattus, European sprat																											
Sprat/Herring									2																		
Alosa alosa, Allis shad											?	?															
Alosa sp. Allis Shad/ Twaite Shad			4																								
Cobitidae, Loaches Family																											
Barbatula barbatula, Stone loach																											
Cyprinid								2																			
Carassius carassius, Crucian carp																											
Tinca tinca, Tench																											
Rhodeus sericeus, Bitterling																											
Abramis brama, Bream																											
Blicca bjoerkna, White/silver bream																											
Alburnus alburnus, Bleak																											
Barbus barbus, Barbel																											
Gobio gobio, Gudgeon																											
Leuciscus leuciscus, Common dace																											
Squalius cephalus, Chub																1											
Chub/Dace																											
Rutilus rutilus, Roach								1																			
Roach/Rudd																											
Leuciscus sp. Dace/Ide/ Soufie/Chub																											
Synodontis sp. Nile Catfish (Import)																											
Esox lucius, Northern pike																											
Salmonidae					1	1																*					
Salmo salar, Atlantic salmon						1																					
Salmo trutta, Sea/brown trout																											
Thymallus thymallus, Grayling																											
Coregonidae (Whitefish)																											
Osmerus eperlanus, European smelt			509																								
Zeus Faber, John Dory															2												
Lota lota, Burbot																											
Molva molva, Ling															1												
Gadidae			5		1				8						66					3	5						
Gadus morhua, Atlantic cod				2					3						67												12
Melanogrammus aeglefinus, Haddock															1												
Merlangius merlangus, Whiting			46					*?													1						
Pollachius pollachius, Pollack															17					6	13						
Pollachius virens, Saithe															1												
Trisopterus minutus, Poor cod																											
Trisopterus sp. Bib/Pout									1																		
Merluccius merluccius, Hake															1												
Scombridae																											
Scomber japonicus, Spanish mackerel																											
Scomber colias, Chub mackerel																											
Scomber scombrus, Atlantic mackerel					1				1										1	2	3						
Syngnathidae, Pipefish family			74																								
Callionymiidae (Dragonets)																											
Mullus surmuletus, Red mullet																											
Gobiidae, Gobies family			267																								
Pomatoschisus microps, Common goby			61																								
Flatfish			15					2+	4						1	1				1	6			1			
Scophthalmidae (L eye flat fish)																											
Scophthalmus maximus, Turbot																											
Pleuronectidae (R eyed flat fish)			20		38	2			8							1											
Pleuronectes platessa, European plaice			1																								
Platichthys flesus, European flounder																											
Plaice/Flounder								*									1										
Limanda limanda, Common dab			7																								
P/F/D																								1			
Microstomus kitt, Lemon Sole																											
Hippoglossus hippoglossus, Atlantic halibut																											
Hippoglossoides platessoides, Long Rough Dab																											
Solidae			3																								
Solea solea, Common sole			14																								
Trachurus trachurus, Atlantic horse mackerel/Scad									1						76												
Atherina presbyter, Sand smelt																											
Belone belone, Garfish																											
Mugilidae															2												
Chelon labrosus, Thicklip grey mullet						1																					
Chelon ramada, Thin-lipped grey mullet			1																								
Lophius piscatorius, Angler																											
Dicentrarchus labrax, Bass			3						8						15	2					3						
Sparidae															87	1				2	17						
Spondyliosoma cantharus, Black seabream															1												
Pagellus bogaraveo, Red seabream															8						2						
Sparus aurata, Gilthead seabream															3												
Sparus pagrus L., Red porgy/couches seabream															8												
Argyrosomus regius, Meagre																											
Labridae															9					8	5						
Labrus mixtus, Cuckoo wrasse																											
Labrus bergylta, Ballan wrasse															16						1						
Perciformes (ray-finned fish)																											
Percidae																											
Perca fluviatilis, European perch																											
Gymnocephalus cernuus (cernua), Ruffe																											
Anarhichas lupus, Atlantic wolffish																											
Ammodytidae																											
Ammodytes tobianus, Small sandeel																											
Triglidae, Gurnards			8																								
Gasterostidae, Sticklebacks			185																								
Gasterosteus aculeatus, Three Spined Stickleback			12																								
Cottidae			19																								
Cottus gobio, Bullhead																											
Myoxocephalus scorpius, Shorthorn sculpin			1																								
Taurulus bubalis (Euphrasen), Longspined bullhead			4																								
Agonus cataphractus (L.), Hooknose			104																								

Key:

?:	Uncertain figure, anecdotal remark only
*:	Noted species but unknown NISP
**:	Noted multiple fragments of species but unknown NISP
***:	Noted large number of fragments of species but unknown NISP
+:	NISP provided but reference to additional fragments that are not included in the figure (from other contexts or unprocessed samples)
v:	vertebrae
s:	scale